

A  
Northern Illinois University  
Academic Computing Services  
Workshop

## UNIX Communications Basics

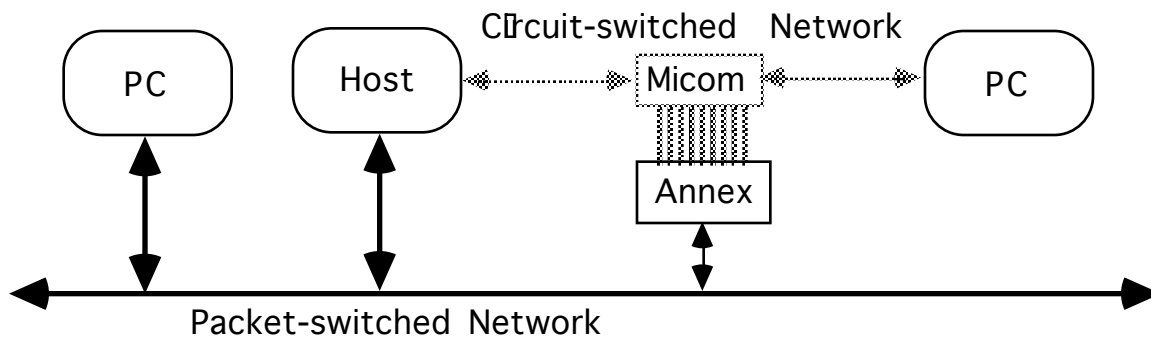
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This workshop is a series of examples that provide experience in basic communications from a UNIX system. It expects that you have an account and physical access to a station on a UNIX system as well as experience with file management within UNIX. The following topics are covered.

- Access to a UNIX system on NIUnet
- Mail* for asynchronous communications
- Talk* for synchronous communications
- Telnet* and *tn3270* over a network connection (remote access)
- Ftp* over a network connection (file transfer)
- Rlogin* and *rsh* over a network connection (remote access)
- Rcp* over a network connection (file transfer)
- Kermit* over a RS232C connection (remote access & file transfer)
- Tip* over a RS232C connection (remote access)
- Uucp* over a RS232C connection (unattended file transfer)

UNIX is a common operating environment for workstations, minicomputers, and supercomputers. UNIX systems are multiuser systems that act as hosts for several users to simultaneously enter commands and receive responses. UNIX is available in several variants (BSD, SysV, and others), but most of the commands are universal. Any differences in the commands described in this workshop are illustrated by giving the syntax of both commands. Most differences appear in command options, program development, and in system administration.

UNIX systems on campus are generally on the NIU packet-switched network "NIUnet". They can be reached by other workstations on this network or by other workstations directly connected to or dialing-in to the Micom RS232C circuit switch.



### Network Access to a UNIX System

A UNIX System on the NIU packet-switched network can be accessed as a remote system from any personal computer that is also on the network and that uses the TCP/IP suite of communications software.

ACS has a Sun SPARCstation that is on the network.

The PCs in SP10A use a variant of the TCP/IP *telnet* command which provides remote access as a DEC vt220 terminal on the network.

`tnvt220 nirvana`                      Accesses the ACS Sun SPARCStation.

The hostname *nirvana* is translated through a table on the PCs to the network of the ACS host system.

### Micom Access to a UNIX System

The UNIX systems on the packet-switched network can also be reached by first going through the Micom circuit switch to get to the Annex terminal switch (*umax*) which is on the packet-switched network.

The Annex allows terminals and PCs acting as terminals on the circuit-switched network access to the packet-switched network.

The following steps describe how to reach the ACS Sun SPARCstation through the Micom from the Stevens Lab.

<code>BREAK BREAK BREAK ENTER</code>	Requests the Micom menu over a Data-Over-Voice (DOV) line. Another procedure is required for dial-in.
<code>umax</code>	Requests an Annex network connection.
<code>ENTER ENTER</code>	Requests the <i>annex:</i> prompt.
<code>telnet nirvana.acs</code>	Accesses the ACS Sun SPARCStation.

Because ACS is on a different subnet than the Annex, you must use the hostname and subnet of the ACS host system.

Most UNIX systems present a *login:* prompt to check account access. Enter your account username and press Enter to identify yourself. A *password:* prompt is displayed. Enter the account password and press Enter to verify your identity. The password is not displayed as a security measure, but if you know that you typed it wrong, you can use `BACKSPACE` to erase erroneous characters, and then retype the correct characters. Successfully accessing a system through the *login:* and *password:* prompts is often called *logging in*.

If the login/password combination does not match with the system values, UNIX will respond with *login incorrect* and redisplay the *login:* prompt. Some systems may redisplay the *login:* prompt a limited number of times.

When the login/password combination is recognized by the system, it displays several messages and finally a command line prompt. If the system prompts for a terminal type, enter `vt220` and press `ENTER`.

<code>ENTER</code>	Scrolls the screen and displays another prompt.
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logout `ENTER` Terminates your session.

Follow the previous instructions and re-access the system.

The typical prompt for new accounts is the percent sign (%). This prompt is characteristic of the *C shell* command interpreter. The *C shell* (the command interpreter) uses any non-zero number of spaces or tabs to separate the parts of a command line. The first word of the command line is the *command*, the remaining words on the line are its *arguments*. Any arguments that begin with a minus or plus are called *flags* or *options*. Pressing `ENTER` signals the shell to act on the command. The symbol `_` is used to identify a space that may too easily be missed. The indication to press the `ENTER` key is omitted hereafter unless it may too easily be missed.

You may need to set the terminal type on the remote host system so that it sends the proper control characters recognized by your local terminal emulator and so that it recognizes the special control keys that you press.

`grep 'l' /etc/termcap | more` Lists the abbreviations and names  
`grep 'l' /etc/terminfo/? | more` for all terminals known to  
the (BSD or SysV) system.

`set noglob` Ignores filename wildcards  
for the next command.

`eval `tset -e^h -k^u -i^c -sr vt220`` Sets the character erase to Ctrl h,  
the line erase to Ctrl u,  
the interrupt to Ctrl c, and  
the terminal type to vt220.

`stty all` Lists the configuration of  
`stty -a` your terminal (tty) access port.

## Internet Addresses

The NIU packet-switched network is a combination of Ethernet network segments and Token Ring network segments. The nodes on these networks are identified by *Internet or IP addresses* which are quartets of eight-bit numbers, that is, numbers between 0 and 255.

For instance, 131.156.7.2 is the address of the ACS Sun and 131.156.1.18 is the address of MVS on the NIU Amdahl.

The most significant number is the leftmost.

The first three numbers indicate the net-subnet corresponding to an organization and the rightmost number indicates the system (node).

The subnet number identifies a portion of the organization.

There are four types (classes) of network addresses.

Type	net	subnet	system	systems/net
A	X. 0+(7-bit network)	X.X. (24-bit host)	X	256 <sup>3</sup> 0.0.0.0 - 127.255.255.255
B	X.X. 10+(14-bit network)	X. (16-bit host)	X	256 <sup>2</sup> 128.0.0.0 - 191.255.255.255
C	X.X.X. 110+(21-bit network)		X (8-bit host)	256 192.0.0.0 - 223.255.255.255
D	X.X.X.X 111+(29-bit special)			1 224.0.0.0 - 255.255.255.255

While an Internet or IP address is the surest way to reach a system, it is often difficult to remember.

Nodes are also given a word address.

For instance, *nirvana.acs.niu.edu* is the address of the ACS Sun and *mvs.cso.niu.edu* is the address of MVS on the NIU Amdahl.

The significance of this address is opposite that of the IP address.

The leftmost word is the hostname; the next word is the department; and the last two words is the organization.

These system names are associated with the IP addresses in a file (host table) on the local system.

`more /etc/hosts` Displays system names and IP addresses known to the local system.

Some systems are configured to interrogate other systems called *nameservers* for the address corresponding to a system name.

`hostname` Displays the name of local system.

`/usr/etc/ping mvs.cso.niu.edu` Checks the connection to the Amdahl.

`/usr/etc/nslookup mvs.cso.niu.edu` Displays the Internet address of MVS.

`/usr/etc/nslookup` Starts the interactive nameserver query tool.

`help` Displays commands for *nslookup*.

`set all` Displays configuration for *nslookup* including default nameserver and recent host.

`server niu.edu` Changes the default server to *niu.edu*.

`ls niu.edu` Displays hosts known to the *niu.edu* nameserver.

`nirvana.acs` Displays the address of host *nirvana* in the domain *acs.niu.edu*.

`finger your_username` Displays information about your account on the most recently named host.

`ls niu.edu > niu_domain` Puts into the file *niu\_domain* information about hosts known to *niu.edu* nameserver.

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<code>view niu_domain</code>	Displays information in <i>niu_domain</i> .
<code>ls -h niu.edu</code>	Displays the types of systems known to the default server.
<code>exit</code>	Exits <i>nslookup</i> .
<code>finger your_username</code>	Displays a description of your account.
<code>finger another_username</code>	Displays a description of another account.
<code>finger</code>	Displays a description of the active accounts.
<code>finger another_username@another_system</code>	Displays a description of another account on another system without using <i>nslookup</i> .

### System Information

The following commands are useful in identifying system characteristics once you have accessed a UNIX system.

<code>uptime</code>	Displays system status.
<code>whoami</code>	Displays your username.
<code>id</code>	Also displays your username user id and group id.
<code>users</code>	Displays the other users on the system.
<code>who</code>	Also displays the other users on the system.
<code>groups</code>	Displays the work groups that include you and allow you to access files in that group.

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tty	Displays the terminal (RS232C) or pseudo-terminal (Ethernet or Token Ring) port being used to access the system.
ps	Displays all processes connected with your terminal. Note the process identifier (PID) of the most recent background process.
pwd	Displays the current working directory.
ls	Lists all files in the current directory.
ls -a	Lists all files in the current directory including those hidden by an initial <i>dot</i> .
mkdir mydir	Creates a new subdirectory.
cd mydir	Changes the current working directory.
pwd	Displays the current working directory.
cd	Changes the current working directory to your home directory. (This is unlike the MS DOS <i>cd</i> command.)
pwd	Displays the current working directory.

### Mail for Asynchronous Communications

Mail provides communications between users who are not at their systems at the same time. The *mail* command can be used to read messages and to write messages.

mail	Indicates that you have no messages.
mail <i>your_username</i>	Creates a message for yourself. (write mode)



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	Enter a one-line subject when prompted.
	Enter line after line of a message using Backspace, Ctrl w, or Ctrl u to revise any current line.
CTRL D	Signals end of input, sends the message, and exits <i>mail</i> .
mail	Displays message headers and waits for instructions. (read mode)
m <i>your_username</i>	Creates a message for yourself while in read mode.
CTRL D	Signals end of input and sends the message.
?	Displays commands for reading messages.
h	Displays message headers without the new message.
inc	Includes new messages.
h	Displays message headers with the new message.
1	Displays message 1.
r 1	Replies to message 1.
	Enter your reply to message 1.
CTRL D	Sends your reply.
d 1	Deletes message 1.
q	Quits <i>mail</i> and saves messages you have read in the <i>mbox</i> file in your home directory.

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mail <i>your_username</i>	Creates another message for yourself. (write mode)
Pour moi!	Enters a subject for the message after the <i>Subject:</i> prompt.
~?	Displays commands for sending messages.
~v	Allows full-screen editing of message.
I	Starts inserting text.
Line 1 Line 2	Example of text to input.
<u>ESCAPE</u>	Terminates insert mode.
:w <i>myfile</i>	Writes the text to the file <i>myfile</i> .
dd	Deletes the current line.
o	Opens a new line for insertion of text.
Line 3	Example of some text to insert.
<u>ESCAPE</u>	Terminates insert mode.
:x	Exits the editor.
Line 4	Adds additional text to the message.
~r <i>myfile</i>	Inserts a file into the message.
~p	Displays the current message.
<u>CTRL D</u>	Signals end of input, sends the message, and exits <i>mail</i> .

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mail	Displays message headers. (read mode)
q	Quits <i>mail</i> and saves messages you have read in the <i>mbox</i> file in your home directory.
mail <i>your_username@localhost</i>	Starts up a session to send a message to a user on the "remote host" <i>localhost</i> .  Enter a subject for the message.
~X	Exits message input without sending the message.
CTRL C CTRL C	Exits <i>mail</i> without sending a message.

### Talk for Synchronous Communications

Talk provides synchronous communications with a user on the same system or on another system connected by a packet-switched network.

who	Displays the active users and which tty lines they are using.
talk <i>username tty_name</i>	Prompts an active user to respond by starting <i>talk</i> on their system and opens outgoing and incoming windows on screen for synchronous communication.  Type messages to the other user and view the responses.
CTRL C	Terminates <i>talk</i> .

## Telnet for Network Remote Access

Telnet provides terminal access to multiple remote systems on a packet-switched network for entering arbitrary commands that are interpreted by the remote system.

more /etc/hosts	Displays a list of systems known to be available on TCP/IP network connections.
telnet localhost	Establishes a TCP/IP network connection with a predefined system <i>localhost</i> sending the TERM variable.
CTRL ]	Switches to <i>telnet</i> command mode.
mode line	Configures <i>telnet</i> to send full lines.
CTRL E	Escapes the local echo in line-by-line mode for hiding passwords.
CTRL ]	Switches to <i>telnet</i> command mode.
mode char	Configures <i>telnet</i> to send single characters.
CTRL ]	Switches to <i>telnet</i> command mode.
?	Displays a list of <i>telnet</i> commands.
status	Displays the current connection and the mode then returns to <i>telnet</i> connect mode.
CTRL ]	Switches to <i>telnet</i> command mode.
display	Displays the character values and the event toggles.
open mp.cs.niu.edu	Begins a session with another system.

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CTRL ]	Escapes to <i>telnet</i> command mode.
close	Ends the session with the other system.
CTRL D	Signals an end of input and terminates <i>telnet</i> .

### TN3270 for Network Remote Access

TN3270 provides telnet access to IBM mainframe systems that use the IBM 3270 terminal/controller protocol. The IBM telnet server will only handle IBM 3270 emulation so tn3270 converts the character stream for the local system.

telnet mvs.cso.niu.edu	Displays garbage when the NIU MVS system is accessed.
CTRL ]	Escapes to <i>telnet</i> command mode.
CTRL D	Terminates <i>telnet</i> .
tn3270 mvs.cso.niu.edu	Displays the NIU VTAM access screen.
CTRL ]	Escapes to <i>tn3270</i> command mode.
help	Displays a list of <i>tn3270</i> commands.
ESCAPE 3	Closes the VTAM session.

### Rlogin for Network Remote Access

Remote UNIX systems can be accessed from trusted systems without logging in.

more /etc/hosts.equiv	Displays trusted systems.
vi ~/.rhosts	Creates a file for individual trusted access.

localhost <i>your_username</i>	Enters access data for <i>localhost</i> .
<u>ESCAPE</u>	
:X	Exits the visual editor and saves the file.
chmod go-rwx ~/.rhosts	Protects the information about which systems can be accessed with your username without a password.
rlogin localhost	Establishes a TCP/IP network connection with a predefined system <i>localhost</i> sending the TERM variable.
exit	Terminates the session on the remote system.
rlogin -l <i>username</i> localhost	
	Establishes a TCP/IP network connection with a predefined system <i>localhost</i> using the login <i>username</i> and sending the TERM variable.
exit	Terminates the session on the remote system.
rsh -l <i>username</i> localhost "ls"	
	Executes a command on a remote UNIX system using the command interpreter (shell) from /etc/passwd on the remote system.
rcp -r localhost:myfile myfile2	
	Copies a directory and its subdirectories from a remote UNIX system to the local system.

Don't use *localhost* as the hostname without using a second filename: you will destroy your local file.

The local username must exist on the remote system because *rcp* does not prompt for it as *rlogin* and *rsh* do.

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rcp -r username@hostname:remote_pathname local_pathname
```

Copies a directory and its subdirectories from a remote UNIX system to the local system after prompting for a password for username.

### **X Windows for Graphical Remote Access**

The X Windows system provides remote access to remote systems through a windowed, menued, graphical user interface that uses a mouse or other pointing device.

Multiple connections can be simultaneously displayed on one screen.

The window server consists of a local display server, a user interface, and a window manager.

A remote program communicates with the display server across the network sending output to be displayed and expecting input from the keyboard and pointer.

### **Ftp for Network File Transfer**

FTP provides reliable file transfer between systems on a TCP/IP network.

It allows more interaction with the remote system than does *rcp*.

Some of the commands that give information about local files may not be available.

`ftp localhost`

Establishes a file transfer session on a predefined system *localhost* over a TCP/IP network.

Login and password prompts from the system are displayed.

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status Describe the current configuration.

FTP allows you to configure the file transfer with character type (ascii, ebcdic, or binary), line format (fortran), and file mode (stream or record).

? Displays a list of *ftp* commands.

pwd Displays the current remote directory.

ls Displays the filenames in the current remote directory.

dir Displays complete information on files in the current remote directory.

lls Displays the filenames in the current local directory.

ldir Displays complete information on files in the current local directory.

cd mydir Changes the current remote directory.

lcd mydir Changes the current local directory.

send myfile yourfile Sends a copy of a file to the system. The second filename is needed only when you want to change the filename.

recv yourfile myfile2 Receives a copy of a file from the remote system. The second filename is needed only when you want to change the file name.

open cs.niu.edu Begins a session with another system.

binary Sets *ftp* to exchange data in full eight-bit bytes.



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ascii	Sets <i>ftp</i> to exchange data ignoring the eighth bit that is not used in text definitions.
close	Ends the session with the other system.
CTRL D	Signals the end of input and terminates <i>ftp</i> .

### Kermit for Dial-in Remote Access and File Transfer

Kermit provides access to a single remote system through a dial-in connection through the Micom.

kermit	Starts <i>kermit</i> accessing a RS232C port.
?	Lists <i>kermit</i> commands.
help !	Describes the shell escape command (!).
help help	Describes the <i>help</i> function.
help set	Describes the <i>set</i> function.
help set ?	Displays the current variable settings.
help set escape	Lists the kermit escape character.
cwd	Displays the current working directory.
show	Displays the kermit configuration.
send myfile yourfile	Sends a file to the remote system under a new name.
rec yourfile myfile2 renames it.	Receives a file from the remote system and renames it.

directory	Display files in current local directory.
remote directory	Display files in current remote directory.
cwd mydir	Changes the current local directory.
remote cwd mydir	Changes current remote directory.
quit	Terminates <i>kermit</i> .

### Tip for Dial-in Remote Access

TIP is a UNIX program that can be used to dial-out of a RS232C port and access another system.

TIP allows file capture, but not reliable file transfer.

more /etc/remote available on direct or modem	Displays the list of systems known to be RS232 connections.
tip <i>system phone#</i>	Establishes an RS232 connection with a predefined system.
~?	Displays a list of <i>tip</i> commands.
~CTRL Z	Escapes to the <i>C shell</i> .
exit	Returns to <i>tip</i> .
~#	Sends a Break.
~>	Sends a file after prompting for its name.
~<	Captures a file after prompting for its name.
~c mydir	Changes directory.

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~s all	Lists all variables.
~s sc	Starts recording the session (script) in the file <i>tip.record</i> .
~s !sc	Stops recording the session.
CTRL D	Signals an end of input and exits <i>tip</i> .

### UUCP for Unattended File Transfer

While ftp and kermit require attention and interaction for file transfer, the UNIX-to-UNIX copy command can be used to transfer files in the background and at other times.

It is very useful when file transfer takes more than twenty minutes.

`uucp -m hostname!username/pathname pathname`

Puts a file in the home directory of *username*.  
The directory must have *rxw* permissions for all.

`uucp -m hostname!/pathname pathname`

Uses the *uucppublic* directory and sends mail on completion.

UUCP requires the system administrator to set up the dial-in RS232C connections between systems.

UUCP and tip need the `/usr/spool/locks` file.

### Termination

logout Terminates your session.

### TN3270 Keys for Novell LAN Workplace

ENTER	RETURN	CLEAR	CTRL Z
Newline	CTRL N		
TAB	CTRL I	BACK TAB	CTRL B
CURSOR UP	CTRL K	CURSOR RIGHT	CTRL L
CURSOR LEFT	CTRL H	CURSOR DOWN	CTRL J
DELETE CHAR	CTRL D	ERASE EOF	CTRL E
INSERT TOGGLE	ESCAPE SPACE	ERASE INPUT	CTRL W
		ERASE FIELD	CTRL U
ERROR RESET	CTRL R	PA1	CTRL P 1
PURGE INPUT	CTRL X	PA2	CTRL P 2
KEYBOARD UNLOCK	CTRL T	PA3	CTRL P 3
REDISPLAY SCREEN	CTRL V		
PF1	ESCAPE 1	PF11	ESCAPE-
PF2	ESCAPE 2	PF12	ESCAPE =
PF3	ESCAPE 3	PF13	ESCAPE !
...	...	...	...