

4.2.6 Lab - Working with Text Files in the CLI



This lab has been updated for use on NETLAB+.
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Objectives

In this lab, you will become familiar with Linux command line text editors and configuration files.

Part 1: Graphical Text Editors

Part 2: Command Line Text Editors

Part 3: Working with Configuration Files

Instructions

Part 1: Graphical Text Editors

Before you can work with text files in Linux, you must be familiar with text editors.

Text editors are one of the oldest categories of applications created for computers. Linux, like many other operating systems, has many different text editors, with various features and functions. Some text editors include graphical interfaces, while others are only usable via the command line. Each text editor includes a feature set designed to support a specific work scenario. Some text editors focus on the programmer and include features such as syntax highlighting, bracket matching, find and replace, multi-line Regex support, spell check, and other programming-focused features.

To save space and keep the virtual machine lean, the **Cisco CyberOps Workstation** VM only includes **SciTE** as a graphical text editor application. **SciTE** is a simple, small and fast text editor. It does not have many advanced features, but it fully supports the work done in this course.

Note: The choice of text editor is a personal one. There is no such thing as a best text editor. The best text editor is the one that you feel most comfortable with and works best for you.

Step 1: Open SciTE from the GUI

- Log on to the **Workstation** VM as the user **analyst** using the password **cyberops**. The account *analyst* is used as the example user account throughout this lab.
- On the top bar, navigate to **Applications > CyberOPS > SciTE** to launch the **SciTE** text editor.
- SciTE** is simple but includes a few important features: tabbed environment, syntax highlighting and more. Spend a few minutes with **SciTE**. In the main work area, type or copy and paste the text below:

"Space, is big. Really big. You just won't believe how vastly, hugely, mindbogglingly big it is. I mean, you may think it's a long way down the road to the chemist, but that's just peanuts to space."

Douglas Adams, *The Hitchhiker's Guide to the Galaxy*

- Click **File > Save** to save the file. Notice that **SciTE** attempts to save the file to the current user's home directory, which is **analyst**, by default. Name the file **space.txt** and click **Save**.
- Close **SciTE** by clicking the **X** icon on the upper right side of the window and then reopen **SciTE**.
- Click **File > Open** and search for the newly saved file, **space.txt**.
Could you immediately find **space.txt**?

- g. Even though *SciTE* is looking at the correct directory (*/home/analyst*), *space.txt* is not displayed. This is because *SciTE* is looking for known extensions and *.txt* is not one of them. To display all files, click the dropdown menu at the bottom of the **Open File** window and select **All Files (*)**.
- h. Select **space.txt** to open it.
Note: While the Linux file systems do not rely on extensions, some applications such as *SciTE* may attempt to use them to identify file types.
- i. Close *space.txt* when finished.

Step 2: Open *SciTE* from the Terminal.

- a. Alternatively, you can also open *SciTE* from the command line. Click the **terminal** icon located in the Dock at the bottom of the desktop. The **terminal** emulator opens.
- b. Type **ls** to see the contents of the current directory. Notice **space.txt** is listed. This means you do not have to provide path information to open the file.
- c. Type `scite space.txt` to open **SciTE**. Note that this will not only launch *SciTE* in the GUI, but it will also automatically load the *space.txt* text file that was previously created.

```
[analyst@secOps ~]$ scite space.txt
```
- d. Notice that while *SciTE* is open on the foreground, the terminal window used to launch it is still open in the background. In addition, notice that the terminal window used to launch *SciTE* no longer displays the prompt.
Why is the prompt not shown in the terminal?

-
- e. Close this instance of **SciTE** by either clicking the X icon as before, or by switching the focus back to the terminal window that launched **SciTE** and stopping the process. You can stop the process by pressing **CTRL+C**.

Note: Starting *SciTE* from the command line is helpful when you want to run *SciTE* as **root**. Simply precede **scite** with the **sudo** command, **sudo scite**.

- f. Close **SciTE** and move on to the next section.

Part 2: Command Line Text Editors

While graphical text editors are convenient and easy to use, command line-based text editors are very important in Linux computers. The main benefit of command line-based text editors is that they allow for text file editing from a remote shell on a remote computer.

Consider the following scenario. A user must perform administrative tasks on a Linux computer but is not sitting in front of that computer. Using *SSH*, the user starts a remote shell to the aforementioned computer. Under the text-based remote shell, the graphical interface may not be available which makes it impossible to rely on graphical text editors. In this type of situation, text-based text editors are crucial.

Note: This is mainly true when connecting to remote, headless servers that lack a GUI interface.

The *Workstation* VM includes a few command line-based text editors. This course focuses on *nano*.

Note: Another extremely popular text editor is called *vi*. While the learning curve for *vi* is considered steep, *vi* is a very powerful command line-based text editor. It is included by default in almost all Linux distributions and its original code was first created in 1976. An updated version of *vi* is named *vim* which stands for vi-improved. Today most *vi* users are actually using the updated version, *vim*.

Due to the lack of graphical support, *nano* (or GNU *nano*) can be controlled solely through the keyboard. **CTRL+O** saves the current file; **CTRL+W** opens the search menu. GNU **nano** uses a two-line shortcut bar at the bottom of the screen, where a number of commands for the current context are listed. After *nano* is open, press **CTRL+G** for the help screen and a complete list.

- a. In the terminal window, type `nano space.txt` to open the text file created in Part 1.

```
[analyst@secOps ~]$ nano space.txt
```

- b. *nano* will launch and automatically load the `space.txt` text file. While the text may seem to be truncated or incomplete, it is not. Because the text was created with no return characters and line wrapping is not enabled, by default, *nano* is displaying one long line of text.

Use the **Home** and **End** keyboard keys to quickly navigate to the beginning and to the end of a line, respectively.

What character does *nano* use to represent that a line continues beyond the boundaries of the screen?

-
- c. As shown on the bottom shortcut lines, **CTRL+X** can be used to exit **nano**. **nano** will ask if you want to save the file before exiting ('Y' for Yes, or 'N' for 'No'). If 'Y' is chosen, you will be prompted to press enter to accept the given file name, or change the file name, or provide a file name if it is a new unnamed document.
 - d. To control **nano**, you can use **CTRL**, **ALT**, **ESCAPE** or the *META* keys. The *META* key is the key on the keyboard with a Windows or Mac logo, depending on your keyboard configuration.

Navigation in *nano* is very user friendly. Use the arrows to move around the files. *Page Up* and *Page Down* can also be used to skip forward or backwards entire pages. Spend some time with **nano** and its help screen. To enter the help screen, press **CTRL+G**. Press **q** to quit the help screen and return to document editing in *nano*. Press **CTRL+X** to exit out of *nano*.

Part 3: Working with Configuration Files

In Linux, everything is treated as a file, including the memory, the disks, the monitor output, the files, and the directories. From the operating system standpoint, everything is a file. It should be no surprise that the system itself is configured through files. Known as configuration files, they are usually text files and are used by various applications and services to store adjustments and settings for that specific application or service. Practically everything in Linux relies on configuration files to work. Some services have not one but several configuration files.

Users with proper permission levels use text editors to change the contents of such configuration files. After the changes are made, the file is saved and can be used by the related service or application. Users are able to specify exactly how they want any given application or service to behave. When launched, services and applications check the contents of specific configuration files and adjust their behavior accordingly.

Step 1: Locating Configuration Files

The program author defines the location of configuration for a given program (service or application). Because of that, the documentation should be consulted when assessing the location of the configuration file.

Conventionally however, in Linux, configuration files that are used to configure user applications are often placed in the user's home directory while configuration files used to control system-wide services are placed in the `/etc` directory. Users always have permission to write to their own home directories and are able to configure the behavior of applications they use.

- a. Use the **ls** command to list all the files in the **analyst** home directory:

```
[analyst@secOps ~]$ ls -l
total 20
drwxr-xr-x 2 analyst analyst 4096 Mar 22 2018 Desktop
```

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```
drwxr-xr-x 3 analyst analyst 4096 Apr  2 14:44 Downloads
drwxr-xr-x 9 analyst analyst 4096 Jul 19 2018 lab.support.files
drwxr-xr-x 2 analyst analyst 4096 Mar 21 2018 second_drive
-rw-r--r-- 1 analyst analyst 255 Apr 17 16:42 space.txt
```

While a few files are displayed, none of them seem to be configuration files. This is because it is convention to hide home-directory-hosted configuration files by preceding their names with a "." (dot) character.

- b. Use the `ls` command again but this time add the `-la` option to also include hidden files in the output:

```
[analyst@secOps ~]$ ls -la
total 144
drwx----- 14 analyst analyst 4096 Apr 17 16:34 .
drwxr-xr-x  3 root      root    4096 Mar 20 2018 ..
-rw-----  1 analyst analyst  424 Apr 17 12:52 .bash_history
-rw-r--r--  1 analyst analyst   21 Feb  7 2018 .bash_logout
-rw-r--r--  1 analyst analyst   57 Feb  7 2018 .bash_profile
-rw-r--r--  1 analyst analyst   97 Mar 20 2018 .bashrc
-rw-r--r--  1 analyst analyst  141 Feb  7 2018 .bashrc_stock
drwxr-xr-x  8 analyst analyst 4096 Mar 25 12:18 .cache
drwxr-xr-x 10 analyst analyst 4096 Jul 19 2018 .config
drwxr-xr-x  2 analyst analyst 4096 Mar 22 2018 Desktop
-rw-r--r--  1 analyst analyst   23 Mar 23 2018 .dmrc
drwxr-xr-x  3 analyst analyst 4096 Apr  2 14:44 Downloads
drwx-----  3 analyst analyst 4096 Mar 22 2018 .gnupg
-rw-----  1 analyst analyst 2520 Mar 24 12:32 .ICEauthority
drwxr-xr-x  2 analyst analyst 4096 Mar 24 2018 .idlerc
drwxr-xr-x  9 analyst analyst 4096 Jul 19 2018 lab.support.files
-rw-----  1 analyst analyst   61 Mar 24 12:36 .lessht
drwxr-xr-x  3 analyst analyst 4096 Mar 22 2018 .local
drwx-----  5 analyst analyst 4096 Mar 24 2018 .mozilla
drwxr-xr-x  2 analyst analyst 4096 Mar 21 2018 second_drive
-rw-r--r--  1 analyst analyst  255 Apr 17 16:42 space.txt
<Some output omitted>
```

- c. Use `cat` command to display the contents of the `.bashrc` file. This file is used to configure user-specific terminal behavior and customization.

```
[analyst@secOps ~]$ cat .bashrc
export EDITOR=vim

PS1='\[\e[1;32m\][\u@\h \W]\$[\e[0m\] '
alias ls="ls --color"
alias vi="vim"
```

Do not worry too much about the syntax of `.bashrc` at this point. The important thing to notice is that `.bashrc` contains configuration for the terminal. For example, the line `PS1='\[\e[1;32m\][\u@\h \W]\$[\e[0m\] '` defines the prompt structure of the prompt displayed by the terminal: `[username@hostname current_dir]` followed by a dollar sign, all in green. A few other configurations include shortcuts to commands such as `ls` and `vi`. In this case, every time the user types `ls`, the shell automatically converts that to `ls --color` to display a color-coded output for `ls` (directories in blue, regular files in grey, executable files in green, etc.)

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The specific syntax is out of the scope of this course. What is important is understanding that user configurations are conventionally stored as hidden files in the user's home directory.

- d. While configuration files related to user applications are conventionally placed under the user's home directory, configuration files relating to system-wide services are placed in the `/etc` directory, by convention. Web services, print services, ftp services, and email services are examples of services that affect the entire system and of which configuration files are stored under `/etc`. Notice that regular users do not have writing access to `/etc`. This is important as it restricts the ability to change the system-wide service configuration to the **root** user only.

Use the `ls` command to list the contents of the `/etc` directory:

```
[analyst@secOps ~]$ ls /etc
adjtime             host.conf           mke2fs.conf         rc_maps.cfg
apache-ant           hostname            mkinitcpio.conf     request-key.conf
apparmor.d           hosts               mkinitcpio.d        request-key.d
arch-release         ifplugd             modprobe.d           resolv.conf
avahi                 initcpio            modules-load.d       resolvconf.conf
bash.bash_logout     inputrc             motd                 rpc
bash.bashrc           iproute2            mtab                 rsyslog.conf
binfmt.d             iptables            nanorc               securetty
ca-certificates      issue               netconfig            security
crypttab             java-7-openjdk      netctl               services
dbus-1               java-8-openjdk      netsniff-ng          shadow
default              kernel              nginx                shadow-
depmod.d             krb5.conf           nscd.conf            shells
dhcpcd.conf          ld.so.cache         nsswitch.conf        skel
dhcpcd.oid           ld.so.conf          ntp.conf             ssh
dkms                 ld.so.conf.d        openldap             ssl
drirc                libnl               openvswitch          sudoers
elasticsearch         libpaper.d          os-release           sudoers.d
environment          lightdm             pacman.conf          sudoers.pacnew
ethertypes           locale.conf         pacman.conf.pacnew  sysctl.d
filebeat             locale.gen          pacman.d             systemd
fonts                locale.gen.pacnew  pam.d               tmpfiles.d
fstab                localtime          pango               trusted-key.key
gai.conf             login.defs          papersize            udev
gemrc                logrotate.conf     passwd              UPower
group                logrotate.d        passwd-             vdpau_wrapper.cfg
group-               logstash           pcmcia              vimrc
group.pacnew         lvm                pkcs11              webapps
grub.d               machine-id          polkit-1            wgetrc
gshadow              mail.rc             profile             X11
gshadow-             makepkg.conf        profile.d            xdg
gshadow.pacnew       man_db.conf         protocols            xinetd.d
gtk-2.0              mdadm.conf          pulse               yaourtc
gtk-3.0              mime.types          rc_keymaps
```

- e. Use the `cat` command to display the contents of the **bash.bashrc** file:

```
[analyst@secOps ~]$ cat /etc/bash.bashrc
#
# /etc/bash.bashrc
```

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```
#

# If not running interactively, don't do anything
[[ $- != *i* ]] && return

[[ $DISPLAY ]] && shopt -s checkwinsize

PS1='[\u@\h \W]\$ '

case ${TERM} in
    xterm*|rxvt*|Eterm|aterm|kterm|gnome*)
        PROMPT_COMMAND=${PROMPT_COMMAND:+$PROMPT_COMMAND; }'printf "\033]0;%s@%s:%s\007"
"$ {USER}" "$ {HOSTNAME%%.*}" "$ {PWD/#$HOME/\~}" '
        ;;
    screen)
        PROMPT_COMMAND=${PROMPT_COMMAND:+$PROMPT_COMMAND; }'printf "\033_%s@%s:%s\033\\"
"$ {USER}" "$ {HOSTNAME%%.*}" "$ {PWD/#$HOME/\~}" '
        ;;
    esac

[ -r /usr/share/bash-completion/bash_completion ] && . /usr/share/bash-
completion/bash_completion
[analyst@secOps ~]$
```

The syntax of *bash.bashrc* is out of scope of this course. This file defines the default behavior of the shell for all users. If a user wants to customize his/her own shell behavior, the default behavior can be overridden by editing the *.bashrc* file located in the user's home directory. Because this is a system-wide configuration, the configuration file is placed under */etc*, making it editable only by the *root* user. Therefore, the user will have to log in as root to modify *bash.bashrc*.

Why are user application configuration files saved in the user's home directory and not under */etc* with all the other system-wide configuration files?

Step 2: Editing and Saving Configuration files

As mentioned before, configuration files can be edited with text editors.

Let's edit *.bashrc* to change the color of the shell prompt from green to red for the *analyst* user.

- First, open **SciTE** by selecting **Applications > CyberOPS > SciTE** from the tool bar located in the upper portion of the *Workstation* VM screen.
- Select **File > Open** to launch *SciTE's Open File* window.
- Because *.bashrc* is a hidden file with no extension, SciTE does not display it in the file list. If the Location feature is not visible in the dialog box, Change the type of file shown by selecting **All Files (*)** from the type drop box, as shown below. All the files in the analyst's home directory are shown.
- Select *.bashrc* and click **Open**.

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- e. Locate 32 and replace it with 31. 32 is the color code for green, while 31 represents red.



- f. Save the file by selecting **File > Save** and close **SciTE** by clicking the **X** icon.
- g. Click the **Terminal** application icon located on the Dock, at the bottom center of the **Workstation** VM screen. The prompt should appear in red instead of green.
- Did the terminal window which was already open also change color from green to red? Explain.

- h. The same change could have been made from the command line with a text editor such as **nano**. From a new terminal window, type `nano .bashrc` to launch **nano** and automatically load the **.bashrc** file in it:

```
[analyst@secOps ~]$ nano .bashrc
```

```
GNU nano 4.9.2                                File: .bashrc

export EDITOR=vim

PS1='\[\e[1;31m\][\u@\h \W]\$[\e[0m\] '
alias ls="ls --color"
alias vi="vim"

[ Read 5 lines ]
^G Get Help  ^O Write Out ^W Where Is  ^K Cut Text  ^J Justify   ^C Cur Pos
^X Exit      ^R Read File ^\ Replace   ^U Uncut Text ^T To Spell  ^_ Go To Line
```

- i. Change 31 to 33. 33 is the color code to yellow.
- j. Press **CTRL+X** to save and then press **Y** to confirm. The text editor **nano** will also offer you the chance to change the filename. Simply press **ENTER** to use the same name, **.bashrc**.
- k. The text editor **nano** will end, and you will be back on the shell prompt. This time reload the bash terminal by entering the command **bash** in the terminal. The prompt should now appear in yellow instead of red.

Step 3: Editing Configuration Files for Services

System-wide configuration files are not very different from the user-application files. *nginx* is a lightweight web server that is installed in the **CyberOPS Workstation** VM. *nginx* can be customized by changing its configuration file, which is located in */etc/nginx*.

- a. First, open **nginx**'s configuration file in a **nano**. The configuration file name used here is **custom_server.conf**. Notice below that the command is preceded by the **sudo** command. After typing **nano** include a space and the **-l** switch. If prompted for a password, enter **cyberops**.

```
[analyst@secOps ~]$ sudo nano -l /etc/nginx/custom_server.conf
[sudo] password for analyst:
```

Use the arrow keys to navigate through the file.

```
GNU nano 4.9.2 /etc/nginx/custom_server.conf

1
2 #user html;
3 worker_processes 1;
4
5 #error_log logs/error.log;
6 #error_log logs/error.log notice;
7 #error_log logs/error.log info;
8
9 #pid logs/nginx.pid;
10
11
12 events {
13     worker_connections 1024;
14 }
15
16
17 http {
18     include mime.types;
19     default_type application/octet-stream;
20
21     #log_format main '$remote_addr - $remote_user [$time_local] "$request" '
22     # '$status $body_bytes_sent "$http_referer" '
23     # '"$http_user_agent" "$http_x_forwarded_for"';
24
25     #access_log logs/access.log main;
26
27     sendfile on;
28     #tcp_nopush on;
29
30     #keepalive_timeout 0;
31     keepalive_timeout 65;
32
33     #gzip on;
34
35     types_hash_max_size 4096;
```


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```
36     server_names_hash_bucket_size 128;
37
38     server {
39         listen      81;
40         server_name localhost;
41
42         #charset koi8-r;
43
44         #access_log  logs/host.access.log  main;
45
46         location / {
47             root    /usr/share/nginx/html;
48             index   index.html index.htm;
49         }
<Some output omitted>
```

Note: Conventionally, `.conf` extensions are used to identify configuration files.

- b. While the configuration file has many parameters, we will configure only two: the port *nginx* listens on for incoming connections, and the directory it will serve web pages from, including the index HTML homepage file.
- c. Notice that at the bottom of the window, above the nano commands, the line number is highlighted and listed. On line 39, change the port number from **81** to **8080**. This will tell nginx to listen to HTTP requests on port **TCP 8080**.
- d. Next, move to line 47 and change the path from **/usr/share/nginx/html/** to **/usr/share/nginx/html/text_ed_lab/**

Note: Be careful not to remove the semi-colon at the end of the line or **nginx** will throw an error on startup.

- e. Press **CTRL+X** to save the file. Press **Y** and then **ENTER** to confirm and use the **custom_server.conf** as the filename.
- f. Type the command below to execute nginx using the modified configuration file:
`[analyst@secOps ~]$ sudo nginx -c custom_server.conf`
- g. Click the web browser icon on the Dock to launch Firefox.
- h. On the address bar, type **127.0.0.1:8080** to connect to a web server hosted on the local machine on port 8080. A page related to this lab should appear.
- i. After successfully opening the **nginx** homepage, look at the connection message in the terminal window. What is the error message referring to?

-
- j. To shut down the **nginx** webserver, press **ENTER** to get a command prompt and type the following command in the terminal window:

```
[analyst@secOps ~]$ sudo pkill nginx
```

- k. You can test whether the **nginx** server is indeed shut down by first clearing the recent history in the web browser, then close and re-open the web browser, then go to the nginx homepage at 127.0.0.1:8080. Does the web page appear?
-

Challenge Question: Can you edit the `/etc/nginx/custom_configuration.conf` file with SciTE? Describe the process below.

Remember, because the file is stored under `/etc`, you will need root permissions to edit it.

Reflection

Depending on the service, more options may be available for configuration.

Configuration file location, syntax, and available parameters will vary from service to service. Always consult the documentation for information.

Permissions are a very common cause of problems. Make sure you have the correct permissions before trying to edit configuration files.

More often than not, services must be restarted before the changes take effect.