Lab – Working with Text Files in the CLI

Introduction

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

Required Resources

- CyberOps Workstation Virtual Machine

Part 1: Graphical Text Editors

Before you can work with text files in Linux, you must get 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 VM** only includes **SciTE** as 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

a. Log on to the CyberOps VM as the user **analyst** using the password **cyberops**. The account **analyst** is used as the example user account throughout this lab.

b. On the top bar, navigate to **Applications > CyberOPS > SciTE** to launch the **SciTE** text editor.

c. **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

d. 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**.

e. Close **SciTE** by clicking the **X** icon on the upper right side of the window and then reopen **SciTE**.

f. 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. 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 the prompt is not shown?

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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 **Cisco CyberOps 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?

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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.

e. 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**.

Part 3: Working with Configuration Files

In Linux, everything is treated as a file. The memory, the disks, the monitor output, the files, the directories; from the operating system standpoint, everything is a file. It should be no surprise that 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 Sep 26  2014 Desktop
drwx------ 3 analyst analyst 4096 Jul 14 11:28 Downloads
drwxr-xr-x 8 analyst analyst 4096 Jul 25 16:27 lab.support.files
drwxr-xr-x 2 analyst analyst 4096 Mar  3 15:56 second_drive
-rw-r--r-- 1 analyst analyst  254 Aug 16 13:32 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 **–a** option to also include hidden files in the output:

```
[analyst@secOps ~]$ ls –la
```

```
total 268
drwxr-xr-x 19 analyst analyst  4096 Aug  2 15:43 .
drwxr-xr-x  3 root    root     4096 Sep 26  2014 ..
-rw-------  1 analyst analyst   250 May  4 11:42 .atftp_history
-rw-------  1 analyst analyst 13191 Aug  1 09:48 .bash_history
-rw-r--r--  1 analyst analyst    97 Mar 21 15:31 .bashrc
drwxr-xr-x  4 analyst analyst  4096 Jul  6 10:26 broken_down
drwxr-xr-x 10 analyst analyst  4096 Nov  7  2016 .cache
drwxr-xr-x 12 analyst analyst  4096 Jun  5 11:45 .config
-rw-r--r--  1 analyst analyst 16384 Apr 12 10:06 .cyberops_topo.py.swp
drwxr-xr-x  2 analyst analyst  4096 Sep 26  2014 Desktop
-rw-r--r--  1 analyst analyst    43 Sep 27  2014 .dmrc
drwx------  3 analyst analyst  4096 Jul 14 11:28 Downloads
-rw-r--r--  1 analyst analyst    72 Sep 26  2014 .fehbg
drwxr-xr-x  5 analyst analyst  4096 Sep 26  2014 .fluxbox
drwx------  3 analyst analyst  4096 Sep  7  2016 .gnupg
-rw-------  1 analyst analyst 28920 Aug  2 15:01 .ICEauthority
drwxr-xr-x  2 analyst analyst  4096 Sep 26  2014 .idlerc
drwxr-xr-x  3 analyst analyst  4096 Sep 27  2014 .java
drwxr-xr-x  8 analyst analyst  4096 Jul 25 16:27 lab.support.files
-rw-------  1 analyst analyst   290 Jul  6 15:15 .lesshst
drwxr-xr-x  3 analyst analyst  4096 Sep 26  2014 .local
<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.)

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 place in the **/etc** directory, by convention. Web services, print services, ftp services, 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.duid       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               yaourtrc
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
#

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

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 **.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?

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Step 2: Editing and Saving Configuration files

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

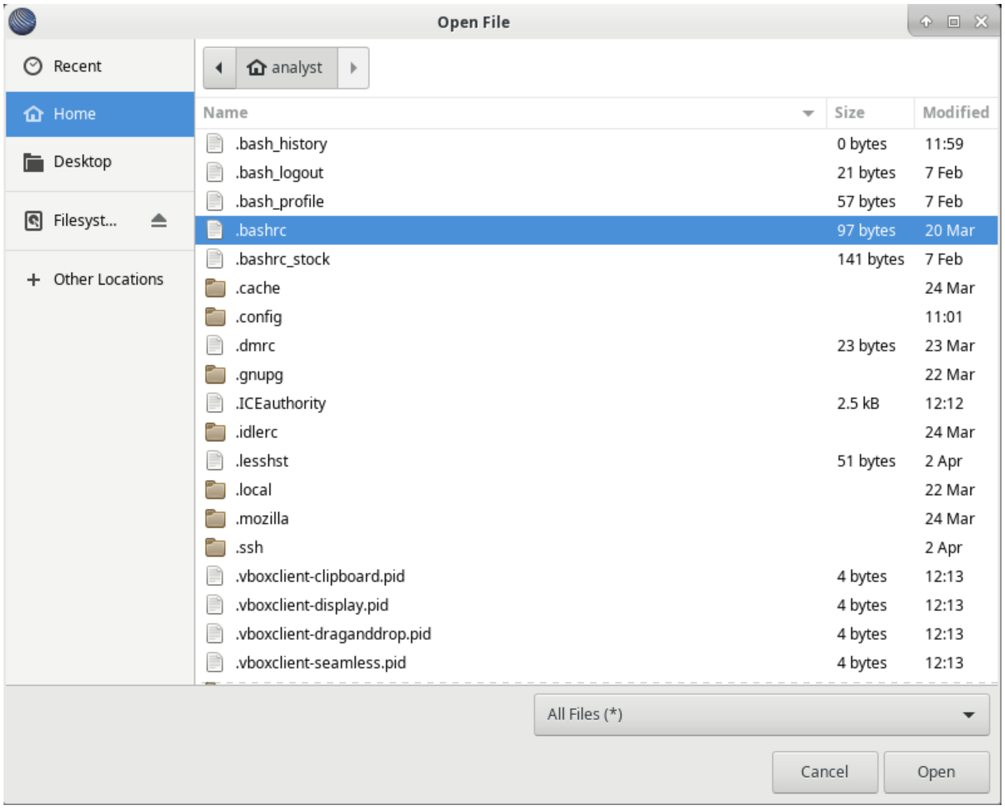
Let's edit **.bashrc** to change the color of the shell prompt from green to red for the **analyst** user.

a. First, open **SciTE** by selecting **Applications** > **CyberOPS** > **SciTE** from the tool bar located in the upper portion of the **Cisco CyberOPS VM** screen.

b. Select **File** > **Open** to launch **SciTE**'s Open File window.

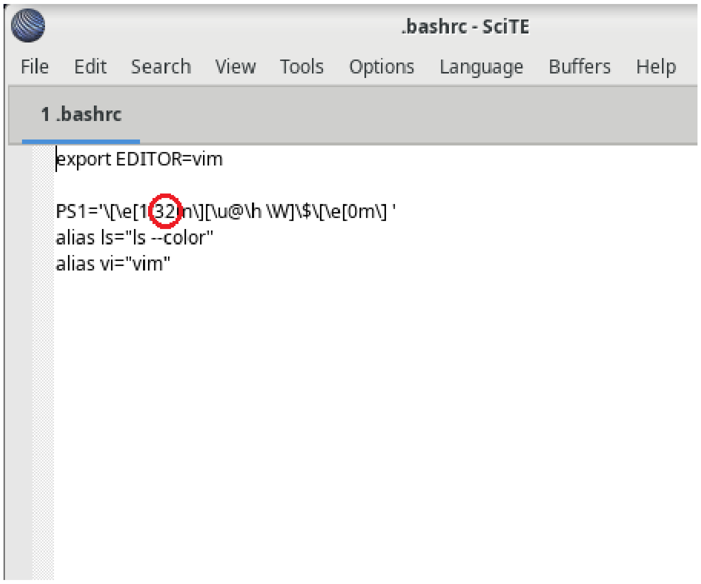
c. Because **.bashrc** is a hidden file with no extension, SciTE does not display it in the file list. If the Location feature is not visible in the dialog box, Change the type of file shown by selecting **All Files (*)** from the type drop box, as shown below. All the files in the analyst's home directory are shown.

d. Select **.bashrc** and click **Open**.



Name	Size	Modified
.bash_history	0 bytes	11:59
.bash_logout	21 bytes	7 Feb
.bash_profile	57 bytes	7 Feb
.bashrc	97 bytes	20 Mar
.bashrc_stock	141 bytes	7 Feb
.cache		24 Mar
.config		11:01
.dmrc	23 bytes	23 Mar
.gnupg		22 Mar
.ICEauthority	2.5 kB	12:12
.idlerc		24 Mar
.lesshst	51 bytes	2 Apr
.local		22 Mar
.mozilla		24 Mar
.ssh		2 Apr
.vboxclient-clipboard.pid	4 bytes	12:13
.vboxclient-display.pid	4 bytes	12:13
.vboxclient-draganddrop.pid	4 bytes	12:13
.vboxclient-seamless.pid	4 bytes	12:13

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



```
export EDITOR=vim

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

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 **Cisco CyberOPS 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.

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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 2.8.1                    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. Nano will also offer you the chance to change the filename. Simply press **ENTER** to use the same name, **.bashrc**.

k. Nano will end, and you will be back on the shell prompt. Again, click the **Terminal** application icon located on the Dock, at the bottom center of the **Cisco CyberOps VM** screen. 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 **Cisco CyberOPS VM**. **nginx** can be customized by changing its configuration file, which is located in under **/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 to turn on line-numbering.

```
[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 2.9.5              /etc/nginx/custom_server.conf

  1
  2 #user html;
```

```
worker_processes  1;

#error_log  logs/error.log;
#error_log  logs/error.log  notice;
#error_log  logs/error.log  info;

#pid        logs/nginx.pid;


events {
    worker_connections  1024;
}


http {
    include       mime.types;
    default_type  application/octet-stream;

    #log_format  main  '$remote_addr - $remote_user [$time_local] "$request" '
    #                  '$status $body_bytes_sent "$http_referer" '
    #                  '"$http_user_agent" "$http_x_forwarded_for"';

    #access_log  logs/access.log  main;

    sendfile        on;
    #tcp_nopush     on;

    #keepalive_timeout  0;
    keepalive_timeout  65;

    #gzip  on;

    types_hash_max_size 4096;
    server_names_hash_bucket_size 128;

    server {
        listen       81;
        server_name  localhost;

        #charset koi8-r;

        #access_log  logs/host.access.log  main;

        location / {
            root   /usr/share/nginx/html;
            index  index.html index.htm;
        }

^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
```

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 "pid /var/run/
nginx_v.pid;"
```

Note: The **"pid /var/run/nginx_v.pid;"** is needed to tell nginx what file to use when storing the process ID that identifies this instance of **nginx**.

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?

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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: 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.

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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.