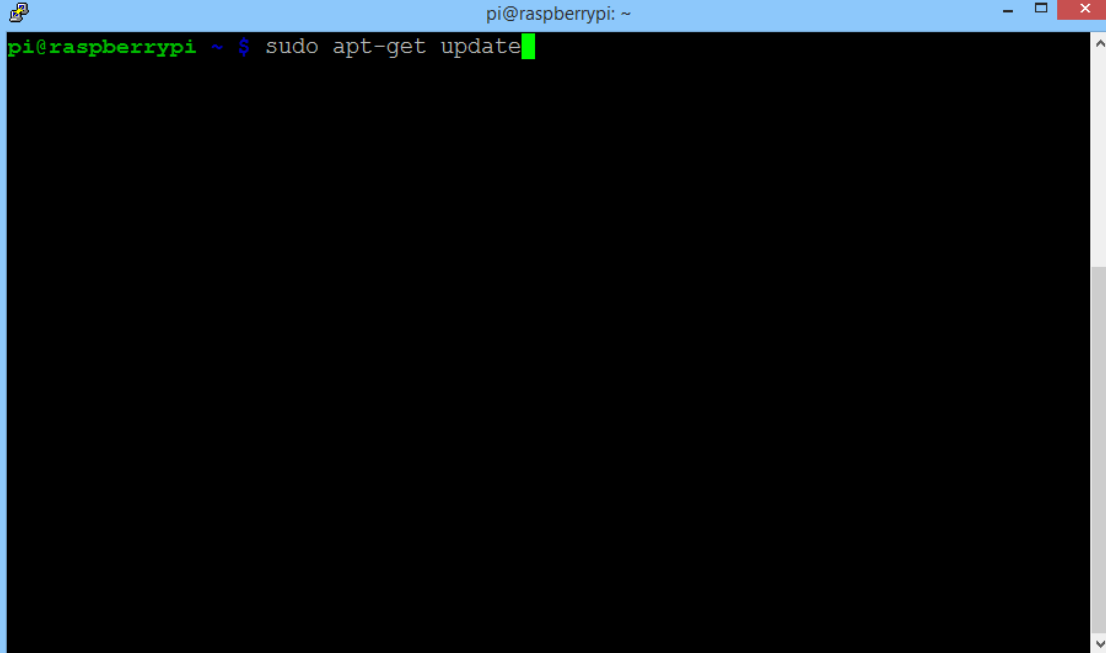
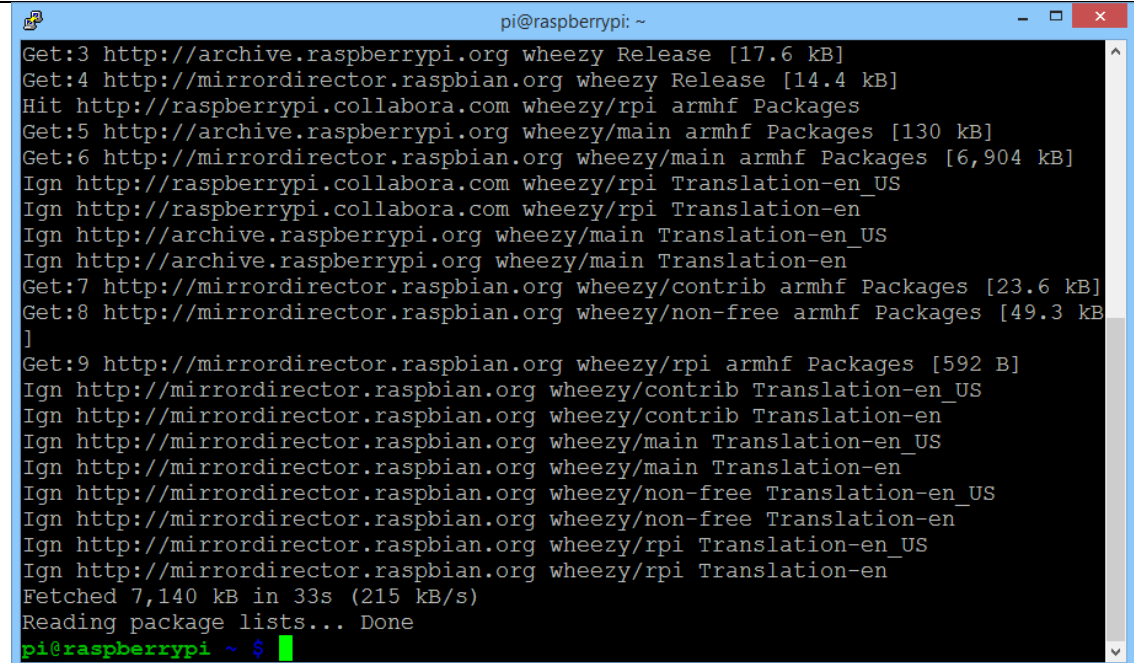
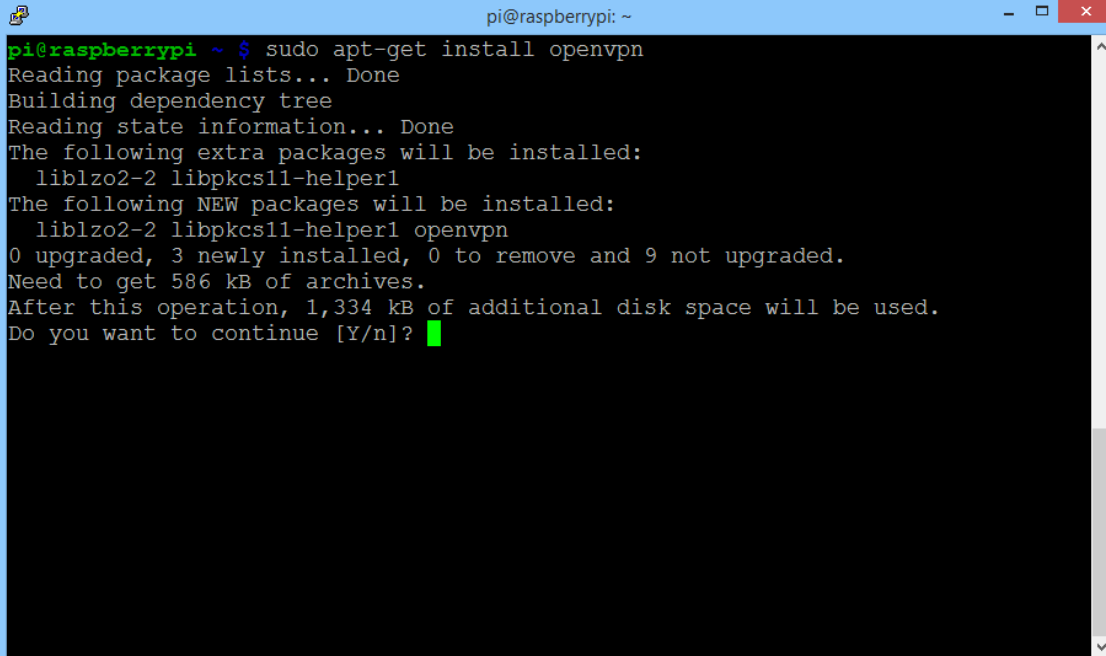
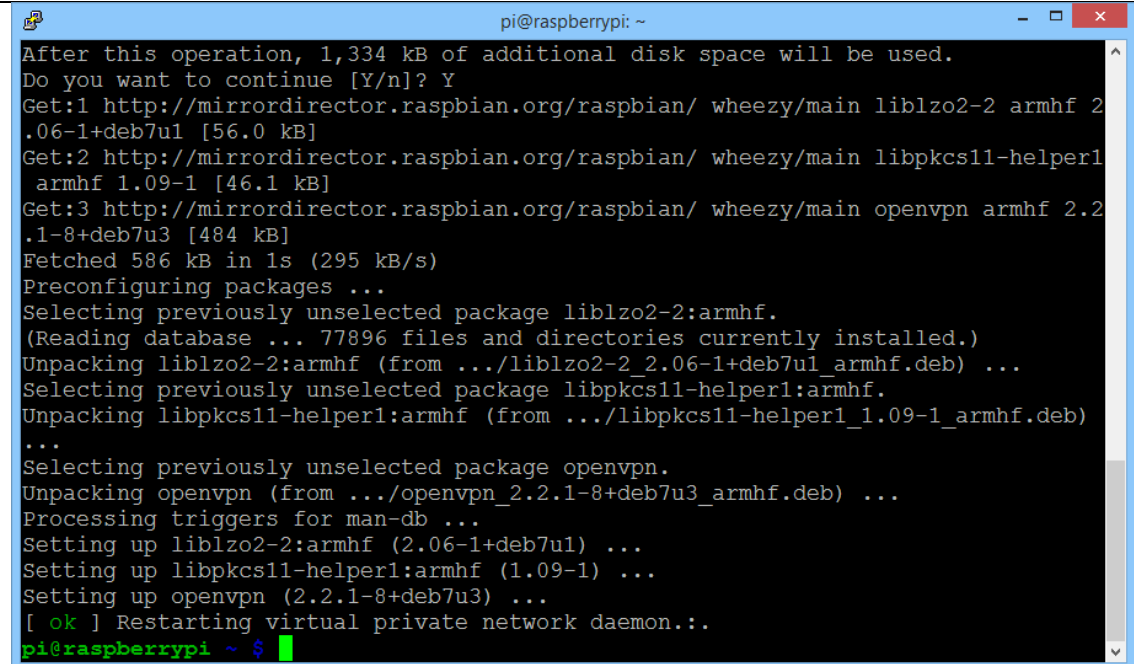


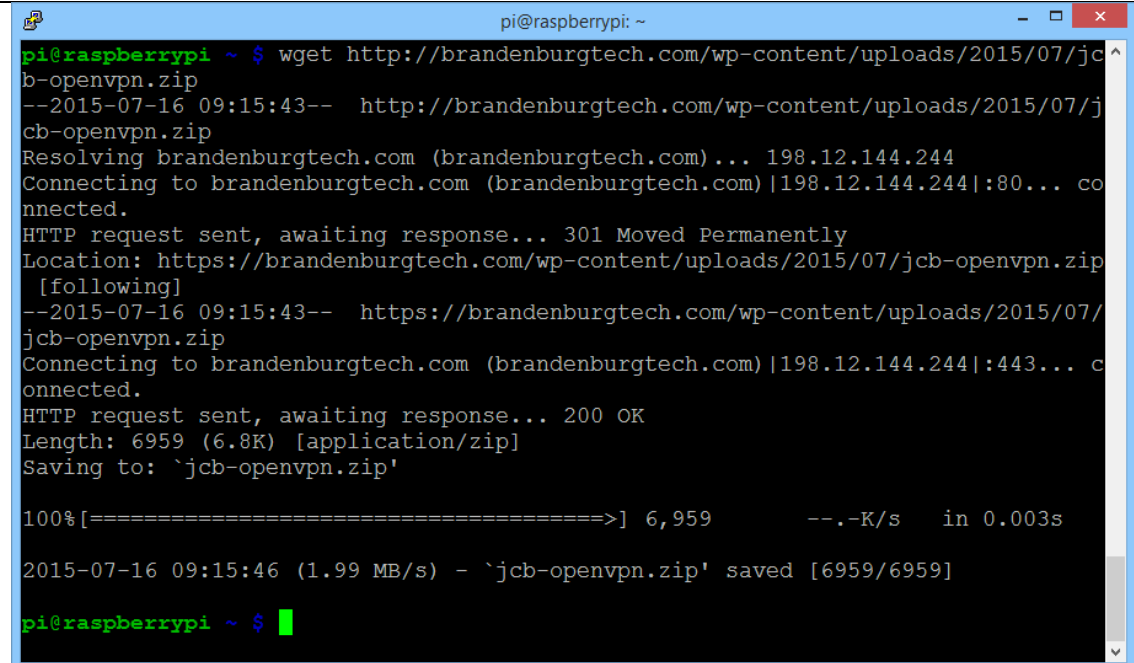
# Configure Raspberry Pi as a VPN Tunnel

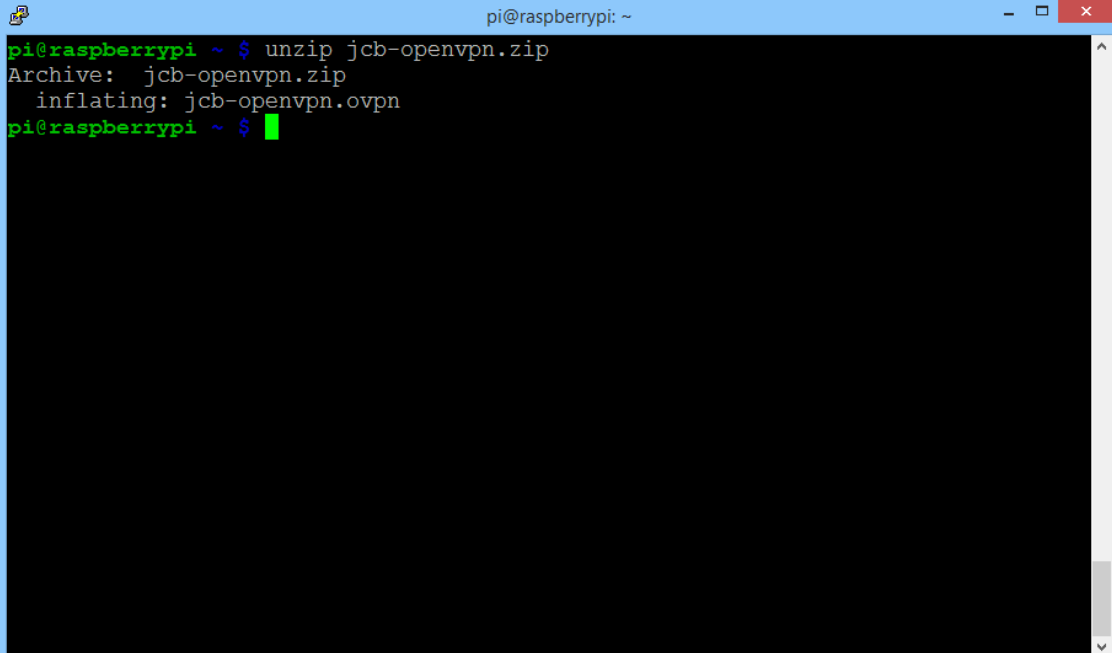
1	 A terminal window titled 'pi@raspberrypi: ~' with a blue header bar. The prompt 'pi@raspberrypi ~ \$' is followed by the command 'sudo apt-get update' with a green cursor at the end. The rest of the terminal is black.	<p>Ensure the Raspberry Pi has the latest catalog of updates.</p> <p>Execute "sudo apt-get update".</p>
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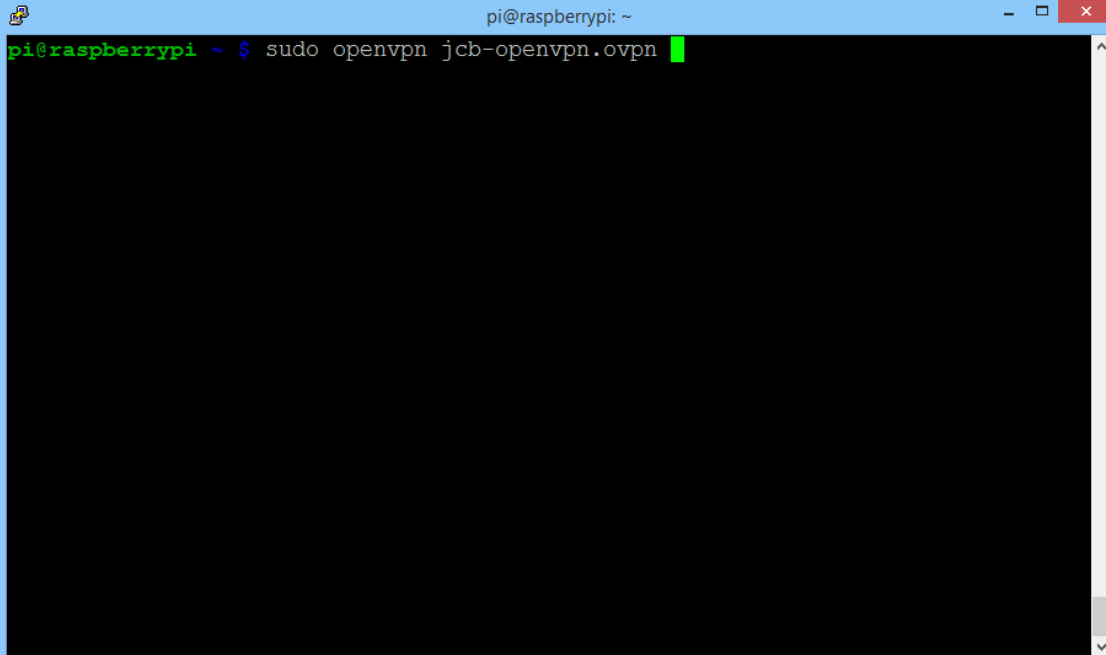
2	 <pre>pi@raspberrypi: ~ Get:3 http://archive.raspberrypi.org wheezy Release [17.6 kB] Get:4 http://mirrordirector.raspbian.org wheezy Release [14.4 kB] Hit http://raspberrypi.collabora.com wheezy/rpi armhf Packages Get:5 http://archive.raspberrypi.org wheezy/main armhf Packages [130 kB] Get:6 http://mirrordirector.raspbian.org wheezy/main armhf Packages [6,904 kB] Ign http://raspberrypi.collabora.com wheezy/rpi Translation-en_US Ign http://raspberrypi.collabora.com wheezy/rpi Translation-en Ign http://archive.raspberrypi.org wheezy/main Translation-en_US Ign http://archive.raspberrypi.org wheezy/main Translation-en Get:7 http://mirrordirector.raspbian.org wheezy/contrib armhf Packages [23.6 kB] Get:8 http://mirrordirector.raspbian.org wheezy/non-free armhf Packages [49.3 kB] ] Get:9 http://mirrordirector.raspbian.org wheezy/rpi armhf Packages [592 B] Ign http://mirrordirector.raspbian.org wheezy/contrib Translation-en_US Ign http://mirrordirector.raspbian.org wheezy/contrib Translation-en Ign http://mirrordirector.raspbian.org wheezy/main Translation-en_US Ign http://mirrordirector.raspbian.org wheezy/main Translation-en Ign http://mirrordirector.raspbian.org wheezy/non-free Translation-en_US Ign http://mirrordirector.raspbian.org wheezy/non-free Translation-en Ign http://mirrordirector.raspbian.org wheezy/rpi Translation-en_US Ign http://mirrordirector.raspbian.org wheezy/rpi Translation-en Fetched 7,140 kB in 33s (215 kB/s) Reading package lists... Done pi@raspberrypi ~ \$</pre>	The results should look similar to the results in the screenshot.
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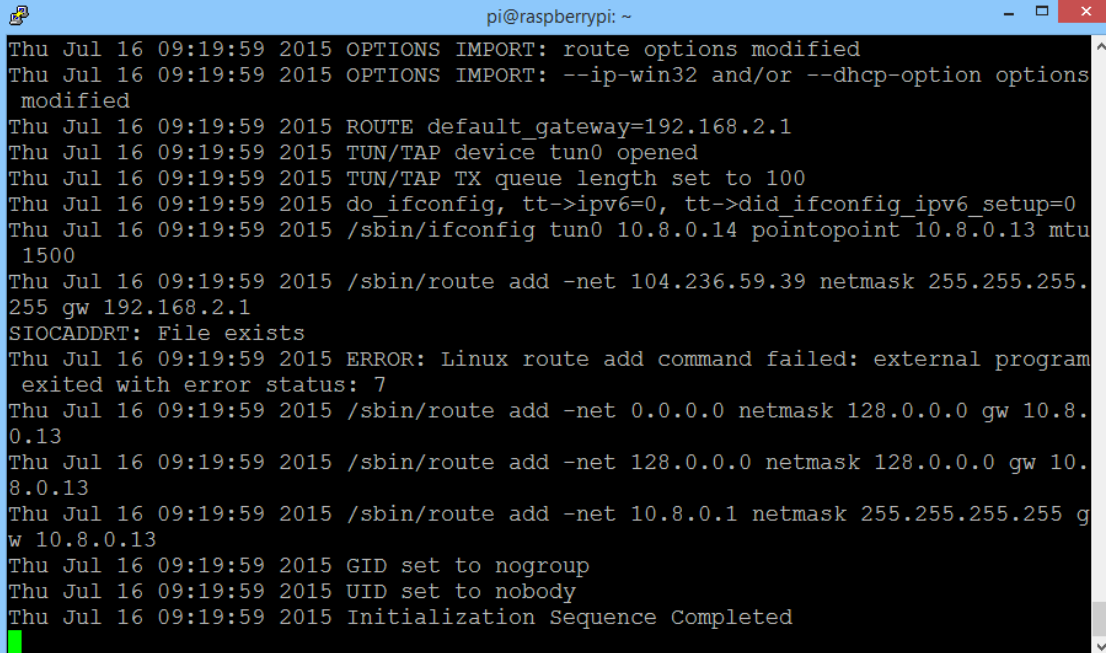
3	 <pre>pi@raspberrypi: ~ pi@raspberrypi ~ \$ sudo apt-get install openvpn Reading package lists... Done Building dependency tree Reading state information... Done The following extra packages will be installed:   liblzo2-2 libpkcs11-helper1 The following NEW packages will be installed:   liblzo2-2 libpkcs11-helper1 openvpn 0 upgraded, 3 newly installed, 0 to remove and 9 not upgraded. Need to get 586 kB of archives. After this operation, 1,334 kB of additional disk space will be used. Do you want to continue [Y/n]? █</pre>	<p>Install OpenVPN.</p> <p>Execute “sudo apt-get install openvpn”.</p> <p>When prompted, enter ‘Y’ to continue the installation of OpenVPN.</p>
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4	 <pre>pi@raspberrypi: ~ After this operation, 1,334 kB of additional disk space will be used. Do you want to continue [Y/n]? Y Get:1 http://mirrordirector.raspbian.org/raspbian/ wheezy/main liblzo2-2 armhf 2 .06-1+deb7u1 [56.0 kB] Get:2 http://mirrordirector.raspbian.org/raspbian/ wheezy/main libpkcs11-helper1 armhf 1.09-1 [46.1 kB] Get:3 http://mirrordirector.raspbian.org/raspbian/ wheezy/main openvpn armhf 2.2 .1-8+deb7u3 [484 kB] Fetched 586 kB in 1s (295 kB/s) Preconfiguring packages ... Selecting previously unselected package liblzo2-2:armhf. (Reading database ... 77896 files and directories currently installed.) Unpacking liblzo2-2:armhf (from ../liblzo2-2_2.06-1+deb7u1_armhf.deb) ... Selecting previously unselected package libpkcs11-helper1:armhf. Unpacking libpkcs11-helper1:armhf (from ../libpkcs11-helper1_1.09-1_armhf.deb) ... Selecting previously unselected package openvpn. Unpacking openvpn (from ../openvpn_2.2.1-8+deb7u3_armhf.deb) ... Processing triggers for man-db ... Setting up liblzo2-2:armhf (2.06-1+deb7u1) ... Setting up libpkcs11-helper1:armhf (1.09-1) ... Setting up openvpn (2.2.1-8+deb7u3) ... [ ok ] Restarting virtual private network daemon.. pi@raspberrypi ~ \$</pre>	The results should look similar to the results in the screenshot.
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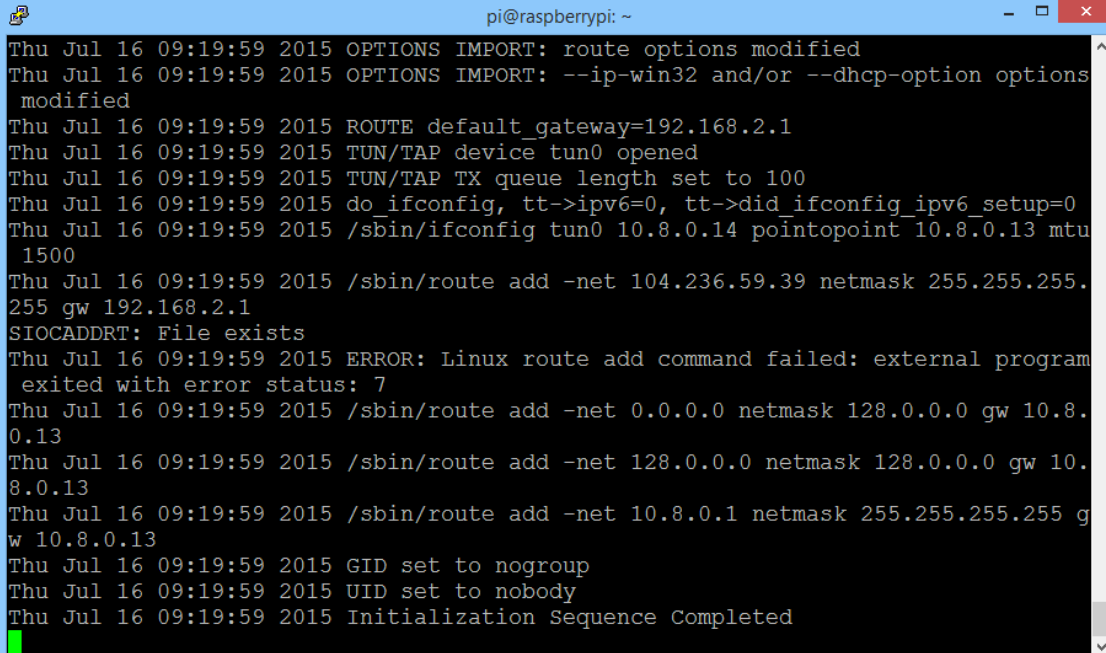
5	 <pre>pi@raspberrypi: ~ pi@raspberrypi ~ \$ wget http://brandenburgtech.com/wp-content/uploads/2015/07/jcb-openvpn.zip --2015-07-16 09:15:43-- http://brandenburgtech.com/wp-content/uploads/2015/07/jcb-openvpn.zip Resolving brandenburgtech.com (brandenburgtech.com)... 198.12.144.244 Connecting to brandenburgtech.com (brandenburgtech.com) 198.12.144.244 :80... connected. HTTP request sent, awaiting response... 301 Moved Permanently Location: https://brandenburgtech.com/wp-content/uploads/2015/07/jcb-openvpn.zip [following] --2015-07-16 09:15:43-- https://brandenburgtech.com/wp-content/uploads/2015/07/jcb-openvpn.zip Connecting to brandenburgtech.com (brandenburgtech.com) 198.12.144.244 :443... connected. HTTP request sent, awaiting response... 200 OK Length: 6959 (6.8K) [application/zip] Saving to: `jcb-openvpn.zip'  100%[=====] 6,959      --.-K/s   in 0.003s  2015-07-16 09:15:46 (1.99 MB/s) - `jcb-openvpn.zip' saved [6959/6959]  pi@raspberrypi ~ \$ █</pre>	<p>Retrieve the OpenVPN client profile for a sample OpenVPN server configured for this class.</p> <p>Execute “<code>wget http://brandenburgtech.com/wp-content/uploads/2015/07/jcb-openvpn.zip</code>”</p>
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6	 <pre>pi@raspberrypi ~ \$ unzip jcb-openvpn.zip Archive:  jcb-openvpn.zip   inflating: jcb-openvpn.ovpn pi@raspberrypi ~ \$ █</pre>	<p>Extract the OpenVPN client profile from the zip file.</p> <p>Execute “unzip jcb –openvpn.zip”</p>
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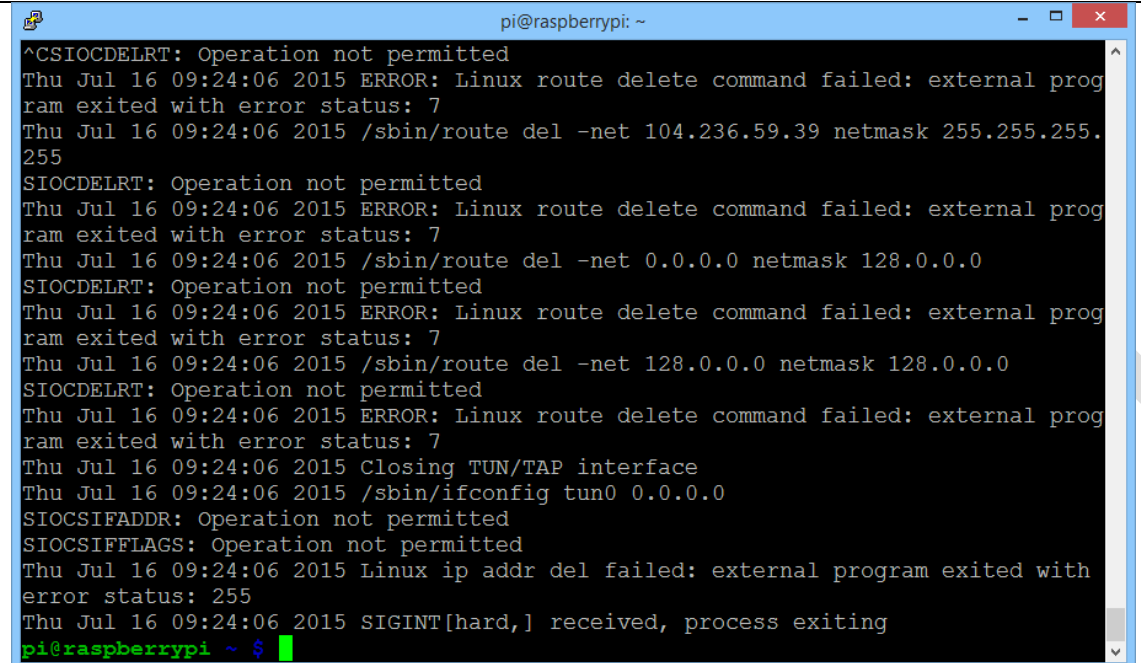
7	 A terminal window titled 'pi@raspberrypi: ~' with a blue header bar. The prompt is 'pi@raspberrypi ~ \$' and the command 'sudo openvpn jcb-openvpn.ovpn' is entered, followed by a green cursor. The rest of the terminal is black.	<p>Test the OpenVPN configuration by forming a tunnel to the test server.</p> <p>Execute “sudo openvpn jcb-openvpn.ovpn”</p>
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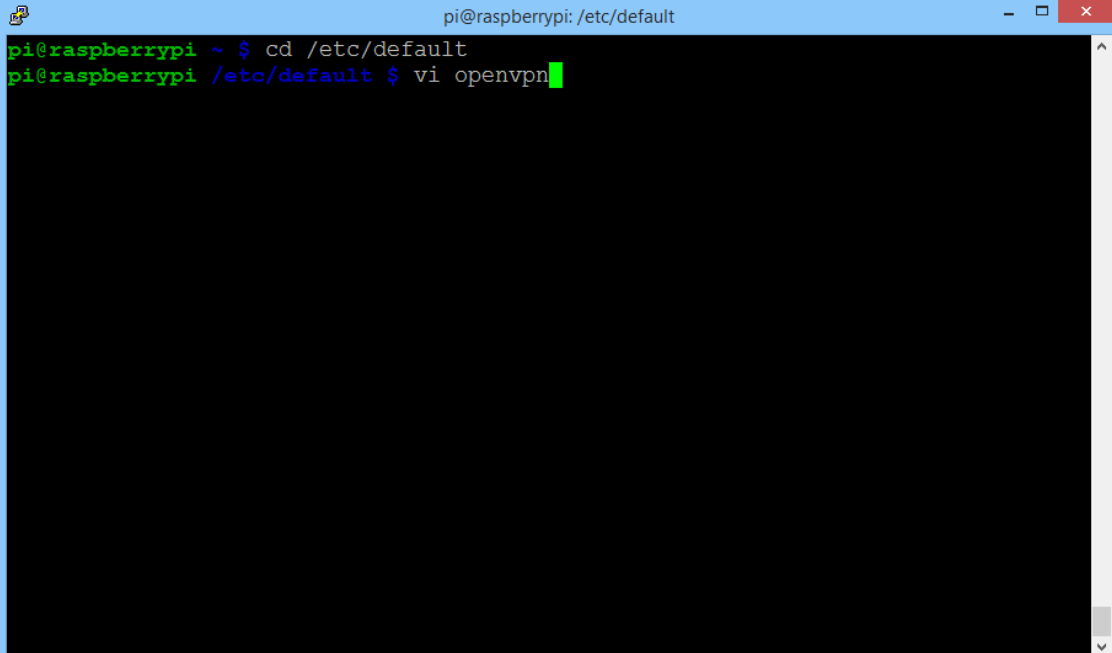
8	 <pre>pi@raspberrypi: ~ Thu Jul 16 09:19:59 2015 OPTIONS IMPORT: route options modified Thu Jul 16 09:19:59 2015 OPTIONS IMPORT: --ip-win32 and/or --dhcp-option options modified Thu Jul 16 09:19:59 2015 ROUTE default_gateway=192.168.2.1 Thu Jul 16 09:19:59 2015 TUN/TAP device tun0 opened Thu Jul 16 09:19:59 2015 TUN/TAP TX queue length set to 100 Thu Jul 16 09:19:59 2015 do_ifconfig, tt-&gt;ipv6=0, tt-&gt;did_ifconfig_ipv6_setup=0 Thu Jul 16 09:19:59 2015 /sbin/ifconfig tun0 10.8.0.14 pointopoint 10.8.0.13 mtu 1500 Thu Jul 16 09:19:59 2015 /sbin/route add -net 104.236.59.39 netmask 255.255.255. 255 gw 192.168.2.1 SIOCADDRT: File exists Thu Jul 16 09:19:59 2015 ERROR: Linux route add command failed: external program exited with error status: 7 Thu Jul 16 09:19:59 2015 /sbin/route add -net 0.0.0.0 netmask 128.0.0.0 gw 10.8. 0.13 Thu Jul 16 09:19:59 2015 /sbin/route add -net 128.0.0.0 netmask 128.0.0.0 gw 10. 8.0.13 Thu Jul 16 09:19:59 2015 /sbin/route add -net 10.8.0.1 netmask 255.255.255.255 g w 10.8.0.13 Thu Jul 16 09:19:59 2015 GID set to nogroup Thu Jul 16 09:19:59 2015 UID set to nobody Thu Jul 16 09:19:59 2015 Initialization Sequence Completed</pre>	The results should look similar to the results in the screenshot.
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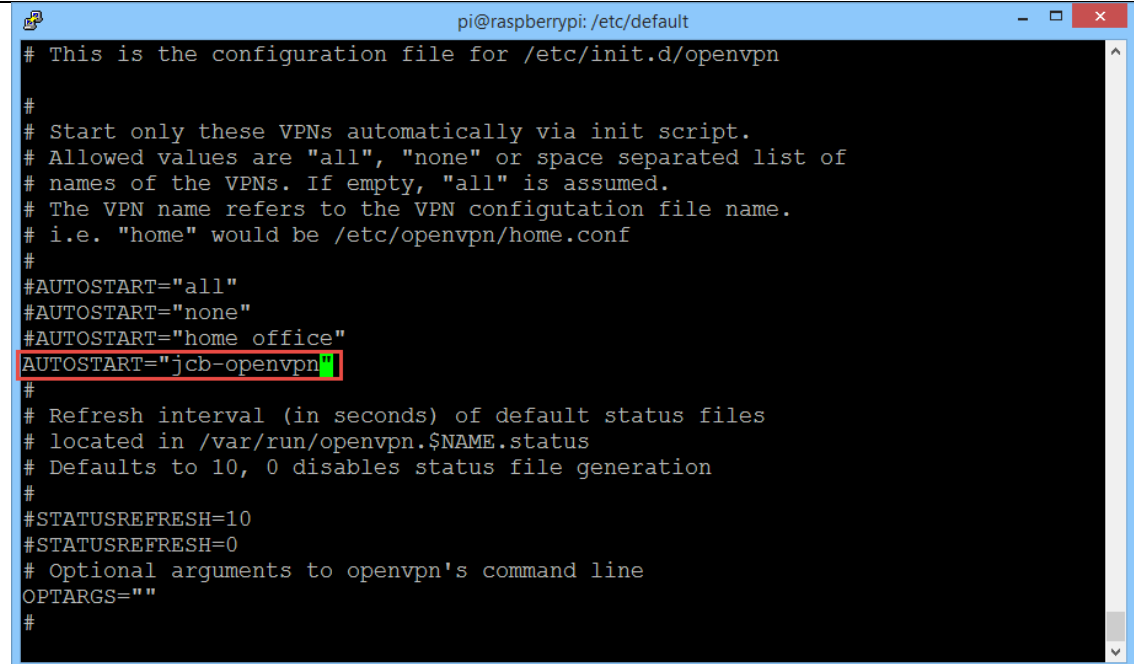



9	 <pre>pi@raspberrypi: ~ Thu Jul 16 09:19:59 2015 OPTIONS IMPORT: route options modified Thu Jul 16 09:19:59 2015 OPTIONS IMPORT: --ip-win32 and/or --dhcp-option options modified Thu Jul 16 09:19:59 2015 ROUTE default_gateway=192.168.2.1 Thu Jul 16 09:19:59 2015 TUN/TAP device tun0 opened Thu Jul 16 09:19:59 2015 TUN/TAP TX queue length set to 100 Thu Jul 16 09:19:59 2015 do_ifconfig, tt-&gt;ipv6=0, tt-&gt;did_ifconfig_ipv6_setup=0 Thu Jul 16 09:19:59 2015 /sbin/ifconfig tun0 10.8.0.14 pointopoint 10.8.0.13 mtu 1500 Thu Jul 16 09:19:59 2015 /sbin/route add -net 104.236.59.39 netmask 255.255.255. 255 gw 192.168.2.1 SIOCADDRT: File exists Thu Jul 16 09:19:59 2015 ERROR: Linux route add command failed: external program exited with error status: 7 Thu Jul 16 09:19:59 2015 /sbin/route add -net 0.0.0.0 netmask 128.0.0.0 gw 10.8. 0.13 Thu Jul 16 09:19:59 2015 /sbin/route add -net 128.0.0.0 netmask 128.0.0.0 gw 10. 8.0.13 Thu Jul 16 09:19:59 2015 /sbin/route add -net 10.8.0.1 netmask 255.255.255.255 g w 10.8.0.13 Thu Jul 16 09:19:59 2015 GID set to nogroup Thu Jul 16 09:19:59 2015 UID set to nobody Thu Jul 16 09:19:59 2015 Initialization Sequence Completed</pre>	<p>See if the OpenVPN tunnel is properly created.</p> <p>Execute “ifconfig”.</p> <p>Note the appearance of the “tun0” interface.</p>
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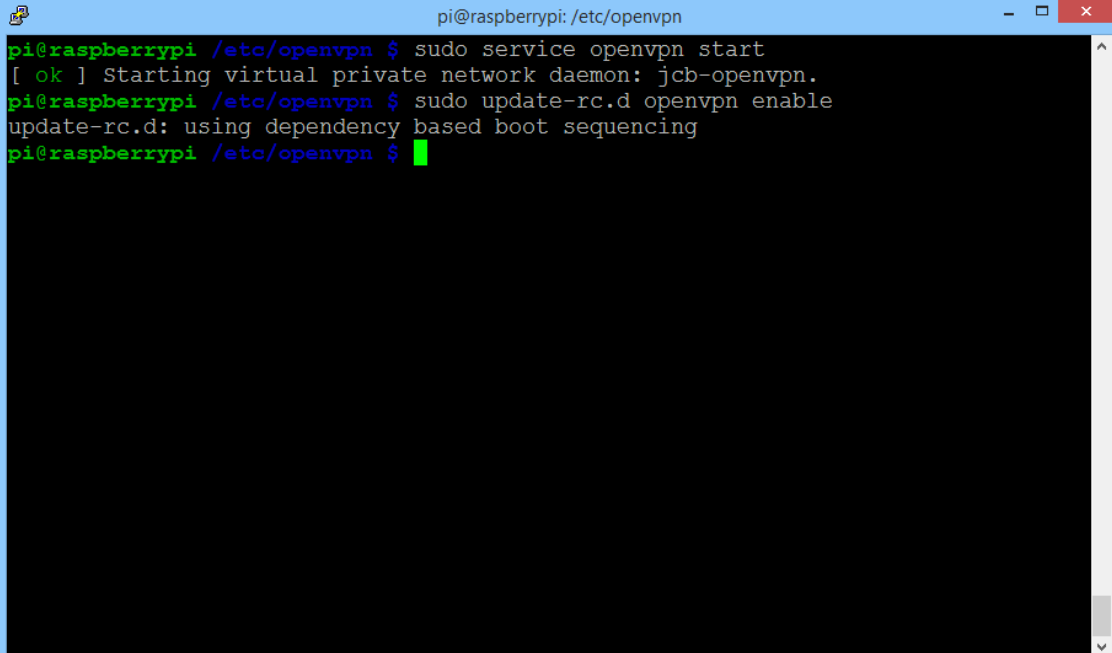


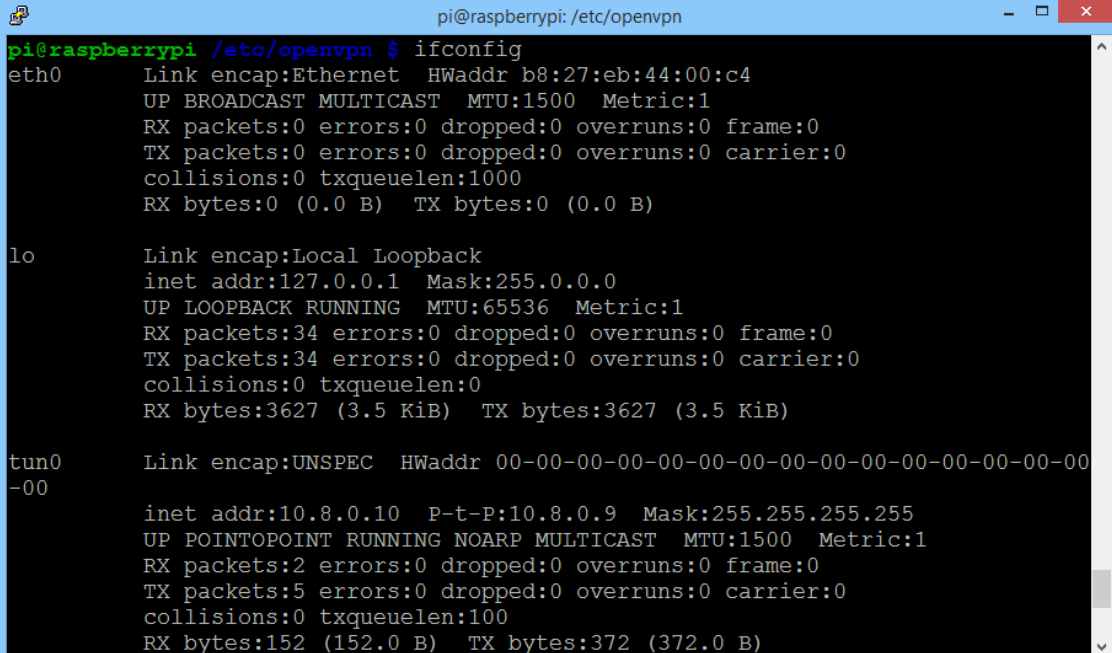
10	 <pre>pi@raspberrypi: ~ ^CSIODELRT: Operation not permitted Thu Jul 16 09:24:06 2015 ERROR: Linux route delete command failed: external prog ram exited with error status: 7 Thu Jul 16 09:24:06 2015 /sbin/route del -net 104.236.59.39 netmask 255.255.255. 255 SIOCODELRT: Operation not permitted Thu Jul 16 09:24:06 2015 ERROR: Linux route delete command failed: external prog ram exited with error status: 7 Thu Jul 16 09:24:06 2015 /sbin/route del -net 0.0.0.0 netmask 128.0.0.0 SIOCODELRT: Operation not permitted Thu Jul 16 09:24:06 2015 ERROR: Linux route delete command failed: external prog ram exited with error status: 7 Thu Jul 16 09:24:06 2015 /sbin/route del -net 128.0.0.0 netmask 128.0.0.0 SIOCODELRT: Operation not permitted Thu Jul 16 09:24:06 2015 ERROR: Linux route delete command failed: external prog ram exited with error status: 7 Thu Jul 16 09:24:06 2015 Closing TUN/TAP interface Thu Jul 16 09:24:06 2015 /sbin/ifconfig tun0 0.0.0.0 SIOCSIFADDR: Operation not permitted SIOCSIFFLAGS: Operation not permitted Thu Jul 16 09:24:06 2015 Linux ip addr del failed: external program exited with error status: 255 Thu Jul 16 09:24:06 2015 SIGINT[hard,] received, process exiting pi@raspberrypi ~ \$</pre>	<p>However, the routing rules are not yet configured to use the VPN tunnel. And, we'd like the OpenVPN tunnel to start on boot.</p> <p>In the window running the "openvpn" client, type Ctrl-C.</p>
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11	 <pre>pi@raspberrypi ~ \$ cd /etc/default pi@raspberrypi /etc/default \$ vi openvpn</pre>	<p>We need to edit the startup options for OpenVPN.</p> <p>Execute "cd /etc/default".</p> <p>Execute "vi openvpn"</p>
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12	 <pre>pi@raspberrypi: /etc/default # This is the configuration file for /etc/init.d/openvpn # # Start only these VPNs automatically via init script. # Allowed values are "all", "none" or space separated list of # names of the VPNs. If empty, "all" is assumed. # The VPN name refers to the VPN configuration file name. # i.e. "home" would be /etc/openvpn/home.conf # #AUTOSTART="all" #AUTOSTART="none" #AUTOSTART="home office" AUTOSTART="jcb-openvpn" # # Refresh interval (in seconds) of default status files # located in /var/run/openvpn.\$NAME.status # Defaults to 10, 0 disables status file generation # #STATUSREFRESH=10 #STATUSREFRESH=0 # Optional arguments to openvpn's command line OPTARGS="" #</pre>	<p>Configure OpenVPN to automatically start a VPN connection using the configuration for “jcb-openvpn”.</p> <p>Add the line <code>AUTOSTART="jcb-openvpn"</code> as seen in the screenshot and save the file.</p>
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13	 <pre>pi@raspberrypi: ~ pi@raspberrypi ~\$ sudo cp jcb-openvpn.ovpn /etc/openvpn/jcb-openvpn.conf pi@raspberrypi ~\$</pre>	<p>Copy the OpenVPN client configuration file to the location expected by OpenVPN.</p> <p>Execute “sudo cp jcb-openvpn.ovpn /etc/openvpn/jcb-openvpn.conf”</p>
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14	 <pre>pi@raspberrypi /etc/openvpn \$ sudo service openvpn start [ ok ] Starting virtual private network daemon: jcb-openvpn. pi@raspberrypi /etc/openvpn \$ sudo update-rc.d openvpn enable update-rc.d: using dependency based boot sequencing pi@raspberrypi /etc/openvpn \$</pre>	<p>Start the OpenVPN service and configure it to automatically start on boot.</p> <p>Execute “sudo service openvpn start”</p> <p>Execute “sudo update-rc.d openvpn enable”</p>
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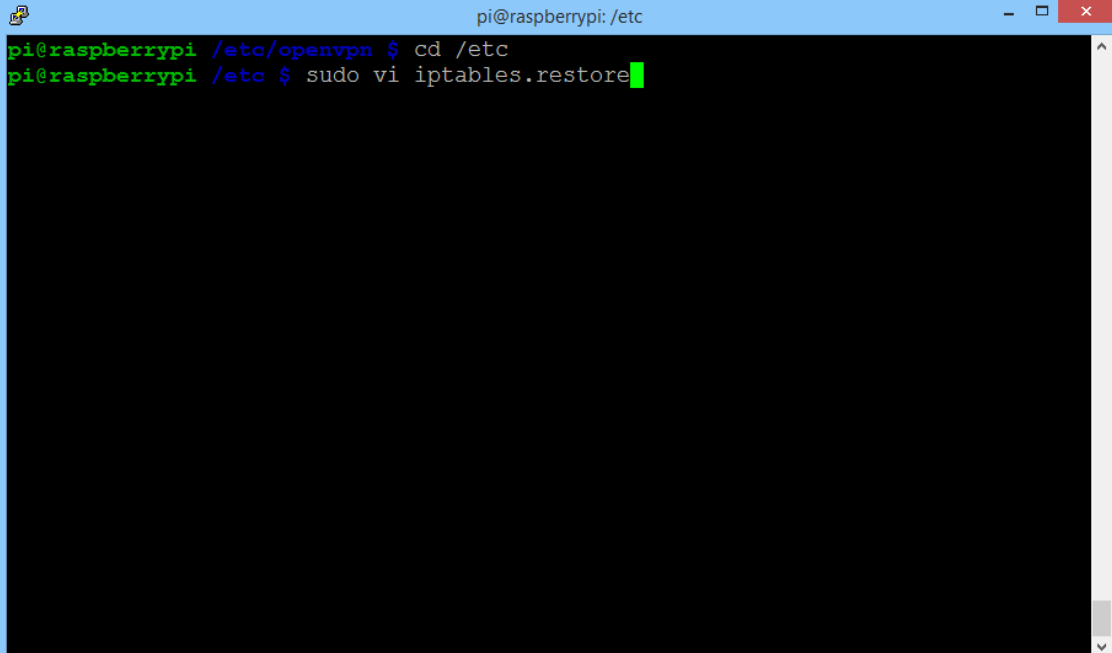
15	 <pre>pi@raspberrypi: /etc/openvpn \$ ifconfig eth0      Link encap:Ethernet  HWaddr b8:27:eb:44:00:c4           UP BROADCAST MULTICAST  MTU:1500  Metric:1           RX packets:0 errors:0 dropped:0 overruns:0 frame:0           TX packets:0 errors:0 dropped:0 overruns:0 carrier:0           collisions:0 txqueuelen:1000           RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)  lo        Link encap:Local Loopback           inet addr:127.0.0.1  Mask:255.0.0.0           UP LOOPBACK RUNNING  MTU:65536  Metric:1           RX packets:34 errors:0 dropped:0 overruns:0 frame:0           TX packets:34 errors:0 dropped:0 overruns:0 carrier:0           collisions:0 txqueuelen:0           RX bytes:3627 (3.5 KiB)  TX bytes:3627 (3.5 KiB)  tun0     Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00 -00           inet addr:10.8.0.10  P-t-P:10.8.0.9  Mask:255.255.255.255           UP POINTOPOINT RUNNING NOARP MULTICAST  MTU:1500  Metric:1           RX packets:2 errors:0 dropped:0 overruns:0 frame:0           TX packets:5 errors:0 dropped:0 overruns:0 carrier:0           collisions:0 txqueuelen:100           RX bytes:152 (152.0 B)  TX bytes:372 (372.0 B)</pre>	<p>See if the OpenVPN tunnel is properly created.</p> <p>Execute “ifconfig”.</p> <p>Note the appearance of the “tun0” interface.</p>
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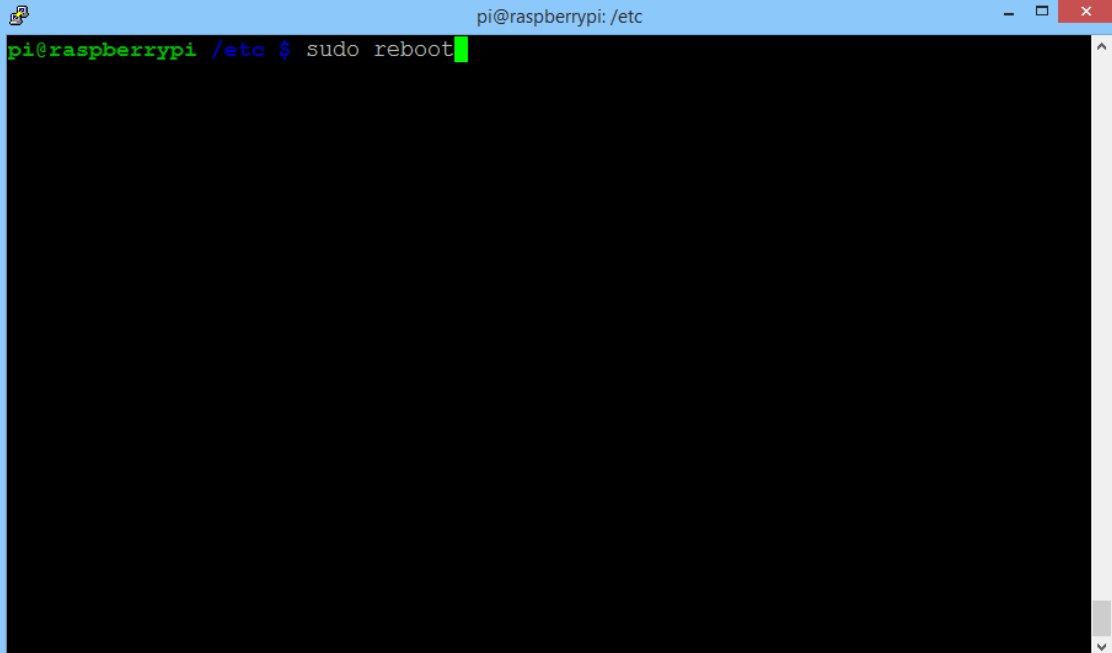
```
pi@raspberrypi: /etc/openvpn
tun0    Link encap:UNSPEC HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
-00
        inet addr:10.8.0.10 P-t-P:10.8.0.9 Mask:255.255.255.255
        UP POINTOPOINT RUNNING NOARP MULTICAST MTU:1500 Metric:1
        RX packets:2 errors:0 dropped:0 overruns:0 frame:0
        TX packets:5 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:100
        RX bytes:152 (152.0 B) TX bytes:372 (372.0 B)

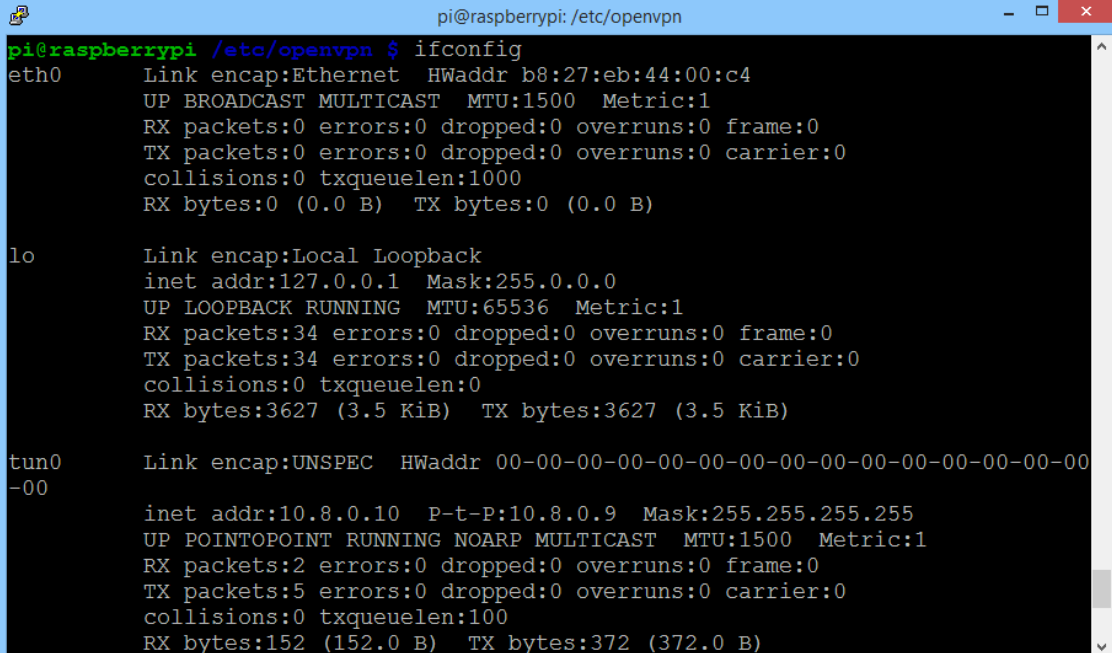
wlan0   Link encap:Ethernet HWaddr 74:da:38:3b:12:72
        inet addr:192.168.2.226 Bcast:192.168.2.255 Mask:255.255.255.0
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:85931 errors:0 dropped:536 overruns:0 frame:0
        TX packets:18507 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:34206053 (32.6 MiB) TX bytes:2832445 (2.7 MiB)

wlan1   Link encap:Ethernet HWaddr 74:da:38:3b:12:88
        inet addr:192.168.10.1 Bcast:192.168.10.255 Mask:255.255.255.0
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:95917 errors:0 dropped:144 overruns:0 frame:0
        TX packets:14328 errors:0 dropped:24 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:2335800 (2.2 MiB) TX bytes:13292908 (12.6 MiB)
```

16	 <pre>pi@raspberrypi /etc/openvpn \$ cd /etc pi@raspberrypi /etc \$ sudo vi iptables.restore</pre>	<p>We need to update the routing rules to use the VPN tunnel.</p> <p>Execute "cd /etc"</p> <p>Execute "sudo vi iptables.restore"</p>
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17	 <pre>pi@raspberrypi: /etc # Generated by iptables-save v1.4.14 on Fri Jun 26 16:38:09 2015 *filter :INPUT ACCEPT [259:31688] :FORWARD ACCEPT [0:0] :OUTPUT ACCEPT [75:7804] -A FORWARD -i wlan1 -o tun0 -j ACCEPT -A FORWARD -i tun0 -o wlan1 -m state --state RELATED,ESTABLISHED -j ACCEPT COMMIT # Completed on Fri Jun 26 16:38:09 2015 # Generated by iptables-save v1.4.14 on Fri Jun 26 16:38:09 2015 *nat :PREROUTING ACCEPT [57:10846] :INPUT ACCEPT [57:10846] :OUTPUT ACCEPT [13:1080] :POSTROUTING ACCEPT [13:1080] -A POSTROUTING -o tun0 -j MASQUERADE COMMIT # Completed on Fri Jun 26 16:38:09 2015 ~ ~ ~ ~ ~/wlan0</pre>	Change all instances of "wlan0" to "tun0"
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18	 A terminal window titled 'pi@raspberrypi: /etc' with a blue header bar. The terminal prompt is 'pi@raspberrypi /etc \$' and the command 'sudo reboot' is entered, followed by a green cursor. The rest of the terminal is black. <pre>pi@raspberrypi /etc \$ sudo reboot</pre>	<p>Reboot the Raspberry Pi to both make the routing rule changes effective and check the automatic start of the VPN.</p>
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19	 <pre>pi@raspberrypi: /etc/openvpn \$ ifconfig eth0      Link encap:Ethernet  HWaddr b8:27:eb:44:00:c4           UP BROADCAST MULTICAST  MTU:1500  Metric:1           RX packets:0 errors:0 dropped:0 overruns:0 frame:0           TX packets:0 errors:0 dropped:0 overruns:0 carrier:0           collisions:0 txqueuelen:1000           RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)  lo        Link encap:Local Loopback           inet addr:127.0.0.1  Mask:255.0.0.0           UP LOOPBACK RUNNING  MTU:65536  Metric:1           RX packets:34 errors:0 dropped:0 overruns:0 frame:0           TX packets:34 errors:0 dropped:0 overruns:0 carrier:0           collisions:0 txqueuelen:0           RX bytes:3627 (3.5 KiB)  TX bytes:3627 (3.5 KiB)  tun0     -00           Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00           inet addr:10.8.0.10  P-t-P:10.8.0.9  Mask:255.255.255.255           UP POINTOPOINT RUNNING NOARP MULTICAST  MTU:1500  Metric:1           RX packets:2 errors:0 dropped:0 overruns:0 frame:0           TX packets:5 errors:0 dropped:0 overruns:0 carrier:0           collisions:0 txqueuelen:100           RX bytes:152 (152.0 B)  TX bytes:372 (372.0 B)</pre>	<p>See if the OpenVPN tunnel is properly created.</p> <p>Execute “ifconfig”.</p> <p>Note the appearance of the “tun0” interface.</p> <p>Test the VPN by connecting to the hot spot from another Raspberry Pi, computer, or even mobile device.</p>
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```
pi@raspberrypi: /etc/openvpn
tun0    Link encap:UNSPEC HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
-00
        inet addr:10.8.0.10 P-t-P:10.8.0.9 Mask:255.255.255.255
        UP POINTOPOINT RUNNING NOARP MULTICAST MTU:1500 Metric:1
        RX packets:2 errors:0 dropped:0 overruns:0 frame:0
        TX packets:5 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:100
        RX bytes:152 (152.0 B) TX bytes:372 (372.0 B)

wlan0   Link encap:Ethernet HWaddr 74:da:38:3b:12:72
        inet addr:192.168.2.226 Bcast:192.168.2.255 Mask:255.255.255.0
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:85931 errors:0 dropped:536 overruns:0 frame:0
        TX packets:18507 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:34206053 (32.6 MiB) TX bytes:2832445 (2.7 MiB)

wlan1   Link encap:Ethernet HWaddr 74:da:38:3b:12:88
        inet addr:192.168.10.1 Bcast:192.168.10.255 Mask:255.255.255.0
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:95917 errors:0 dropped:144 overruns:0 frame:0
        TX packets:14328 errors:0 dropped:24 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:2335800 (2.2 MiB) TX bytes:13292908 (12.6 MiB)
```