

## IPV6-ONLY NETWORK FUNCTIONAL TEST REPORT

### DEVICE UNDER TEST AND TESTPLAN INFORMATION

DEVICE A	
Vendor Name	Canonical Inc.
Product Name	Ubuntu
Software Version	24.04.1
Product Category	Router
Test Selection Table Version	IPv6-Only R1v1.1
Test Specification	IPv6-Only Network Functional Test Plan, Version 1.1
Tool Used	Manual
CNLABS Product ID	250100

### TEST RESULTS

ADDRESS ARCHITECTURE TEST RESULTS		
Reference	Test Number	Result
USGv6-R1	IPv6Only.1.1: Online Installation	Pass
USGv6-R1	IPv6Only.1.2: Online Update	Pass
USGv6-R1	IPv6Only.1.3: User Initiated Management/Monitoring Access	Pass
USGv6-R1	IPv6Only.1.4: Devices Initiated Management/Monitoring Functions	Pass
USGv6-R1	IPv6Only.1.5: User Interface (A)(B)	Pass
USGv6-R1	IPv6Only.1.6: Logging (A) (B)	Pass

### NOTE:

Test logs are attached below.

## IPv6-Only.1.1: Installation

IPv6 Configuration:


```
root@cnlabs-refdutipv6: ~
```

```
root@cnlabs-refdutipv6:~# cat /etc/sysctl.conf | grep ens160
net.ipv6.conf.ens160.accept_dad = 1
net.ipv6.conf.ens160.accept_ra = 0
net.ipv6.conf.ens160.addr_gen_mode = 0
net.ipv6.conf.ens160.autoconf = 1
net.ipv6.conf.ens160.disable_ipv6 = 0
net.ipv6.conf.ens160.forwarding = 1
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# sysctl -p
net.ipv6.conf.all.forwarding = 1
net.ipv6.conf.ens160.accept_dad = 1
net.ipv6.conf.ens160.accept_ra = 0
net.ipv6.conf.ens160.addr_gen_mode = 0
net.ipv6.conf.ens160.autoconf = 1
net.ipv6.conf.ens160.disable_ipv6 = 0
net.ipv6.conf.ens160.forwarding = 1
net.ipv6.conf.ens192.accept_dad = 1
net.ipv6.conf.ens192.accept_ra = 0
net.ipv6.conf.ens192.addr_gen_mode = 0
net.ipv6.conf.ens192.autoconf = 1
net.ipv6.conf.ens192.disable_ipv6 = 0
net.ipv6.conf.ens192.forwarding = 1
net.ipv6.conf.ens224.accept_dad = 1
net.ipv6.conf.ens224.accept_ra = 0
net.ipv6.conf.ens224.addr_gen_mode = 0
net.ipv6.conf.ens224.autoconf = 1
net.ipv6.conf.ens224.disable_ipv6 = 0
net.ipv6.conf.ens224.forwarding = 1
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~#
```

```
root@cnlabs-refdutipv6: ~
```

```
root@cnlabs-refdutipv6:~# ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
        valid_lft forever preferred_lft forever
2: ens160: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:e7:28:67 brd ff:ff:ff:ff:ff:ff
    altname enp3s0
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867/64 scope global
        valid_lft forever preferred_lft forever
    inet6 2001:470:1:88e:20c:29ff:fee7:2867/64 scope global
        valid_lft forever preferred_lft forever
    inet6 fe80::20c:29ff:fee7:2867/64 scope link
        valid_lft forever preferred_lft forever
3: ens192: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc fq_codel state DOWN group default qlen 1000
    link/ether 00:0c:29:28:de:f4 brd ff:ff:ff:ff:ff:ff
    altname enp11s0
4: ens224: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc fq_codel state DOWN group default qlen 1000
    link/ether 00:0c:29:28:de:fe brd ff:ff:ff:ff:ff:ff
    altname enp19s0
root@cnlabs-refdutipv6:~#
```

## SSH Configuration:

 root@cnlabs-refdutipv6: /etc/ssh

```
# This is the sshd server system-wide configuration file.  See
# sshd_config(5) for more information.

# This sshd was compiled with PATH=/usr/bin:/bin:/usr/sbin:/sbin

# The strategy used for options in the default sshd_config shipped with
# OpenSSH is to specify options with their default value where
# possible, but leave them commented.  Uncommented options override the
# default value.

Include /etc/ssh/sshd_config.d/*.conf

#Port 22
#AddressFamily any
#ListenAddress 0.0.0.0
#ListenAddress ::

#HostKey /etc/ssh/ssh_host_rsa_key
#HostKey /etc/ssh/ssh_host_ecdsa_key
#HostKey /etc/ssh/ssh_host_ed25519_key

# Ciphers and keying
#RekeyLimit default none

# Logging
#SyslogFacility AUTH
#LogLevel INFO

# Authentication:

#LoginGraceTime 2m
PermitRootLogin yes
#StrictModes yes
#MaxAuthTries 6
#MaxSessions 10

#PubkeyAuthentication yes

# Expect .ssh/authorized_keys2 to be disregarded by default in future.
#AuthorizedKeysFile .ssh/authorized_keys .ssh/authorized_keys2

#AuthorizedPrincipalsFile none

#AuthorizedKeysCommand none
#AuthorizedKeysCommandUser nobody

# For this to work you will also need host keys in /etc/ssh/ssh_known_hosts
#HostbasedAuthentication no
# Change to yes if you don't trust ~/.ssh/known_hosts for
# HostbasedAuthentication
#IgnoreUserKnownHosts no
# Don't read the user's ~/.rhosts and ~/.shosts files
#IgnoreRhosts yes

# To disable tunneled clear text passwords, change to no here!
```

## SSH Service Status:

```
root@cnlabs-refdutipv6: ~
root@cnlabs-refdutipv6:~# systemctl restart ssh
root@cnlabs-refdutipv6:~# systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/usr/lib/systemd/system/ssh.service; disabled; preset: enabled)
   Active: active (running) since Tue 2025-03-18 11:17:03 UTC; 4s ago
 TriggeredBy: ● ssh.socket
     Docs: man:sshd(8)
           man:sshd_config(5)
   Process: 1993 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCESS)
  Main PID: 1997 (sshd)
    Tasks: 1 (limit: 1068)
   Memory: 1.2M (peak: 1.4M)
      CPU: 27ms
   CGroup: /system.slice/ssh.service
           └─1997 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Mar 18 11:17:03 cnlabs-refdutipv6 systemd[1]: Starting ssh.service - OpenBSD Secure Shell server...
Mar 18 11:17:03 cnlabs-refdutipv6 sshd[1997]: Server listening on :: port 22.
Mar 18 11:17:03 cnlabs-refdutipv6 systemd[1]: Started ssh.service - OpenBSD Secure Shell server.
root@cnlabs-refdutipv6:~#
```

## Remote service is operational: Device Logged in via SSH using IPv6 address

```
root@cnlabs-refdutipv6: ~
login as: root
root@3ffe:501:ffff:100:20c:29ff:fee7:2867's password:
Welcome to Ubuntu 24.04.1 LTS (GNU/Linux 6.8.0-49-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/pro

System information as of Thu Jan 23 10:58:17 AM UTC 2025

System load:            0.04
Usage of /:              48.1% of 14.66GB
Memory usage:           25%
Swap usage:              0%
Temperature:            100.0 C
Processes:              150
Users logged in:        1
IPv6 address for ens160: 3ffe:501:ffff:100:20c:29ff:fee7:2867

Expanded Security Maintenance for Applications is not enabled.

31 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Failed to connect to https://changelogs.ubuntu.com/meta-release. Check your Internet connection or proxy settings

Last login: Thu Jan 23 10:58:18 2025 from 3ffe:501:ffff:100:115e:5de9:322c:9b95
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 1603 bytes 432511 (432.5 KB)
    RX errors 0 dropped 334 overruns 0 frame 0
    TX packets 532 bytes 88056 (88.0 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~# uname -a
Linux cnlabs-refdutipv6 6.8.0-49-generic #49-Ubuntu SMP PREEMPT_DYNAMIC Mon Nov  4 02:06:24 UTC 2024 x86_64 x86_64 x86_64 GNU/Linux
root@cnlabs-refdutipv6:~#
```

Note: The DUT software is installed offline, so the online installation steps 1 and 2 have been skipped as per the test specification.

## IPv6-Only.1.2: Update

### DUT Information:

```

root@cnlabs-refdutipv6: ~
root@cnlabs-refdutipv6:~# ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid lft forever preferred lft forever
    inet6 ::1/128 scope host noprefixroute
        valid lft forever preferred lft forever
2: ens160: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:e7:28:67 brd ff:ff:ff:ff:ff:ff
    altname enp3s0
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867/64 scope global
        valid lft forever preferred lft forever
    inet6 2001:470:1:88e:20c:29ff:fee7:2867/64 scope global
        valid lft forever preferred lft forever
    inet6 fe80::20c:29ff:fee7:2867/64 scope link
        valid lft forever preferred lft forever
3: ens192: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc fq_codel state DOWN group default qlen 1000
    link/ether 00:0c:29:28:de:f4 brd ff:ff:ff:ff:ff:ff
    altname enp11s0
4: ens224: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc fq_codel state DOWN group default qlen 1000
    link/ether 00:0c:29:28:de:fe brd ff:ff:ff:ff:ff:ff
    altname enp19s0
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# cat /etc/resolv.conf
# This is /run/systemd/resolve/stub-resolv.conf managed by man:systemd-resolved(8).
# Do not edit.
#
# This file might be symlinked as /etc/resolv.conf. If you're looking at
# /etc/resolv.conf and seeing this text, you have followed the symlink.
#
# This is a dynamic resolv.conf file for connecting local clients to the
# internal DNS stub resolver of systemd-resolved. This file lists all
# configured search domains.
#
# Run "resolvectl status" to see details about the uplink DNS servers
# currently in use.
#
# Third party programs should typically not access this file directly, but only
# through the symlink at /etc/resolv.conf. To manage man:resolv.conf(5) in a
# different way, replace this symlink by a static file or a different symlink.
#
# See man:systemd-resolved.service(8) for details about the supported modes of
# operation for /etc/resolv.conf.

nameserver 127.0.0.53
options edns0 trust-ad
search .
root@cnlabs-refdutipv6:~# ip -6 route
2001:470:1:88e::/64 dev ens160 proto kernel metric 256 pref medium
3ffe:501:ffff:100::/64 dev ens160 proto kernel metric 256 pref medium
fe80::/64 dev ens160 proto kernel metric 256 pref medium
default via 2001:470:1:88e::1 dev ens160 metric 1024 pref medium
root@cnlabs-refdutipv6:~# uname -r
6.8.0-49-generic
root@cnlabs-refdutipv6:~#

```

root@cnlabs-refdutipv6: ~

root@cnlabs-refdutipv6:~# sudo apt list linux-\*image-\* | grep generic

WARNING: apt does not have a stable CLI interface. Use with caution in scripts.

```
linux-image-5.4.0-147-generic/now 5.4.0-147.164 amd64 [residual-config]
linux-image-5.4.0-148-generic/now 5.4.0-148.165 amd64 [residual-config]
linux-image-5.4.0-149-generic/now 5.4.0-149.166 amd64 [residual-config]
linux-image-5.4.0-77-generic/now 5.4.0-77.86 amd64 [residual-config]
linux-image-5.4.0-80-generic/now 5.4.0-80.90 amd64 [residual-config]
linux-image-5.4.0-81-generic/now 5.4.0-81.91 amd64 [residual-config]
linux-image-5.4.0-84-generic/now 5.4.0-84.94 amd64 [residual-config]
linux-image-5.4.0-86-generic/now 5.4.0-86.97 amd64 [residual-config]
linux-image-5.4.0-88-generic/now 5.4.0-88.99 amd64 [residual-config]
linux-image-5.4.0-89-generic/now 5.4.0-89.100 amd64 [residual-config]
linux-image-5.4.0-90-generic/now 5.4.0-90.101 amd64 [residual-config]
linux-image-5.4.0-91-generic/now 5.4.0-91.102 amd64 [residual-config]
linux-image-5.8.0-59-generic/now 5.8.0-59.66~20.04.1 amd64 [residual-config]
linux-image-6.11.0-17-generic/noble-updates 6.11.0-17.17~24.04.2 amd64
linux-image-6.11.0-19-generic/noble-updates,noble-security 6.11.0-19.19~24.04.1 amd64
linux-image-6.8.0-31-generic/noble 6.8.0-31.31 amd64
linux-image-6.8.0-35-generic/noble-updates,noble-security 6.8.0-35.35+1 amd64
linux-image-6.8.0-36-generic/noble-updates,noble-security 6.8.0-36.36 amd64
linux-image-6.8.0-38-generic/noble-updates,noble-security 6.8.0-38.38 amd64
linux-image-6.8.0-39-generic/noble-updates,noble-security 6.8.0-39.39 amd64
linux-image-6.8.0-40-generic/noble-updates,noble-security 6.8.0-40.40 amd64
linux-image-6.8.0-41-generic/noble-updates,noble-security 6.8.0-41.41 amd64
linux-image-6.8.0-44-generic/noble-updates,noble-security 6.8.0-44.44 amd64
linux-image-6.8.0-45-generic/noble-updates,noble-security 6.8.0-45.45 amd64
linux-image-6.8.0-47-generic/noble-updates,noble-security 6.8.0-47.47 amd64
linux-image-6.8.0-48-generic/noble-updates,noble-security 6.8.0-48.48 amd64
linux-image-6.8.0-49-generic/noble-updates,noble-security,now 6.8.0-49.49 amd64 [installed,automatic]
linux-image-6.8.0-50-generic/noble-updates,noble-security,now 6.8.0-50.51 amd64 [residual-config]
linux-image-6.8.0-51-generic/noble-updates,noble-security,now 6.8.0-51.52 amd64 [installed,automatic]
linux-image-6.8.0-52-generic/noble-updates,noble-security 6.8.0-52.53 amd64
linux-image-6.8.0-53-generic/noble-updates 6.8.0-53.55 amd64
linux-image-6.8.0-54-generic/noble-updates,noble-security 6.8.0-54.56 amd64
linux-image-6.8.0-55-generic/noble-updates,noble-security 6.8.0-55.57 amd64
linux-image-generic-hwe-24.04-edge/noble-updates,noble-security 6.11.0-19.19~24.04.1 amd64
linux-image-generic-hwe-24.04/noble-updates,noble-security 6.11.0-19.19~24.04.1 amd64
linux-image-generic/noble-updates,noble-security 6.8.0-55.57 amd64 [upgradable from: 6.8.0-51.52]
linux-image-uc-6.11.0-17-generic/noble-updates 6.11.0-17.17~24.04.2 amd64
linux-image-uc-6.11.0-19-generic/noble-updates,noble-security 6.11.0-19.19~24.04.1 amd64
linux-image-uc-6.8.0-31-generic/noble 6.8.0-31.31 amd64
linux-image-uc-6.8.0-35-generic/noble-updates,noble-security 6.8.0-35.35+1 amd64
linux-image-uc-6.8.0-36-generic/noble-updates,noble-security 6.8.0-36.36 amd64
linux-image-uc-6.8.0-38-generic/noble-updates,noble-security 6.8.0-38.38 amd64
linux-image-uc-6.8.0-39-generic/noble-updates,noble-security 6.8.0-39.39 amd64
linux-image-uc-6.8.0-40-generic/noble-updates,noble-security 6.8.0-40.40 amd64
linux-image-uc-6.8.0-41-generic/noble-updates,noble-security 6.8.0-41.41 amd64
linux-image-uc-6.8.0-44-generic/noble-updates,noble-security 6.8.0-44.44 amd64
linux-image-uc-6.8.0-45-generic/noble-updates,noble-security 6.8.0-45.45 amd64
linux-image-uc-6.8.0-47-generic/noble-updates,noble-security 6.8.0-47.47 amd64
linux-image-uc-6.8.0-48-generic/noble-updates,noble-security 6.8.0-48.48 amd64
linux-image-uc-6.8.0-49-generic/noble-updates,noble-security 6.8.0-49.49 amd64
linux-image-uc-6.8.0-50-generic/noble-updates,noble-security 6.8.0-50.51 amd64
```



## Kernel Upgradation:

```

root@cnlabs-refdutipv6:/etc/grub.d
root@cnlabs-refdutipv6:~# sudo apt install linux-image-6.8.0-55-generic
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libbson-1.0-0t64 libdbi1t64 libesmt6 libhiredis1.1.0 libivykis0t64 libmongoc-1.0-0t64 libmongocrypt0 libnet1 libprotobuf-cl librabbitmq4 librdkafka libriemann-client0 libsnappy1v5
  libuserproc3 mailcap python3-cachetools python3-google-auth python3-kubernetes python3-requests-oauthlib python3-rsa python3-websocket
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  linux-libc-dev linux-modules-6.8.0-55-generic linux-tools-common
Suggested packages:
  fdutils linux-tools linux-headers-6.8.0-55-generic linux-modules-extra-6.8.0-55-generic
The following NEW packages will be installed:
  linux-image-6.8.0-55-generic linux-modules-6.8.0-55-generic
The following packages will be upgraded:
  linux-libc-dev linux-tools-common
2 upgraded, 2 newly installed, 0 to remove and 138 not upgraded.
Need to get 0 B/56.4 MB of archives.
After this operation, 54.1 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Selecting previously unselected package linux-modules-6.8.0-55-generic.
(Reading database ... 126555 files and directories currently installed.)
Preparing to unpack .../linux-modules-6.8.0-55-generic_6.8.0-55.57_amd64.deb ...
Unpacking linux-modules-6.8.0-55-generic (6.8.0-55.57) ...
Selecting previously unselected package linux-image-6.8.0-55-generic.
Preparing to unpack .../linux-image-6.8.0-55-generic_6.8.0-55.57_amd64.deb ...
Unpacking linux-image-6.8.0-55-generic (6.8.0-55.57) ...
Preparing to unpack .../linux-libc-dev_6.8.0-55.57_amd64.deb ...
Unpacking linux-libc-dev_6.8.0-55.57 over (6.8.0-51.52) ...
Preparing to unpack .../linux-tools-common_6.8.0-55.57_all.deb ...
Unpacking linux-tools-common (6.8.0-55.57) over (6.8.0-51.52) ...
Setting up linux-libc-dev:amd64 (6.8.0-55.57) ...
Setting up linux-modules-6.8.0-55-generic (6.8.0-55.57) ...
Setting up linux-tools-common (6.8.0-55.57) ...
Setting up linux-image-6.8.0-55-generic (6.8.0-55.57) ...
I: /boot/vmlinuz.old is now a symlink to vmlinuz-6.8.0-51-generic
I: /boot/initrd.img.old is now a symlink to initrd.img-6.8.0-51-generic
I: /boot/vmlinuz is now a symlink to vmlinuz-6.8.0-55-generic
I: /boot/initrd.img is now a symlink to initrd.img-6.8.0-55-generic
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for linux-image-6.8.0-55-generic (6.8.0-55.57) ...
/etc/kernel/postinst.d/initramfs-tools:
update-initramfs: Generating /boot/initrd.img-6.8.0-55-generic
/etc/kernel/postinst.d/zz-update-grub:
Sourcing file '/etc/default/grub'
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-6.8.0-55-generic
Found initrd image: /boot/initrd.img-6.8.0-55-generic
Found linux image: /boot/vmlinuz-6.8.0-51-generic
Found initrd image: /boot/initrd.img-6.8.0-51-generic
Found linux image: /boot/vmlinuz-6.8.0-49-generic
Found initrd image: /boot/initrd.img-6.8.0-49-generic
Found linux image: /boot/vmlinuz-5.8.0-59-generic
Found initrd image: /boot/initrd.img-5.8.0-59-generic
Warning: os-prober will not be executed to detect other bootable partitions.

```

```

root@cnlabs-refdutipv6:/etc/grub.d
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-6.8.0-55-generic
Found initrd image: /boot/initrd.img-6.8.0-55-generic
Found linux image: /boot/vmlinuz-6.8.0-51-generic
Found initrd image: /boot/initrd.img-6.8.0-51-generic
Found linux image: /boot/vmlinuz-6.8.0-49-generic
Found initrd image: /boot/initrd.img-6.8.0-49-generic
Found linux image: /boot/vmlinuz-5.8.0-59-generic
Found initrd image: /boot/initrd.img-5.8.0-59-generic
Warning: os-prober will not be executed to detect other bootable partitions.
Systems on them will not be added to the GRUB boot configuration.
Check GRUB_DISABLE_OS_PROBER documentation entry.
Adding boot menu entry for UEFI Firmware Settings ...
done
root@cnlabs-refdutipv6:/etc/grub.d#
root@cnlabs-refdutipv6:/etc/grub.d#
root@cnlabs-refdutipv6:/etc/grub.d#
root@cnlabs-refdutipv6:/etc/grub.d# reboot
root@cnlabs-refdutipv6:/etc/grub.d# Connection to 2001:470:1:88e:20c:29ff:fee7:2867 closed by remote host.
Connection to 2001:470:1:88e:20c:29ff:fee7:2867 closed.
cnlabs@fmt2-server-01:~$ █

```

The DUT has successfully updated the Kernel version from “6.8.0-49-generic” to “6.8.0-55-generic”:

```

root@cnlabs-refdutipv6: ~
root@2001:470:1:88e:20c:29ff:fee7:2867's password:
Welcome to Ubuntu 24.04.1 LTS (GNU/Linux 6.8.0-55-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/pro

System information as of Tue Mar 18 12:43:07 PM UTC 2025

System load:          0.0
Usage of /:           53.2% of 14.66GB
Memory usage:         24%
Swap usage:           0%
Processes:            136
Users logged in:      0
IPv6 address for ens160: 3ffe:501:ffff:100:20c:29ff:fee7:2867
IPv6 address for ens160: 2001:470:1:88e:20c:29ff:fee7:2867

Expanded Security Maintenance for Applications is not enabled.

128 updates can be applied immediately.
44 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Failed to connect to https://changelogs.ubuntu.com/meta-release. Check your Internet connection or proxy settings

Last login: Tue Mar 18 12:41:08 2025 from 2001:470:1:88e:7a2b:cbff:fe26:d4ac
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# uname -r
6.8.0-55-generic
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
        valid_lft forever preferred_lft forever
2: ens160: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:e7:28:67 brd ff:ff:ff:ff:ff:ff
    altname enp3s0
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867/64 scope global
        valid_lft forever preferred_lft forever
    inet6 2001:470:1:88e:20c:29ff:fee7:2867/64 scope global
        valid_lft forever preferred_lft forever
    inet6 fe80::20c:29ff:fee7:2867/64 scope link
        valid_lft forever preferred_lft forever

```

Note: The DUT doesn't require update media to be copied to the system before the update can be initiated, so step 1 is omitted as per the test specification.



## IPv6-Only.1.3: User Initiated Management/Monitoring Access

### SSH Login:

```
root@cnlabs-refdutipv6: ~  
login as: root  
root@3ffe:501:ffff:100:20c:29ff:fee7:2867's password:  
Welcome to Ubuntu 24.04.1 LTS (GNU/Linux 6.8.0-49-generic x86_64)  
  
* Documentation:  https://help.ubuntu.com  
* Management:    https://landscape.canonical.com  
* Support:       https://ubuntu.com/pro  
  
System information as of Thu Jan 23 10:58:17 AM UTC 2025  
  
System load:          0.04  
Usage of /:           48.1% of 14.66GB  
Memory usage:        25%  
Swap usage:          0%  
Temperature:         100.0 C  
Processes:           150  
Users logged in:      1  
IPv6 address for ens160: 3ffe:501:ffff:100:20c:29ff:fee7:2867  
  
Expanded Security Maintenance for Applications is not enabled.  
  
31 updates can be applied immediately.  
To see these additional updates run: apt list --upgradable  
  
Enable ESM Apps to receive additional future security updates.  
See https://ubuntu.com/esm or run: sudo pro status  
  
Failed to connect to https://changelogs.ubuntu.com/meta-release. Check your Internet connection or proxy settings  
  
Last login: Thu Jan 23 10:58:18 2025 from 3ffe:501:ffff:100:115e:5de9:322c:9b95  
root@cnlabs-refdutipv6:~#  
root@cnlabs-refdutipv6:~# ifconfig ens160  
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>  
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>  
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)  
    RX packets 1603 bytes 432511 (432.5 KB)  
    RX errors 0 dropped 334 overruns 0 frame 0  
    TX packets 532 bytes 88056 (88.0 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
root@cnlabs-refdutipv6:~# uname -a  
Linux cnlabs-refdutipv6 6.8.0-49-generic #49-Ubuntu SMP PREEMPT_DYNAMIC Mon Nov  4 02:06:24 UTC 2024 x86_64 x86_64 x86_64 GNU/Linux  
root@cnlabs-refdutipv6:~#
```

## SSH Login through another device:

```

root@Router-C:~# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:0c:29:3c:35:97
          inet6 addr: 3ffe:501:ffff:100:20c:29ff:fe3c:3597/64 Scope:Global
          inet6 addr: fe80::20c:29ff:fe3c:3597/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:4819 errors:0 dropped:1 overruns:0 frame:0
          TX packets:1429 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:385513 (385.5 KB)  TX bytes:186352 (186.3 KB)

root@Router-C:~# ssh root@3ffe:501:ffff:100:20c:29ff:fee7:2867
root@3ffe:501:ffff:100:20c:29ff:fee7:2867's password:
Welcome to Ubuntu 24.04.1 LTS (GNU/Linux 6.8.0-51-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/pro

System information as of Fri Jan  3 06:08:17 AM UTC 2025

System load:  0.0               Swap usage:   0%               Users logged in: 1
Usage of /:   47.8% of 14.66GB   Temperature: 100.0 C
Memory usage: 25%              Processes:    141

Expanded Security Maintenance for Applications is not enabled.

20 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

The list of available updates is more than a week old.
To check for new updates run: sudo apt update
Failed to connect to https://changelogs.ubuntu.com/meta-release. Check your Internet connection or proxy settings

Last login: Fri Jan  3 06:04:52 2025 from 3ffe:501:ffff:100:20c:29ff:fe3c:3597
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
          inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867  prefixlen 64  scopeid 0x0<global>
          inet6 fe80::20c:29ff:fee7:2867  prefixlen 64  scopeid 0x20<link>
          ether 00:0c:29:e7:28:67  txqueuelen 1000  (Ethernet)
          RX packets 742714  bytes 45327651 (45.3 MB)
          RX errors 0  dropped 411  overruns 0  frame 0
          TX packets 326601  bytes 30209506 (30.2 MB)
          TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

root@cnlabs-refdutipv6:~#

```

## DUT Information: Confirm version, IPv6 Address(es)

root@cnlabs-refdutipv6: ~

```
* Documentation: https://help.ubuntu.com
* Management:   https://landscape.canonical.com
* Support:      https://ubuntu.com/pro
```

System information as of Thu Dec 26 02:05:46 PM UTC 2024

```
System load:          0.0
Usage of /:            47.3% of 14.66GB
Memory usage:         28%
Swap usage:           1%
Temperature:          100.0 C
Processes:             142
Users logged in:       1
IPv6 address for ens160: 3ffe:501:ffff:100:20c:29ff:fee7:2867
```

\* Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s just raised the bar for easy, resilient and secure K8s cluster deployment.

<https://ubuntu.com/engage/secure-kubernetes-at-the-edge>

Expanded Security Maintenance for Applications is not enabled.

20 updates can be applied immediately.

To see these additional updates run: `apt list --upgradable`

Enable ESM Apps to receive additional future security updates.

See <https://ubuntu.com/esm> or run: `sudo pro status`

New release '24.10' available.

Run 'do-release-upgrade' to upgrade to it.

\*\*\* System restart required \*\*\*

Last login: Thu Dec 26 13:43:17 2024 from fe80::a47a:db35:a6bd:e953%ens160

root@cnlabs-refdutipv6:~# `ifconfig ens160`

```
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet6 fe80::20c:29ff:fee7:2867  prefixlen 64  scopeid 0x20<link>
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867  prefixlen 64  scopeid 0x0<global>
    ether 00:0c:29:e7:28:67  txqueuelen 1000  (Ethernet)
    RX packets 18975  bytes 1234615 (1.2 MB)
    RX errors 0  dropped 73839  overruns 0  frame 0
    TX packets 1268  bytes 227030 (227.0 KB)
    TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0
```

root@cnlabs-refdutipv6:~# `uname -a`

Linux cnlabs-refdutipv6 6.8.0-49-generic #49-Ubuntu SMP PREEMPT\_DYNAMIC Mon Nov 4 02:06:24 UTC 2024 x86\_64 x86\_64 x86\_64 GNU/Linux

root@cnlabs-refdutipv6:~#

root@cnlabs-refdutipv6:~# `lsb_release -a`

No LSB modules are available.

Distributor ID: Ubuntu

Description: Ubuntu 24.04.1 LTS

Release: 24.04

Codename: noble

root@cnlabs-refdutipv6:~#

## IPv6-Only.1.4: Device Initiated Management/Monitoring Functions

DUT is successfully configured with a target for monitoring.

DUT SNMPv2/SNMPv3 Configuration:

```

root@cnlabs-refdutipv6: /etc/snmp

# specify which address, interface, transport type and port(s) that you
# want the agent to listen on. Multiple definitions of this token
# are concatenated together (using ':').
# arguments: [transport:]port[@interface/address],...

#agentaddress 127.0.0.1,[:1]
agentAddress udp6:[::]:161

#####
# SECTION: Access Control Setup
#
# This section defines who is allowed to talk to your running
# snmp agent.

# Views
# arguments viewname included [oid]

# system + hrSystem groups only
view systemonly included .1.3.6.1.2.1.1
view systemonly included .1.3.6.1.2.1.25.1

# rocommunity: a SNMPv1/SNMPv2c read-only access community name
# arguments: community [default|hostname|network/bits] [oid | -V view]

# Read-only access to everyone to the systemonly view
rocommunity public default -V systemonly
rocommunity6 public default -V systemonly
trap2sink udp6:[3ffe:501:ffff:100:20c:29ff:fe3c:3597]

# SNMPv3 doesn't use communities, but users with (optionally) an
# authentication and encryption string. This user needs to be created
# with what they can view with rouser/rwuser lines in this file.
#
# createUser username (MD5|SHA|SHA-512|SHA-384|SHA-256|SHA-224) authpassphrase [DES|AES] [pri
vpassphrase]
# e.g.
# createUser authPrivUser SHA-512 myauthphrase AES myprivphrase

createUser admin SHA authpass123 DES privpass123
rouser admin authPriv
authtrapenable 1
informsink udp6:[3ffe:501:ffff:100:20c:29ff:fe3c:3597]

# This should be put into /var/lib/snmp/snmpd.conf
#
# rouser: a SNMPv3 read-only access username
# arguments: username [noauth|auth|priv [OID | -V VIEW [CONTEXT]]]
rouser authPrivUser authpriv -V systemonly

# include all *.conf files in a directory
includeDir /etc/snmp/snmpd.conf.d
root@cnlabs-refdutipv6: /etc/snmp#

```

## SNMPv2:

- DUT successfully emits an alert for the wrong community name, and the alert is consumed by the target (marked in red)

```

root@Router-C:/etc/snmp# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:c2:93:c3:59:7f
          inet6 addr: 3ffe:501:ffff:100:20c:29ff:fe3c:3597/64 Scope:Global
          inet6 addr: fe80::20c:29ff:fe3c:3597/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1597174 errors:0 dropped:453 overruns:0 frame:0
          TX packets:19722 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:106358851 (106.3 Mb)  TX bytes:2376691 (2.3 Mb)

root@Router-C:/etc/snmp# snmpget -v2c -c public udp6:[3ffe:501:ffff:100:20c:29ff:fe7:2867] sysName.0
SNMPv2-MIB::sysName.0 = STRING: cnlabs-refdutipv6

root@Router-C:/etc/snmp# snmpget -v2c -c wrong udp6:[3ffe:501:ffff:100:20c:29ff:fe7:2867] sysName.0
Timeout: No Response from udp6:[3ffe:501:ffff:100:20c:29ff:fe7:2867].

root@Router-C:/etc/snmp#

```

```

root@cnlabs-refdutipv6:/etc/snmp# ifconfig ens160
ens160:   flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
          inet6 fe80::20c:29ff:fe7:2867 prefixlen 64 scopeid 0x20<link>
          inet6 3ffe:501:ffff:100:20c:29ff:fe7:2867 prefixlen 64 scopeid 0x0<global>
          ether 00:c2:93:c3:59:7f txqueuelen 1000 (Ethernet)
          RX packets 148675 bytes 11728914 (11.7 MB)
          RX errors 0 dropped 26314 overruns 0 frame 0
          TX packets 10365 bytes 1620421 (1.6 Mb)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:/etc/snmp# tcpdump -nni ens160 port 161 or port 162
tcpdump: verbose output suppressed, use -v[v]... for full protocol decode
listening on ens160, link-type EN10MB (Ethernet), snapshot length 262144 bytes
04:45:10.079972 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597.45263 > 3ffe:501:ffff:100:20c:29ff:fe7:2867.161: GetRequest(28) .1.3.6.1.2.1.1.5.0
04:45:10.080324 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.161 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.45263: GetResponse(45) .1.3.6.1.2.1.1.5.0="cnlabs-refdutipv6"
04:45:17.608718 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597.47515 > 3ffe:501:ffff:100:20c:29ff:fe7:2867.161: C="wrong" GetRequest(28) .1.3.6.1.2.1.1.5.0
04:45:17.609210 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.40900 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.162: V2Trap(81) .1.3.6.1.2.1.1.3.0=10588 .1.3.6.1.6.3.1.1.4.1.0=.1.3.6.1.6.3.1.1.5.0
04:45:18.609886 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597.47515 > 3ffe:501:ffff:100:20c:29ff:fe7:2867.161: C="wrong" GetRequest(28) .1.3.6.1.2.1.1.5.0
04:45:18.610230 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.40900 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.162: V2Trap(81) .1.3.6.1.2.1.1.3.0=10688 .1.3.6.1.6.3.1.1.4.1.0=.1.3.6.1.6.3.1.1.5.0
04:45:19.611071 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597.47515 > 3ffe:501:ffff:100:20c:29ff:fe7:2867.161: C="wrong" GetRequest(28) .1.3.6.1.2.1.1.5.0
04:45:19.611416 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.40900 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.162: V2Trap(81) .1.3.6.1.2.1.1.3.0=10788 .1.3.6.1.6.3.1.1.4.1.0=.1.3.6.1.6.3.1.1.5.0
04:45:20.612198 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597.47515 > 3ffe:501:ffff:100:20c:29ff:fe7:2867.161: C="wrong" GetRequest(28) .1.3.6.1.2.1.1.5.0
04:45:20.612549 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.40900 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.162: V2Trap(81) .1.3.6.1.2.1.1.3.0=10889 .1.3.6.1.6.3.1.1.4.1.0=.1.3.6.1.6.3.1.1.5.0
04:45:21.613383 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597.47515 > 3ffe:501:ffff:100:20c:29ff:fe7:2867.161: C="wrong" GetRequest(28) .1.3.6.1.2.1.1.5.0
04:45:21.613773 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.40900 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.162: V2Trap(81) .1.3.6.1.2.1.1.3.0=10989 .1.3.6.1.6.3.1.1.4.1.0=.1.3.6.1.6.3.1.1.5.0
04:45:22.614555 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597.47515 > 3ffe:501:ffff:100:20c:29ff:fe7:2867.161: C="wrong" GetRequest(28) .1.3.6.1.2.1.1.5.0
04:45:22.614933 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.40900 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.162: V2Trap(81) .1.3.6.1.2.1.1.3.0=11089 .1.3.6.1.6.3.1.1.4.1.0=.1.3.6.1.6.3.1.1.5.0

```

## SNMPv3:

- DUT successfully emits an alert for the wrong credentials, and the alert is consumed by the target (marked in red)

```

root@Router-C:/etc/snmp# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:0c:29:3c:35:97
          inet6 addr: 3ffe:501:ffff:100:20c:29ff:fe3c:3597/64 Scope:Global
          inet6 addr: fe80::20c:29ff:fe3c:3597/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1599240 errors:0 dropped:453 overruns:0 frame:0
          TX packets:19961 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:106509658 (106.5 MB)  TX bytes:2423094 (2.4 MB)

root@Router-C:/etc/snmp# snmpget -v3 -l authpriv -u admin -a SHA -A authpass123 -x DES -X privpass123 udp6:[3ffe:501:ffff:100:20c:29ff:fe7:2867] sysName.0
SNMPv2-MIB:sysName.0 = STRING: cnlabs-refdutipv6
root@Router-C:/etc/snmp#
root@Router-C:/etc/snmp# snmpget -v3 -l authpriv -u admin -a SHA -A wrongauthpass123 -x DES -X privpass123 udp6:[3ffe:501:ffff:100:20c:29ff:fe7:2867] sysName.0
snmpget: Authentication failure (incorrect password, community or key) (Sub-id not found: (to p) -> sysName)
root@Router-C:/etc/snmp#

```

```

root@cnlabs-refdutipv6:/etc/snmp# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet6 fe80::20c:29ff:fe7:2867 prefixlen 64 scopeid 0x20<link>
        inet6 3ffe:501:ffff:100:20c:29ff:fe7:2867 prefixlen 64 scopeid 0x0<global>
        ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
        RX packets 156083 bytes 12411665 (12.4 MB)
        RX errors 0 dropped 26462 overruns 0 frame 0
        TX packets 11244 bytes 1781519 (1.7 MB)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:/etc/snmp# tcpdump -nni ens160 port 161 or port 162
tcpdump: verbose output suppressed, use -v[... for full protocol decode
listening on ens160, link-type EN10MB (Ethernet), snapshot length 262144 bytes
04:57:04.675867 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597.60368 > 3ffe:501:ffff:100:20c:29ff:fe7:2867.161: F=w U="" E=c"" GetRequest(14)
04:57:04.676256 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.161 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.60368: F=U"" E=80_00_1f_88_80_61_5f_df_65_aa_87_77_67_00_00_00_00 C="" Report(31)
.1.3.6.1.6.3.15.1.1.4.0=2
04:57:04.676866 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597.60368 > 3ffe:501:ffff:100:20c:29ff:fe7:2867.161: F=ap U="admin" [!scoped PDU]bb d8 d6 22 a7 79 b5 73 de 43 6f 2c b9 0a 19 0b e 0 5d 94 ab 39 8f fe 0f 18 56 20 10 29 50 c9 ff c7 72 52 26 d9 60 be 68 33 c5 a5 0c 5a 80 29 7 a 2a 08 55 97 ac 4b cd 36
04:57:04.677124 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.161 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.60368: F=ap U="admin" [!scoped PDU]2c 73 db aa cb 13 8a 67 ca 34 ee 25 a9 69 6f cd e6 9f 03 a7 97 0b 23 f8 a0 fe 37 9e 13 a7 31 e2 6f 6c d1 bb d1 05 e2 78 31 3a ba 1c 36 f8 95 aa fe 1c ba 01 90 4d ef f0 3e 22 26 c1 3b 1a 02 ae 44 82 40 cc dc b7 b6 92
04:57:15.487524 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597.40478 > 3ffe:501:ffff:100:20c:29ff:fe7:2867.161: F=r U="" E=c"" GetRequest(14)
04:57:15.487937 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.161 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.40478: F=U"" E=80_00_1f_88_80_61_5f_df_65_aa_87_77_67_00_00_00_00 C="" Report(31)
.1.3.6.1.6.3.15.1.1.4.0=3
04:57:15.488572 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597.40478 > 3ffe:501:ffff:100:20c:29ff:fe7:2867.161: F=ap U="admin" [!scoped PDU]ce d8 d8 f5 c0 d8 d5 1a 8a ea 92 03 2b b7 f0 15 7 6 d9 d1 9d 67 54 7d 9e c9 da 05 9b 53 b6 8b 40 1c a0 5d 74 1e 7e d5 99 2f fd 5d c0 6f d0 01 d 0 25 d1 dd 44 0f fb 39 89
04:57:15.489057 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.57185 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.162: Inform(81) .1.3.6.1.2.1.1.3.0=5285 .1.3.6.1.6.3.1.1.4.1.0=.1.3.6.1.6.3.1.1.5. 5 .1.3.6.1.6.3.1.1.4.3.0=.1.3.6.1.4.1.8072.3.2.10
04:57:15.489206 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.161 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.40478: F=U"" E=80_00_1f_88_80_61_5f_df_65_aa_87_77_67_00_00_00_00 C="" Report(29) .1.3.6.1.6.3.15.1.1.5.0=1
04:57:16.490288 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.57185 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.162: Inform(81) .1.3.6.1.2.1.1.3.0=5285 .1.3.6.1.6.3.1.1.4.1.0=.1.3.6.1.6.3.1.1.5. 5 .1.3.6.1.6.3.1.1.4.3.0=.1.3.6.1.4.1.8072.3.2.10
04:57:17.491054 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.57185 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.162: Inform(81) .1.3.6.1.2.1.1.3.0=5285 .1.3.6.1.6.3.1.1.4.1.0=.1.3.6.1.6.3.1.1.5. 5 .1.3.6.1.6.3.1.1.4.3.0=.1.3.6.1.4.1.8072.3.2.10
04:57:18.492149 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.57185 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.162: Inform(81) .1.3.6.1.2.1.1.3.0=5285 .1.3.6.1.6.3.1.1.4.1.0=.1.3.6.1.6.3.1.1.5. 5 .1.3.6.1.6.3.1.1.4.3.0=.1.3.6.1.4.1.8072.3.2.10
04:57:19.493436 IP6 3ffe:501:ffff:100:20c:29ff:fe7:2867.57185 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597.162: Inform(81) .1.3.6.1.2.1.1.3.0=5285 .1.3.6.1.6.3.1.1.4.1.0=.1.3.6.1.6.3.1.1.5.

```

## IPv6-Only.1.5: User Interface

### Part A: IPv6 Address Display

DUT's interface Link-local/Global addresses:

```
root@cnlabs-refdutipv6: ~  
root@cnlabs-refdutipv6:~# ifconfig ens160  
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>  
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>  
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)  
    RX packets 21084 bytes 1369714 (1.3 MB)  
    RX errors 0 dropped 73841 overruns 0 frame 0  
    TX packets 1379 bytes 245052 (245.0 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
root@cnlabs-refdutipv6:~#
```

Leading zeros suppressed:

- Configured the DUT with the “2001:0db8::0001” address and the DUT is displaying “2001:db8::1”.

```
root@cnlabs-refdutipv6: ~  
root@cnlabs-refdutipv6:~# ifconfig ens160  
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>  
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>  
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)  
    RX packets 24925 bytes 1615787 (1.6 MB)  
    RX errors 0 dropped 73842 overruns 0 frame 0  
    TX packets 1559 bytes 273368 (273.3 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
root@cnlabs-refdutipv6:~#  
root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add 2001:0db8::0001/64  
root@cnlabs-refdutipv6:~#  
root@cnlabs-refdutipv6:~# ifconfig ens160  
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>  
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>  
    inet6 2001:db8::1 prefixlen 64 scopeid 0x0<global>  
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)  
    RX packets 25007 bytes 1622197 (1.6 MB)  
    RX errors 0 dropped 73842 overruns 0 frame 0  
    TX packets 1583 bytes 277716 (277.7 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
root@cnlabs-refdutipv6:~#
```



Multiple groups of leading zeros abbreviated to “::”:

- Configured the DUT with the “2001:db8:0:0:0:2:1” address and the DUT is displaying “2001:db8::2:1”.

```
root@cnlabs-refdutipv6: ~
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 25724 bytes 1669389 (1.6 MB)
    RX errors 0 dropped 73842 overruns 0 frame 0
    TX packets 1636 bytes 285838 (285.8 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add 2001:db8:0:0:0:2:1/64
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 2001:db8::2:1 prefixlen 64 scopeid 0x0<global>
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 25850 bytes 1681163 (1.6 MB)
    RX errors 0 dropped 73842 overruns 0 frame 0
    TX packets 1692 bytes 294962 (294.9 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~#
```

Single 16-bit zero field is not suppressed with “::”:

- Configured the DUT with the “2001:db8:0:1:1:1:1:1” address and the DUT is displaying “2001:db8:0:1:1:1:1:1”.

```
root@cnlabs-refdutipv6: ~
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 26346 bytes 1713237 (1.7 MB)
    RX errors 0 dropped 73842 overruns 0 frame 0
    TX packets 1725 bytes 300672 (300.6 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add 2001:db8:0:1:1:1:1:1/64
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    inet6 2001:db8:0:1:1:1:1:1 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 26501 bytes 1728277 (1.7 MB)
    RX errors 0 dropped 73842 overruns 0 frame 0
    TX packets 1801 bytes 312180 (312.1 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~#
```

Longer group of consecutive zeros suppressed with“::”:

- Configured the DUT with the “2001:0:0:1:0:0:0:1” address and the DUT is displaying “2001:0:0:1::1”.

```
root@cnlabs-refdutipv6: ~
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 26914 bytes 1757283 (1.7 MB)
    RX errors 0 dropped 73842 overruns 0 frame 0
    TX packets 1869 bytes 323232 (323.2 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add 2001:0:0:1:0:0:0:1/64
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    inet6 2001:0:0:1::1 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 27145 bytes 1775033 (1.7 MB)
    RX errors 0 dropped 73842 overruns 0 frame 0
    TX packets 1920 bytes 331434 (331.4 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~#
```

First group of consecutive zeros suppressed with“::”:

- Configured the DUT with the “2001:db8:0:0:1:0:0:1” address and the DUT is displaying “2001:db8::1:0:0:1”.

```
root@cnlabs-refdutipv6: ~
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 27979 bytes 1839371 (1.8 MB)
    RX errors 0 dropped 73842 overruns 0 frame 0
    TX packets 2111 bytes 360092 (360.0 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add 2001:db8:0:0:1:0:0:1/64
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    inet6 2001:db8::1:0:0:1 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 28040 bytes 1844255 (1.8 MB)
    RX errors 0 dropped 73842 overruns 0 frame 0
    TX packets 2130 bytes 363622 (363.6 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~#
```

The address's characters is displayed in lowercase:

- Configured the DUT with the “2001:DB8:A:B:C:D:E:F” address and the DUT is displaying “2001:db8:a:b:c:d:e:f”.

```
root@cnlabs-refdutipv6: ~  
root@cnlabs-refdutipv6:~# ifconfig ens160  
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>  
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>  
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)  
    RX packets 28559 bytes 1879632 (1.8 MB)  
    RX errors 0 dropped 73842 overruns 0 frame 0  
    TX packets 2193 bytes 374652 (374.6 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add 2001:DB8:A:B:C:D:E:F/64  
root@cnlabs-refdutipv6:~#  
root@cnlabs-refdutipv6:~# ifconfig ens160  
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>  
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>  
    inet6 2001:db8:a:b:c:d:e:f prefixlen 64 scopeid 0x0<global>  
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)  
    RX packets 28669 bytes 1890030 (1.8 MB)  
    RX errors 0 dropped 73842 overruns 0 frame 0  
    TX packets 2250 bytes 383906 (383.9 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
root@cnlabs-refdutipv6:~#
```

## Part B: IPv6 Address Input

### Ping diagnostic utility:

```

root@Router-C:~# ifconfig eth0
eth0:    Link encap:Ethernet  HWaddr 00:0c:29:3c:35:97
          inet6 addr: 3ffe:501:ffff:100:20c:29ff:fe3c:3597/64 Scope:Global
          inet6 addr: fe80::20c:29ff:fe3c:3597/64 Scope:link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:16425 errors:0 dropped:161 overruns:0 frame:0
          TX packets:2362 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1286385 (1.2 MB)  TX bytes:330116 (330.1 KB)

root@Router-C:~# tcpdump -nni eth0 icmp6
tcpdump: WARNING: eth0: no IPv4 address assigned
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 65535 bytes
18:06:53.543048 IP6 fe80::20c:29ff:fe3c:3597 > fe80::20c:29ff:fe3c:3597: ICMP6, echo request, seq 1, length 64
18:06:53.543083 IP6 fe80::20c:29ff:fe3c:3597 > fe80::20c:29ff:fe3c:3597: ICMP6, echo reply, seq 1, length 64
18:06:54.563097 IP6 fe80::20c:29ff:fe3c:3597 > fe80::20c:29ff:fe3c:3597: ICMP6, echo request, seq 2, length 64
18:06:54.563124 IP6 fe80::20c:29ff:fe3c:3597 > fe80::20c:29ff:fe3c:3597: ICMP6, echo reply, seq 2, length 64
18:06:55.587162 IP6 fe80::20c:29ff:fe3c:3597 > fe80::20c:29ff:fe3c:3597: ICMP6, echo request, seq 3, length 64
18:06:55.587193 IP6 fe80::20c:29ff:fe3c:3597 > fe80::20c:29ff:fe3c:3597: ICMP6, echo reply, seq 3, length 64
18:06:58.463861 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597: ICMP6, echo request, seq 1, length 64
18:06:58.463897 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597: ICMP6, echo reply, seq 1, length 64
18:06:59.491328 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597: ICMP6, echo request, seq 2, length 64
18:06:59.491356 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597: ICMP6, echo reply, seq 2, length 64
18:07:00.515317 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597: ICMP6, echo request, seq 3, length 64
18:07:00.515342 IP6 3ffe:501:ffff:100:20c:29ff:fe3c:3597 > 3ffe:501:ffff:100:20c:29ff:fe3c:3597: ICMP6, echo reply, seq 3, length 64
18:07:00.734138 IP6 fe80::21c:7fff:fe66:40e9 > ff02::1: ICMP6, neighbor advertisement, tgt is fe80::21c:7fff:fe66:40e9, length 32

root@cnlabs-refdutipv6:~# ifconfig ens160
ens160:  flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
          inet6 3ffe:501:ffff:100:20c:29ff:fe3c:3597/64 scopeid 0x0<global>
          inet6 fe80::20c:29ff:fe3c:3597/64 scopeid 0x20<link>
          ether 00:0c:29:e7:28:67 txqueuelen 1000  (Ethernet)
          RX packets 2122 bytes 162782 (162.7 KB)
          RX errors 0 dropped 40 overruns 0 frame 0
          TX packets 447 bytes 69694 (69.6 KB)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~# ping6 -c 3 -I ens160 fe80::20c:29ff:fe3c:3597
ping6: Warning: source address might be selected on device other than: ens160
PING fe80::20c:29ff:fe3c:3597 (fe80::20c:29ff:fe3c:3597) from ::1: ens160: 56 data bytes
64 bytes from fe80::20c:29ff:fe3c:3597: icmp_seq=1 ttl=64 time=0.602 ms
64 bytes from fe80::20c:29ff:fe3c:3597: icmp_seq=2 ttl=64 time=0.600 ms
64 bytes from fe80::20c:29ff:fe3c:3597: icmp_seq=3 ttl=64 time=0.713 ms

--- fe80::20c:29ff:fe3c:3597 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2044ms
rtt min/avg/max/mdev = 0.600/0.638/0.713/0.052 ms

root@cnlabs-refdutipv6:~# ping6 -c 3 -I ens160 3ffe:501:ffff:100:20c:29ff:fe3c:3597
PING 3ffe:501:ffff:100:20c:29ff:fe3c:3597 (3ffe:501:ffff:100:20c:29ff:fe3c:3597) from 3ffe:501:ffff:100:20c:29ff:fe3c:3597: 56 data bytes
64 bytes from 3ffe:501:ffff:100:20c:29ff:fe3c:3597: icmp_seq=1 ttl=64 time=0.442 ms
64 bytes from 3ffe:501:ffff:100:20c:29ff:fe3c:3597: icmp_seq=2 ttl=64 time=0.629 ms
64 bytes from 3ffe:501:ffff:100:20c:29ff:fe3c:3597: icmp_seq=3 ttl=64 time=0.677 ms

--- 3ffe:501:ffff:100:20c:29ff:fe3c:3597 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2051ms
rtt min/avg/max/mdev = 0.442/0.582/0.677/0.101 ms

root@cnlabs-refdutipv6:~#

```

### Configuring an invalid IPv6 link-local address that is too long:

- Configured the DUT with the “FE80:0:0:0::1:2:3:4:5:6” and it is not accepted.

```

root@cnlabs-refdutipv6:~# ifconfig ens160
ens160:  flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
          inet6 3ffe:501:ffff:100:20c:29ff:fe3c:3597/64 scopeid 0x0<global>
          inet6 fe80::20c:29ff:fe3c:3597/64 scopeid 0x20<link>
          ether 00:0c:29:e7:28:67 txqueuelen 1000  (Ethernet)
          RX packets 550628 bytes 33445251 (33.4 MB)
          RX errors 0 dropped 325 overruns 0 frame 0
          TX packets 244140 bytes 10517990 (10.5 MB)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add FE80:0:0:0::1:2:3:4:5:6/64
FE80:0:0:0::1:2:3:4:5:6: Resolver Error 0 (no error)
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160:  flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
          inet6 3ffe:501:ffff:100:20c:29ff:fe3c:3597/64 scopeid 0x0<global>
          inet6 fe80::20c:29ff:fe3c:3597/64 scopeid 0x20<link>
          ether 00:0c:29:e7:28:67 txqueuelen 1000  (Ethernet)
          RX packets 552516 bytes 33565329 (33.5 MB)
          RX errors 0 dropped 335 overruns 0 frame 0
          TX packets 244857 bytes 10553500 (10.5 MB)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~#

```

Configuring an invalid IPv6 link-local address contains characters that are invalid:

- Configured the DUT with the “FE80::AB:CD:EF:GH” and it is not accepted.

```
root@cnlabs-refdutipv6: ~
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 552822 bytes 33585001 (33.5 MB)
    RX errors 0 dropped 335 overruns 0 frame 0
    TX packets 244988 bytes 10562098 (10.5 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add FE80::AB:CD:EF:GH/64
FE80::AB:CD:EF:GH: Resolver Error 0 (no error)
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 553032 bytes 33602244 (33.6 MB)
    RX errors 0 dropped 336 overruns 0 frame 0
    TX packets 245101 bytes 10573136 (10.5 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~#
```

Configuring an invalid IPv6 link-local address with more “::”:

- Configured the DUT with the “FE80::1000::2000” and it is not accepted.

```
root@cnlabs-refdutipv6: ~
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 733910 bytes 44710789 (44.7 MB)
    RX errors 0 dropped 405 overruns 0 frame 0
    TX packets 322549 bytes 13891974 (13.8 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add FE80::1000::2000/64
FE80::1000::2000: Resolver Error 0 (no error)
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 734004 bytes 44719928 (44.7 MB)
    RX errors 0 dropped 405 overruns 0 frame 0
    TX packets 322616 bytes 13901108 (13.9 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~#
```



Configuring an invalid IPv6 global address that is too long:

- Configured the DUT with the “2001:2:0:1:2:3:4:5:6” and it is not accepted.

```
root@cnlabs-refdutipv6: ~  
root@cnlabs-refdutipv6:~# ifconfig ens160  
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>  
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>  
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)  
    RX packets 734106 bytes 44727063 (44.7 MB)  
    RX errors 0 dropped 405 overruns 0 frame 0  
    TX packets 322680 bytes 13907092 (13.9 MB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add 2001:2:0:1:2:3:4:5:6/64  
2001:2:0:1:2:3:4:5:6: Resolver Error 0 (no error)  
root@cnlabs-refdutipv6:~#  
root@cnlabs-refdutipv6:~# ifconfig ens160  
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>  
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>  
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)  
    RX packets 734204 bytes 44736037 (44.7 MB)  
    RX errors 0 dropped 405 overruns 0 frame 0  
    TX packets 322743 bytes 13915086 (13.9 MB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
root@cnlabs-refdutipv6:~# █
```

Configuring an invalid IPv6 Global address contains characters that are invalid:

- Configured the DUT with the “2001:2:0:AB:CD:EF:G:H” and it is not accepted.

```
root@cnlabs-refdutipv6: ~  
root@cnlabs-refdutipv6:~# ifconfig ens160  
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>  
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>  
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)  
    RX packets 734342 bytes 44745275 (44.7 MB)  
    RX errors 0 dropped 405 overruns 0 frame 0  
    TX packets 322803 bytes 13919758 (13.9 MB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add 2001:2:0:AB:CD:EF:G:H/64  
2001:2:0:AB:CD:EF:G:H: Resolver Error 0 (no error)  
root@cnlabs-refdutipv6:~#  
root@cnlabs-refdutipv6:~# ifconfig ens160  
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>  
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>  
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)  
    RX packets 734426 bytes 44753601 (44.7 MB)  
    RX errors 0 dropped 405 overruns 0 frame 0  
    TX packets 322858 bytes 13927288 (13.9 MB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
root@cnlabs-refdutipv6:~# █
```

Configuring an invalid Global address with more “::”:

- Configured the DUT with the “2001:2::1000::1000” and it is not accepted.

```
root@cnlabs-refdutipv6: ~
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 734533 bytes 44760995 (44.7 MB)
    RX errors 0 dropped 405 overruns 0 frame 0
    TX packets 322917 bytes 13932182 (13.9 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add 2001:2::1000::1000/64
2001:2::1000::1000: Resolver Error 0 (no error)
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 734671 bytes 44774931 (44.7 MB)
    RX errors 0 dropped 405 overruns 0 frame 0
    TX packets 323002 bytes 13943708 (13.9 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~#
```

Verifying the invalid addresses using ping6:

```
root@cnlabs-refdutipv6: ~
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 438 bytes 43825 (43.8 KB)
    RX errors 0 dropped 2 overruns 0 frame 0
    TX packets 220 bytes 36072 (36.0 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~# ping6 -I ens160 FE80:0:0:0::1:2:3:4:5:6
ping6: FE80:0:0:0::1:2:3:4:5:6: Name or service not known
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ping6 -I ens160 FE80::AB:CD:EF:GH
ping6: FE80::AB:CD:EF:GH: Name or service not known
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ping6 -I ens160 FE80::1000::2000
ping6: FE80::1000::2000: Name or service not known
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ping6 -I ens160 2001:2:0:1:2:3:4:5:6
ping6: 2001:2:0:1:2:3:4:5:6: Name or service not known
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ping6 -I ens160 2001:2:0:AB:CD:EF:G:H
ping6: 2001:2:0:AB:CD:EF:G:H: Name or service not known
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~# ping6 -I ens160 2001:2::1000::1000
ping6: 2001:2::1000::1000: Name or service not known
root@cnlabs-refdutipv6:~#
root@cnlabs-refdutipv6:~#
```



## Configuring valid link-local IPv6 address assigned to a different device on the IPv6-Only network:

```

root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 247706 bytes 21635127 (21.6 MB)
    RX errors 0 dropped 32491 overruns 0 frame 0
    TX packets 24312 bytes 3549611 (3.5 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add fe80::20c:29ff:fee6:7fa3/64
root@cnlabs-refdutipv6:~#

root@FreeBSD:~# ifconfig em0
em0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> metric 0 mtu 1500
    options=81009b<RXCSUM,VLAN_MTU,VLAN_HWTAGGING,VLAN_HWCSUM,VLAN_HWFILTER>
    ether 00:10:0c:2d:e6:7f:a3
    inet6 fe80::20c:29ff:fee6:7fa3 em0 prefixlen 64 scopeid 0x1
    inet6 3ffe:501:ffff:100:20c:29ff:fee6:7fa3 prefixlen 64
    media: Ethernet autoselect (1000baseT <full-duplex>)
    status: active
    nd6 options=21<PERFORMNUD,AUTO_LINKLOCAL>
root@FreeBSD:~#

```

## Performed the diagnostic for Link-local Address:

IPv6-Only.1.5.B - IPv6 LLA address DAD diagnostic.pcap

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Leng	Leng	Info
1	0.000000	fe80::20c:29ff:fee6:7fa3	fe80::a47a:db35:a6bd:e953	ICMPv6	86		Neighbor Solicitation for fe80::a47a:db35:a6bd:e953 from 00:0c:29:e6:7f:a3
2	0.002392	fe80::a47a:db35:a6bd:e953	fe80::20c:29ff:fee6:7fa3	ICMPv6	86		Neighbor Advertisement fe80::a47a:db35:a6bd:e953 (sol, ovr) is at d6:36:4e:d0:fe:91
3	0.017716	fe80::a47a:db35:a6bd:e953	fe80::20c:29ff:fee6:7fa3	ICMPv6	86		Neighbor Solicitation for fe80::20c:29ff:fee6:7fa3 from d6:36:4e:d0:fe:91
4	0.017796	fe80::20c:29ff:fee6:7fa3	fe80::a47a:db35:a6bd:e953	ICMPv6	78		Neighbor Advertisement fe80::20c:29ff:fee6:7fa3 (rtr, sol)
5	4.014658	fe80::a47a:db35:a6bd:e953	fe80::20c:29ff:fee7:2867	ICMPv6	86		Neighbor Solicitation for fe80::20c:29ff:fee7:2867 from d6:36:4e:d0:fe:91
6	4.014779	fe80::20c:29ff:fee7:2867	fe80::a47a:db35:a6bd:e953	ICMPv6	78		Neighbor Advertisement fe80::20c:29ff:fee7:2867 (rtr, sol)
7	4.875283	::	ff02::1:ffe6:7fa3	ICMPv6	86		Neighbor Solicitation for fe80::20c:29ff:fee6:7fa3
8	4.875469	fe80::20c:29ff:fee6:7fa3	ff02::1	ICMPv6	86		Neighbor Advertisement fe80::20c:29ff:fee6:7fa3 (rtr, ovr) is at 00:0c:29:e6:7f:a3
9	27.693940	fe80::20c:29ff:fee6:7fa3	fe80::20c:29ff:fe38:14ad	ICMPv6	86		Neighbor Advertisement fe80::20c:29ff:fee6:7fa3 (rtr, sol, ovr) is at 00:0c:29:e6:7f:a3
10	27.693988	fe80::20c:29ff:fe38:14ad	fe80::20c:29ff:fee6:7fa3	ICMPv6	70		Echo (ping) request id=0x0511, seq=0, hop limit=64 (reply in 11)
11	27.694091	fe80::20c:29ff:fee6:7fa3	fe80::20c:29ff:fe38:14ad	ICMPv6	70		Echo (ping) reply id=0x0511, seq=0, hop limit=64 (request in 10)
12	28.694573	fe80::20c:29ff:fe38:14ad	fe80::20c:29ff:fee6:7fa3	ICMPv6	70		Echo (ping) request id=0x0511, seq=1, hop limit=64 (reply in 13)
13	28.694718	fe80::20c:29ff:fee6:7fa3	fe80::20c:29ff:fe38:14ad	ICMPv6	70		Echo (ping) reply id=0x0511, seq=1, hop limit=64 (request in 12)
14	29.694373	fe80::20c:29ff:fe38:14ad	fe80::20c:29ff:fee6:7fa3	ICMPv6	70		Echo (ping) request id=0x0511, seq=2, hop limit=64 (reply in 15)
15	29.694581	fe80::20c:29ff:fee6:7fa3	fe80::20c:29ff:fe38:14ad	ICMPv6	70		Echo (ping) reply id=0x0511, seq=2, hop limit=64 (request in 14)
16	30.694204	fe80::20c:29ff:fe38:14ad	fe80::20c:29ff:fee6:7fa3	ICMPv6	70		Echo (ping) request id=0x0511, seq=3, hop limit=64 (reply in 17)
17	30.694382	fe80::20c:29ff:fee6:7fa3	fe80::20c:29ff:fe38:14ad	ICMPv6	70		Echo (ping) reply id=0x0511, seq=3, hop limit=64 (request in 16)
18	31.694026	fe80::20c:29ff:fe38:14ad	fe80::20c:29ff:fee6:7fa3	ICMPv6	70		Echo (ping) request id=0x0511, seq=4, hop limit=64 (reply in 19)
19	31.694253	fe80::20c:29ff:fee6:7fa3	fe80::20c:29ff:fe38:14ad	ICMPv6	70		Echo (ping) reply id=0x0511, seq=4, hop limit=64 (request in 18)
20	32.700145	fe80::20c:29ff:fee6:7fa3	fe80::20c:29ff:fe38:14ad	ICMPv6	86		Neighbor Solicitation for fe80::20c:29ff:fe38:14ad from 00:0c:29:e6:7f:a3
21	32.700206	fe80::20c:29ff:fe38:14ad	fe80::20c:29ff:fee6:7fa3	ICMPv6	78		Neighbor Advertisement fe80::20c:29ff:fe38:14ad (rtr, sol)

> Frame 11: 70 bytes on wire (560 bits), 70 bytes captured (560 bits)

> Ethernet II, Src: VMware\_e6:7f:a3 (00:0c:29:e6:7f:a3), Dst: VMware\_38:14:ad (00:0c:29:38:14:ad)

> Destination: VMware\_38:14:ad (00:0c:29:38:14:ad)

> Source: VMware\_e6:7f:a3 (00:0c:29:e6:7f:a3)

Type: IPv6 (0x86dd)

> Internet Protocol Version 6, Src: fe80::20c:29ff:fee6:7fa3, Dst: fe80::20c:29ff:fe38:14ad

0110 .... = Version: 6

> .... 0000 0000 .... = Traffic Class: 0x00 (DSCP: CS0, ECN: Not-ECT)

.... 0000 0000 0000 0000 = Flow Label: 0x000000

Payload Length: 16

Next Header: ICMPv6 (58)

Hop Limit: 64

Source Address: fe80::20c:29ff:fee6:7fa3

Destination Address: fe80::20c:29ff:fe38:14ad

[Source SLAAC MAC: VMware\_e6:7f:a3 (00:0c:29:e6:7f:a3)]

[Destination SLAAC MAC: VMware\_38:14:ad (00:0c:29:38:14:ad)]

> Internet Control Message Protocol v6

## Configuring valid Global IPv6 address assigned to a different device on the IPv6-Only network:

```

root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 251329 bytes 21864158 (21.8 MB)
    RX errors 0 dropped 32892 overruns 0 frame 0
    TX packets 24381 bytes 3562917 (3.5 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refdutipv6:~# ifconfig ens160 inet6 add 3ffe:501:ffff:100:20c:29ff:fee6:7fa3/64
root@cnlabs-refdutipv6:~#

root@FreeBSD:~# ifconfig em0
em0: flags=8943<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> metric 0 mtu 1500
    options=9b<RXCSUM,TKCSUM,VLAN_MTU,VLAN_HWTAGGING,VLAN_HWCSUM>
    ether 00:0c:29:38:14:ad
    inet6 fe80::20c:29ff:fee3:14ad prefixlen 64 scopeid 0x1
    inet6 3ffe:501:ffff:100:20c:29ff:fee3:14ad prefixlen 64
    media: Ethernet autoselect (1000baseTX <full-duplex>)
    status: active

root@FreeBSD:~# ping6 -c 5 -I em0 3ffe:501:ffff:100:20c:29ff:fee6:7fa3
PING6(56=40+8+8 bytes) 3ffe:501:ffff:100:20c:29ff:fee3:14ad --> 3ffe:501:ffff:100:20c:29ff:fee6:7fa3
16 bytes from 3ffe:501:ffff:100:20c:29ff:fee6:7fa3, icmp_seq=0 hlim=64 time=0.409 ms
16 bytes from 3ffe:501:ffff:100:20c:29ff:fee6:7fa3, icmp_seq=1 hlim=64 time=0.373 ms
16 bytes from 3ffe:501:ffff:100:20c:29ff:fee6:7fa3, icmp_seq=2 hlim=64 time=0.318 ms
16 bytes from 3ffe:501:ffff:100:20c:29ff:fee6:7fa3, icmp_seq=3 hlim=64 time=0.240 ms
16 bytes from 3ffe:501:ffff:100:20c:29ff:fee6:7fa3, icmp_seq=4 hlim=64 time=0.333 ms

--- 3ffe:501:ffff:100:20c:29ff:fee6:7fa3 ping6 statistics ---
5 packets transmitted, 5 packets received, 0.0% packet loss
round-trip min/avg/max/std-dev = 0.240/0.335/0.409/0.057 ms

root@FreeBSD:~#

```

## Performed the diagnostic for Global Address:

IPv6-Only.1.5.B - IPv6 GA address DAD diagnostic.pcap

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-F>

Source	Destination	Protocol	Leng	Leng	Info
fe80::a47a:db35:a6bd:e953	fe80::20c:29ff:fee7:2867	ICMPv6	86	78	Neighbor Solicitation for fe80::20c:29ff:fee7:2867 from d6:36:4e:d0:fe:91
fe80::20c:29ff:fee7:2867	fe80::a47a:db35:a6bd:e953	ICMPv6	78	86	Neighbor Advertisement fe80::20c:29ff:fee7:2867 (rtr, sol)
::	ff02::1:ffe6:7fa3	ICMPv6	86	86	Neighbor Solicitation for 3ffe:501:ffff:100:20c:29ff:fee6:7fa3
fe80::20c:29ff:fee6:7fa3	ff02::1	ICMPv6	86	86	Neighbor Advertisement 3ffe:501:ffff:100:20c:29ff:fee6:7fa3 (rtr, ovr) is at 00:0c:29:e6:7f:a3
fe80::a47a:db35:a6bd:e953	fe80::20c:29ff:fee7:2867	ICMPv6	86	78	Neighbor Solicitation for fe80::20c:29ff:fee7:2867 from d6:36:4e:d0:fe:91
fe80::20c:29ff:fee7:2867	fe80::a47a:db35:a6bd:e953	ICMPv6	78	86	Neighbor Advertisement fe80::20c:29ff:fee7:2867 (rtr, sol)
3ffe:501:ffff:100:20c:29ff:fee6:7fa3	3ffe:501:ffff:100:20c:29ff:fee3:14ad	ICMPv6	86	86	Neighbor Advertisement 3ffe:501:ffff:100:20c:29ff:fee6:7fa3 (rtr, sol, ovr) is at 00:0c:29:e6:7f:a3
3ffe:501:ffff:100:20c:29ff:fee3:14ad	3ffe:501:ffff:100:20c:29ff:fee6:7fa3	ICMPv6	70	86	Echo (ping) request id=0x0517, seq=0, hop limit=64 (reply in 9)
3ffe:501:ffff:100:20c:29ff:fee6:7fa3	3ffe:501:ffff:100:20c:29ff:fee3:14ad	ICMPv6	70	86	Echo (ping) reply id=0x0517, seq=0, hop limit=64 (request in 8)
3ffe:501:ffff:100:20c:29ff:fee3:14ad	3ffe:501:ffff:100:20c:29ff:fee6:7fa3	ICMPv6	70	86	Echo (ping) request id=0x0517, seq=1, hop limit=64 (reply in 11)
3ffe:501:ffff:100:20c:29ff:fee6:7fa3	3ffe:501:ffff:100:20c:29ff:fee3:14ad	ICMPv6	70	86	Echo (ping) reply id=0x0517, seq=1, hop limit=64 (request in 10)
3ffe:501:ffff:100:20c:29ff:fee3:14ad	3ffe:501:ffff:100:20c:29ff:fee6:7fa3	ICMPv6	70	86	Echo (ping) request id=0x0517, seq=2, hop limit=64 (reply in 13)
3ffe:501:ffff:100:20c:29ff:fee6:7fa3	3ffe:501:ffff:100:20c:29ff:fee3:14ad	ICMPv6	70	86	Echo (ping) reply id=0x0517, seq=2, hop limit=64 (request in 12)
3ffe:501:ffff:100:20c:29ff:fee3:14ad	3ffe:501:ffff:100:20c:29ff:fee6:7fa3	ICMPv6	70	86	Echo (ping) request id=0x0517, seq=3, hop limit=64 (reply in 15)
3ffe:501:ffff:100:20c:29ff:fee6:7fa3	3ffe:501:ffff:100:20c:29ff:fee3:14ad	ICMPv6	70	86	Echo (ping) reply id=0x0517, seq=3, hop limit=64 (request in 14)
3ffe:501:ffff:100:20c:29ff:fee3:14ad	3ffe:501:ffff:100:20c:29ff:fee6:7fa3	ICMPv6	70	86	Echo (ping) request id=0x0517, seq=4, hop limit=64 (reply in 17)
3ffe:501:ffff:100:20c:29ff:fee6:7fa3	3ffe:501:ffff:100:20c:29ff:fee3:14ad	ICMPv6	70	86	Echo (ping) reply id=0x0517, seq=4, hop limit=64 (request in 16)
3ffe:501:ffff:100:20c:29ff:fee3:14ad	3ffe:501:ffff:100:20c:29ff:fee6:7fa3	ICMPv6	86	78	Neighbor Solicitation for 3ffe:501:ffff:100:20c:29ff:fee3:14ad from 00:0c:29:e6:7f:a3
3ffe:501:ffff:100:20c:29ff:fee6:7fa3	3ffe:501:ffff:100:20c:29ff:fee3:14ad	ICMPv6	78	86	Neighbor Advertisement 3ffe:501:ffff:100:20c:29ff:fee3:14ad (rtr, sol)

> Frame 9: 70 bytes on wire (560 bits), 70 bytes captured (560 bits)

> Ethernet II, Src: VMware\_e6:7f:a3 (00:0c:29:e6:7f:a3), Dst: VMware\_38:14:ad (00:0c:29:38:14:ad)

> Destination: VMware\_38:14:ad (00:0c:29:38:14:ad)

> Source: VMware\_e6:7f:a3 (00:0c:29:e6:7f:a3)

Type: IPv6 (0x86dd)

> Internet Protocol Version 6, Src: 3ffe:501:ffff:100:20c:29ff:fee6:7fa3, Dst: 3ffe:501:ffff:100:20c:29ff:fee3:14ad

0110 .... = Version: 6

> .... 0000 0000 .... = Traffic Class: 0x00 (DSCP: CS0, ECN: Not-ECT)

.... 0000 0000 0000 0000 = Flow Label: 0x00000

Payload Length: 16

Next Header: ICMPv6 (58)

Hop Limit: 64

Source Address: 3ffe:501:ffff:100:20c:29ff:fee6:7fa3

Destination Address: 3ffe:501:ffff:100:20c:29ff:fee3:14ad

[Source SLAAC MAC: VMware\_e6:7f:a3 (00:0c:29:e6:7f:a3)]

[Destination SLAAC MAC: VMware\_38:14:ad (00:0c:29:38:14:ad)]

> Internet Control Message Protocol v6

IPv6-Only.1.5.B - IPv6 GA address DAD diagnostic.pcap

Packets: 19 - Displayed: 19 (100.0%)

Performed ping6 operation for a valid FQDN which has a AAAA (IPv6) record assigned to a different device:

```
root@REFDNS:/etc/bind# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 3ffe:501:ffff:100:20c:29ff:fee7:5c8c prefixlen 64 scopeid 0x0<global>
    inet fe80::20c:29ff:fee4:5c8c prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:4e:5c:8c txqueuelen 1000 (Ethernet)
    RX packets 13946 bytes 1154278 (1.1 MB)
    RX errors 0 dropped 47 overruns 0 frame 0
    TX packets 3967 bytes 441542 (441.5 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@REFDNS:/etc/bind# tcpdump -nni ens160 host 3ffe:501:ffff:100:20c:29ff:fee7:2867 or fe80::20c:29ff:fee7:2867
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
WARNING: no DNS support, link-type EN10MB (Ethernet), seq=1 size 26214 bytes
15:08:03.687719 IP6 fe80::a47a:db35:ab6d:e953.57495 > fe80::20c:29ff:fee7:2867.22: Flags [P.]
, seq 3868195758:3868195922, ack 648104154, win 510, length 64
15:08:03.690815 IP6 fe80::20c:29ff:fee7:2867.22 > fe80::a47a:db35:ab6d:e953.57495: Flags [P.]
, seq 165, ack 64, win 2166, length 64
15:08:03.693315 IP6 3ffe:501:ffff:100:20c:29ff:fee7:2867.40337 > 3ffe:501:ffff:100:20c:29ff:fe
4e:5c8c.53: 33754* [!au] A? model.test.example.com. (51)
15:08:03.693315 IP6 3ffe:501:ffff:100:20c:29ff:fee7:2867.40337 > 3ffe:501:ffff:100:20c:29ff:fe
4e:5c8c.53: 48594* [!au] AAAA? model.test.example.com. (51)
15:08:03.693830 IP6 3ffe:501:ffff:100:20c:29ff:fee4:5c8c.53 > 3ffe:501:ffff:100:20c:29ff:fee7
:2867.40337: 33754* O/1/1 (96)
15:08:03.694028 IP6 3ffe:501:ffff:100:20c:29ff:fee4:5c8c.53 > 3ffe:501:ffff:100:20c:29ff:fee7
:2867.40337: 48594* 1/1 AAAA 3ffe:501:ffff:100:20c:29ff:fee4:5c8c (93)
15:08:03.694951 IP6 fe80::20c:29ff:fee7:2867.22 > fe80::a47a:db35:ab6d:e953.57495: Flags [P.]
, seq 65257, ack 64, win 2166, length 192
15:08:03.695001 IP6 fe80::20c:29ff:fee7:2867.22 > fe80::a47a:db35:ab6d:e953.57495: Flags [P.]
, seq 257:321, ack 64, win 2166, length 64
15:08:03.695054 IP6 3ffe:501:ffff:100:20c:29ff:fee7:2867 > 3ffe:501:ffff:100:20c:29ff:fee4:5c
8c: ICMP6, echo request, seq 1, length 64
15:08:03.695110 IP6 3ffe:501:ffff:100:20c:29ff:fee4:5c8c > 3ffe:501:ffff:100:20c:29ff:fee7:28
67: ICMP6, echo reply, seq 1, length 64
15:08:03.695350 IP6 3ffe:501:ffff:100:20c:29ff:fee7:2867.33108 > 3ffe:501:ffff:100:20c:29ff:fe
4e:5c8c.53: 16321* [!au] PTR? c.8.c.5.e.4.e.f.f.9.2.c.0.2.0.0.1.0.f.f.f.1.0.5.0.e.f.f.
3.ip6.arpa. (101)
15:08:03.724895 IP6 fe80::a47a:db35:ab6d:e953.57495 > fe80::20c:29ff:fee7:2867.22: Flags [.]
, ack 321, win 509, length 0
15:08:08.700434 IP6 3ffe:501:ffff:100:20c:29ff:fee7:2867.33108 > 3ffe:501:ffff:100:20c:29ff:fe
4e:5c8c.53: 16321* [!au] PTR? c.8.c.5.e.4.e.f.f.9.2.c.0.2.0.0.1.0.f.f.f.1.0.5.0.e.f.f.
3.ip6.arpa. (101)
15:08:08.744771 IP6 fe80::20c:29ff:fee4:5c8c > 3ffe:501:ffff:100:20c:29ff:fee7:2867: ICMP6, n
eighbor solicitation, who has 3ffe:501:ffff:100:20c:29ff:fee7:2867, length 32
15:08:08.765022 IP6 3ffe:501:ffff:100:20c:29ff:fee7:2867 > fe80::20c:29ff:fee4:5c8c: ICMP6, n
eighbor advertisement, tgt is 3ffe:501:ffff:100:20c:29ff:fee7:2867, length 24
15:08:09.096689 IP6 fe80::20c:29ff:fee7:2867 > 3ffe:501:ffff:100:20c:29ff:fee4:5c8c: ICMP6, n
eighbor solicitation, who has 3ffe:501:ffff:100:20c:29ff:fee4:5c8c, length 32
15:08:09.096715 IP6 3ffe:501:ffff:100:20c:29ff:fee4:5c8c > fe80::20c:29ff:fee7:2867: ICMP6, n
eighbor advertisement, tgt is 3ffe:501:ffff:100:20c:29ff:fee4:5c8c, length 24
15:08:12.399189 IP6 3ffe:501:ffff:100:20c:29ff:fee4:5c8c.53 > 3ffe:501:ffff:100:20c:29ff:fee7
:2867.33108: 16321 NXDomain? O/1/1 (165)
15:08:12.399662 IP6 3ffe:501:ffff:100:20c:29ff:fee7:2867 > 3ffe:501:ffff:100:20c:29ff:fee4:5c
8c: 33754* [!au] A? model.test.example.com. (51)
15:08:12.399662 IP6 3ffe:501:ffff:100:20c:29ff:fee7:2867 > 3ffe:501:ffff:100:20c:29ff:fee4:5c
8c: 48594* [!au] AAAA? model.test.example.com. (51)
15:08:12.399830 IP6 3ffe:501:ffff:100:20c:29ff:fee4:5c8c.53 > 3ffe:501:ffff:100:20c:29ff:fee7
:2867.40337: 33754* O/1/1 (96)
15:08:12.399830 IP6 3ffe:501:ffff:100:20c:29ff:fee4:5c8c.53 > 3ffe:501:ffff:100:20c:29ff:fee7
:2867.40337: 48594* 1/1 AAAA 3ffe:501:ffff:100:20c:29ff:fee4:5c8c (93)
15:08:12.399951 IP6 fe80::20c:29ff:fee7:2867.22 > fe80::a47a:db35:ab6d:e953.57495: Flags [P.]
, seq 65257, ack 64, win 2166, length 192
15:08:12.399951 IP6 fe80::20c:29ff:fee7:2867.22 > fe80::a47a:db35:ab6d:e953.57495: Flags [P.]
, seq 257:321, ack 64, win 2166, length 64
15:08:12.399954 IP6 3ffe:501:ffff:100:20c:29ff:fee7:2867 > 3ffe:501:ffff:100:20c:29ff:fee4:5c
8c: ICMP6, echo request, seq 1, length 64
15:08:12.399954 IP6 3ffe:501:ffff:100:20c:29ff:fee4:5c8c > 3ffe:501:ffff:100:20c:29ff:fee7:28
67: ICMP6, echo reply, seq 1, length 64
15:08:12.399954 IP6 3ffe:501:ffff:100:20c:29ff:fee7:2867.33108 > 3ffe:501:ffff:100:20c:29ff:fe
4e:5c8c.53: 16321* [!au] PTR? c.8.c.5.e.4.e.f.f.9.2.c.0.2.0.0.1.0.f.f.f.1.0.5.0.e.f.f.
3.ip6.arpa. (101)
15:08:12.724895 IP6 fe80::a47a:db35:ab6d:e953.57495 > fe80::20c:29ff:fee7:2867.22: Flags [.]
, ack 321, win 509, length 0
15:08:12.724895 IP6 fe80::20c:29ff:fee7:2867.33108 > 3ffe:501:ffff:100:20c:29ff:fee4:5c8c.53
: 16321* [!au] PTR? c.8.c.5.e.4.e.f.f.9.2.c.0.2.0.0.1.0.f.f.f.1.0.5.0.e.f.f.
3.ip6.arpa. (101)
15:08:12.744771 IP6 fe80::20c:29ff:fee4:5c8c > 3ffe:501:ffff:100:20c:29ff:fee7:2867: ICMP6, n
eighbor solicitation, who has 3ffe:501:ffff:100:20c:29ff:fee7:2867, length 32
15:08:12.765022 IP6 3ffe:501:ffff:100:20c:29ff:fee7:2867 > fe80::20c:29ff:fee4:5c8c: ICMP6, n
eighbor advertisement, tgt is 3ffe:501:ffff:100:20c:29ff:fee7:2867, length 24
15:08:12.096689 IP6 fe80::20c:29ff:fee7:2867 > 3ffe:501:ffff:100:20c:29ff:fee4:5c8c: ICMP6, n
eighbor solicitation, who has 3ffe:501:ffff:100:20c:29ff:fee4:5c8c, length 32
15:08:12.096715 IP6 3ffe:501:ffff:100:20c:29ff:fee4:5c8c &gt
```

DNS diagnostic:

The image shows a Wireshark packet capture of a DNS transaction. The top pane displays a list of packets, with packet 10 selected. The middle pane shows the details of the selected packet, and the bottom pane shows the packet bytes in hexadecimal and ASCII.

**Packet List:**

No.	Time	Source	Destination	Protocol	Leng	Leng	Info
6	1.016669	3ffe:501:ffff:100:20c:29ff:fe7:2867	3ffe:501:ffff:100:20c:29ff:fe4e:5c8c	DNS	113	59	Standard query 0xc10 A node1.test.example.com OPT
7	1.016701	3ffe:501:ffff:100:20c:29ff:fe7:2867	3ffe:501:ffff:100:20c:29ff:fe4e:5c8c	DNS	113	59	Standard query 0xe828 AAAA node1.test.example.com OPT
8	1.017081	3ffe:501:ffff:100:20c:29ff:fe4e:5c8c	3ffe:501:ffff:100:20c:29ff:fe7:2867	DNS	158	104	Standard query response 0xc10 A node1.test.example.com SOA ns1.test.example.com OPT
9	1.017195	3ffe:501:ffff:100:20c:29ff:fe4e:5c8c	3ffe:501:ffff:100:20c:29ff:fe7:2867	DNS	155	101	Standard query response 0xe828 AAAA node1.test.example.com AAAA 3ffe:501:ffff:100:20c:29ff:fe7:2867
10	1.017980	fe80::20c:29ff:fe7:2867	fe80::a47a:db35:a6bd:e953	SSH	266		Server: Encrypted packet (len=192)
11	1.018203	fe80::20c:29ff:fe7:2867	fe80::a47a:db35:a6bd:e953	SSH	138		Server: Encrypted packet (len=64)
12	1.018245	3ffe:501:ffff:100:20c:29ff:fe7:2867	3ffe:501:ffff:100:20c:29ff:fe4e:5c8c	ICMPv6	118		Echo (ping) request id=0x1059, seq=1, hop limit=64 (reply in 13)
13	1.018262	3ffe:501:ffff:100:20c:29ff:fe4e:5c8c	3ffe:501:ffff:100:20c:29ff:fe7:2867	ICMPv6	118		Echo (ping) reply id=0x1059, seq=1, hop limit=64 (request in 12)
14	1.018490	3ffe:501:ffff:100:20c:29ff:fe7:2867	3ffe:501:ffff:100:20c:29ff:fe4e:5c8c	DNS	163	109	Standard query 0xe5f4 PTR c.8.c.5.e.4.e.f.f.f.9.2.c.0.2.0.0.1.0.f.f.f.1.0.5.0.e.f.f.3.ip6
15	1.018686	3ffe:501:ffff:100:20c:29ff:fe4e:5c8c	3ffe:501:ffff:100:20c:29ff:fe7:2867	DNS	227	173	Standard query response 0xe5f4 No such name PTR c.8.c.5.e.4.e.f.f.f.9.2.c.0.2.0.0.1.0.f.f.f.
16	1.018929	fe80::20c:29ff:fe7:2867	fe80::a47a:db35:a6bd:e953	SSH	218		Server: Encrypted packet (len=144)

**Packet 10 Details:**

- Frame 9: 155 bytes on wire (1240 bits), 155 bytes captured (1240 bits)
- Ethernet II, Src: VMware\_4e:5c:8c (00:0c:29:4e:5c:8c), Dst: VMware\_e7:28:67 (00:0c:29:e7:28:67)
- Internet Protocol Version 6, Src: 3ffe:501:ffff:100:20c:29ff:fe4e:5c8c, Dst: 3ffe:501:ffff:100:20c:29ff:fe7:2867
- User Datagram Protocol, Src Port: 53, Dst Port: 44396
- Domain Name System (response)
  - Transaction ID: 0xe828
  - Flags: 0x8580 Standard query response, No error
  - Questions: 1
  - Answer RRs: 1
  - Authority RRs: 1
  - Additional RRs: 1
  - Queries
    - node1.test.example.com: type AAAA, class IN
      - Name: node1.test.example.com
      - [Name Length: 22]
      - [Label Count: 4]
      - Type: AAAA (28) (IP6 Address)
      - Class: IN (0x0001)
  - Answers
    - node1.test.example.com: type AAAA, class IN, addr 3ffe:501:ffff:100:20c:29ff:fe4e:5c8c
      - Name: node1.test.example.com
      - Type: AAAA (28) (IP6 Address)
      - Class: IN (0x0001)
      - Time to live: 604800 (7 days)
      - Data length: 16
      - AAAA Address: 3ffe:501:ffff:100:20c:29ff:fe4e:5c8c
  - Authoritative nameservers
  - Additional records
    - [Request In: 7]

[Time: 0.000494000 seconds]

Note: The DUT doesn't support a GUI-accessible user interface and an API endpoint, so steps 26-29 are omitted per the test specification.

## IPv6-Only.1.6: Logging

## Part A: Local Logging

Logs can be viewed locally on the DUT.

Link-local addresses are displayed in a text format per RFC 5952:

```
root@Router-C:~#
eth0 Link encap:Ethernet HWaddr 00:0c:29:3c:35:97
      inet6 addr: fe80::501:ffff:100:20c:29ff:fe3c:3597/64 Scope:Global
      inet6 addr: fe80::20c:29ff:fe3c:3597/64 Scope:Link
      UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
      RX packets:13842 errors:0 dropped:111 overruns:0 frame:0
      TX packets:2104 errors:0 dropped:0 overruns:0 carrier:0
      collisions:0 txqueuelen:1000
      RX bytes:1089195 (1.0 MB) TX bytes:289497 (289.4 KB)

root@Router-C:~# ssh root@fe80::20c:29ff:fe7:2867#eth0
root@fe80::20c:29ff:fe7:2867#eth0's password:
Welcome to Ubuntu 24.04.1 LTS (GNU/Linux 6.8.0-51-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

System information as of Fri Jan 3 12:26:34 PM UTC 2025

System load:  0.17           Swap usage:   0%           Users logged in: 1
Usage of /:   47.4% of 14.66GB Temperature: 100.0 C
Memory usage: 25%           Processes:   149

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
  just raised the bar for easy, resilient and secure K8s cluster deployment.

https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

20 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

New release '24.10' available.
Run 'do-release-upgrade' to upgrade to it.

Last login: Fri Jan 3 12:30:04 2025 from fe80::a47a:db35:a6bd:e953#ens160
root@cnlabs-refduftipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
      inet6 3ffe:501:ffff:100:20c:29ff:fe7:2867  prefixlen 64  scopeid 0x0<global>
      inet6 fe80::20c:29ff:fe7:2867  prefixlen 64  scopeid 0x20<link>
      ether 00:0c:29:e7:28:67  txqueuelen 1000  (Ethernet)
      RX packets 405 bytes 38126 (38.1 KB)
      RX errors 0 dropped 0 overruns 0 frame 0
      TX packets 132 bytes 24964 (24.9 KB)
      TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refduftipv6:~# exit
logout
Connection to fe80::20c:29ff:fe7:2867#eth0 closed.

root@cnlabs-refduftipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
      inet6 3ffe:501:ffff:100:20c:29ff:fe7:2867  prefixlen 64  scopeid 0x0<global>
      inet6 fe80::20c:29ff:fe7:2867  prefixlen 64  scopeid 0x20<link>
      ether 00:0c:29:e7:28:67  txqueuelen 1000  (Ethernet)
      RX packets 274 bytes 23886 (23.8 KB)
      RX errors 0 dropped 0 overruns 0 frame 0
      TX packets 78 bytes 14086 (14.0 KB)
      TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cnlabs-refduftipv6:~# cat /var/log/auth.log
2025-01-03T12:29:23.448974+00:00 cnlabs-refduftipv6 systemd-logind[843]: New seat seat0.
2025-01-03T12:29:23.448981+00:00 cnlabs-refduftipv6 systemd-logind[843]: Watching system butto
ns on /dev/input/event0 (Power Button)
2025-01-03T12:29:23.448988+00:00 cnlabs-refduftipv6 systemd-logind[843]: Watching system butto
ns on /dev/input/event1 (AT Translated Set 2 keyboard)
2025-01-03T12:29:59.164516+00:00 cnlabs-refduftipv6 sshd[1076]: Server listening on :: port 22
.
2025-01-03T12:30:03.307089+00:00 cnlabs-refduftipv6 sshd[1078]: Accepted password for root fr
m fe80::a47a:db35:a6bd:e953#ens160 port 51532 ssh2
2025-01-03T12:30:03.310860+00:00 cnlabs-refduftipv6 sshd[1078]: pam_unix(sshd:session): sessio
n opened for user root(uid=0) by root(uid=0)
2025-01-03T12:30:03.344590+00:00 cnlabs-refduftipv6 systemd-logind[843]: New session 1 of user
root.
2025-01-03T12:30:03.424082+00:00 cnlabs-refduftipv6 (systemd): pam_unix(systemd-user:session):
session opened for user root(uid=0) by root(uid=0)
2025-01-03T12:30:20.178375+00:00 cnlabs-refduftipv6 sshd[1203]: Accepted password for root fr
m fe80::20c:29ff:fe3c:3597#ens160 port 34144 ssh2
2025-01-03T12:30:20.183429+00:00 cnlabs-refduftipv6 sshd[1203]: pam_unix(sshd:session): sessio
n opened for user root(uid=0) by root(uid=0)
2025-01-03T12:30:20.193533+00:00 cnlabs-refduftipv6 systemd-logind[843]: New session 3 of user
root.
2025-01-03T12:30:26.766552+00:00 cnlabs-refduftipv6 sshd[1203]: Received disconnect from fe80:
:20c:29ff:fe3c:3597#ens160 port 34144:11: disconnected by user
2025-01-03T12:30:26.769205+00:00 cnlabs-refduftipv6 sshd[1203]: Disconnected from user root fe
80::20c:29ff:fe3c:3597#ens160 port 34144
2025-01-03T12:30:26.769415+00:00 cnlabs-refduftipv6 sshd[1203]: pam_unix(sshd:session): sessio
n closed for user root
2025-01-03T12:30:26.775573+00:00 cnlabs-refduftipv6 systemd-logind[843]: Session 3 logged out.
Waiting for processes to exit.
2025-01-03T12:30:26.776691+00:00 cnlabs-refduftipv6 systemd-logind[843]: Removed session 3.
root@cnlabs-refduftipv6:~#
```

Global addresses are displayed in a text format per RFC 5952:

```

root@Router-C:~#
eth0      Link encap:Ethernet  HWaddr 00:0c:29:3c:35:97
          inet6 addr: fe80::20c:29ff:fe3c:3597/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:9330 errors:0 dropped:60 overruns:0 frame:0
          TX packets:1463 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:757383 (757.3 KB)  TX bytes:186402 (186.4 KB)

root@Router-C:~# ssh root@3ffe:501:ffff:100:20c:29ff:fe7:2867
root@3ffe:501:ffff:100:20c:29ff:fe7:2867's password:
Welcome to Ubuntu 24.04.1 LTS (GNU/Linux 6.8.0-51-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/pro

System information as of Fri Jan 3 12:14:04 PM UTC 2025

System load:  0.81               Swap usage:  0%
Usage of /:   47.3% of 14.66GB   Temperature: 100.0 C
Memory usage: 24%               Processes:   149

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
   just raised the bar for easy, resilient and secure K8s cluster deployment.

https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

20 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

New release '24.10' available.
Run 'do-release-upgrade' to upgrade to it.

Last login: Fri Jan 3 12:13:37 2025 from fe80::a47a:db35:a6bd:e953%ens160
root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 3ffe:501:ffff:100:20c:29ff:fe7:2867  prefixlen 64  scopeid 0x0<global>
        inet6 fe80::20c:29ff:fe7:2867  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:e7:28:67  txqueuelen 1000  (Ethernet)
        RX packets 483  bytes 43552 (43.5 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 135  bytes 25846 (25.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

root@cnlabs-refdutipv6:~# exit
logout
Connection to 3ffe:501:ffff:100:20c:29ff:fe7:2867 closed.

```

```

root@cnlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 3ffe:501:ffff:100:20c:29ff:fe7:2867  prefixlen 64  scopeid 0x0<global>
        inet6 fe80::20c:29ff:fe7:2867  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:e7:28:67  txqueuelen 1000  (Ethernet)
        RX packets 365  bytes 31262 (31.2 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 96  bytes 16794 (16.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

root@cnlabs-refdutipv6:~# cat /var/log/auth.log
2025-01-03T12:12:56.433348+00:00 cnlabs-refdutipv6 systemd-logind[841]: New seat seat0.
2025-01-03T12:12:56.433361+00:00 cnlabs-refdutipv6 systemd-logind[841]: Watching system butto
na on /dev/input/event0 (Power Button)
2025-01-03T12:12:56.433368+00:00 cnlabs-refdutipv6 systemd-logind[841]: Watching system butto
na on /dev/input/event1 (AT Translated Set 2 keyboard)
2025-01-03T12:13:32.420538+00:00 cnlabs-refdutipv6 sshd[1076]: Server listening on :: port 22
.
2025-01-03T12:13:36.419782+00:00 cnlabs-refdutipv6 sshd[1078]: Accepted password for root fro
m fe80::a47a:db35:a6bd:e953%ens160 port 51093 ssh2
2025-01-03T12:13:36.423341+00:00 cnlabs-refdutipv6 sshd[1078]: pam_unix(sshd:session): sessio
n opened for user root(uid=0) by root(uid=0)
2025-01-03T12:13:36.474605+00:00 cnlabs-refdutipv6 systemd-logind[841]: New session 1 of user
root.
2025-01-03T12:13:36.542665+00:00 cnlabs-refdutipv6 (systemd): pam_unix(systemd-user:session):
session opened for user root(uid=0) by root(uid=0)
2025-01-03T12:14:04.390834+00:00 cnlabs-refdutipv6 sshd[1203]: Accepted password for root fro
m 3ffe:501:ffff:100:20c:29ff:fe3c:3597 port 37212 ssh2
2025-01-03T12:14:04.396651+00:00 cnlabs-refdutipv6 sshd[1203]: pam_unix(sshd:session): sessio
n opened for user root(uid=0) by root(uid=0)
2025-01-03T12:14:04.406661+00:00 cnlabs-refdutipv6 systemd-logind[841]: New session 3 of user
root.
2025-01-03T12:14:17.180915+00:00 cnlabs-refdutipv6 sshd[1203]: Received disconnect from 3ffe:
501:ffff:100:20c:29ff:fe3c:3597 port 37212:11: disconnected by user
2025-01-03T12:14:17.182025+00:00 cnlabs-refdutipv6 sshd[1203]: Disconnected from user root 3f
fe:501:ffff:100:20c:29ff:fe3c:3597 port 37212
2025-01-03T12:14:17.182665+00:00 cnlabs-refdutipv6 sshd[1203]: pam_unix(sshd:session): sessio
n closed for user root
2025-01-03T12:14:17.189414+00:00 cnlabs-refdutipv6 systemd-logind[841]: Session 3 logged out.
Waiting for processes to exit.
2025-01-03T12:14:17.190970+00:00 cnlabs-refdutipv6 systemd-logind[841]: Removed session 3.
root@cnlabs-refdutipv6:~#

```



## Part B: IP Enabled Remote Logging

Configured the DUT for remote logging over IPv6:

root@cnlabs-refdutipv6: ~

```
#### MODULES ####
#####

module(load="imuxsock") # provides support for local system logging
#module(load="immark") # provides --MARK-- message capability

# provides UDP syslog reception
#module(load="imudp")
#input(type="imudp" port="514")

# provides TCP syslog reception
#module(load="imtcp")
#input(type="imtcp" port="514")

# provides kernel logging support and enable non-kernel klog messages
module(load="imklog" permitnonkernelfacility="on")

#####
#### GLOBAL DIRECTIVES ####
#####

# Filter duplicated messages
$RepeatedMsgReduction on

#
# Set the default permissions for all log files.
#
$LocalHostName
$FileOwner syslog
$FileGroup adm
$FileCreateMode 0640
$DirCreateMode 0755
$Umask 0022
$PrivDropToUser syslog
$PrivDropToGroup syslog

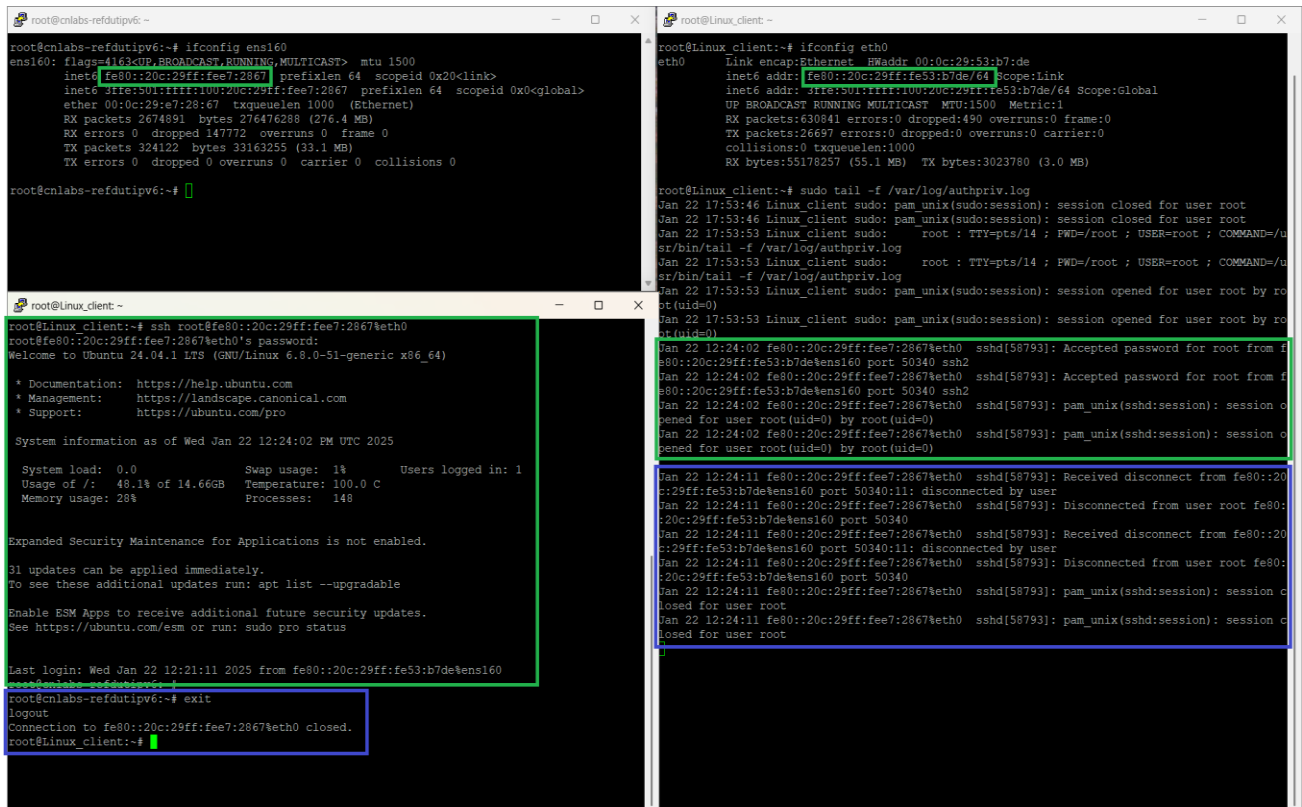
# Disable hostname resolution and DNS lookups
#$PreserveFQDN off
#$UseDNS off

# Define template to log raw IPv6 addresses
#$template NoHostnameFormat,"%TIMESTAMP% %FROMHOST-IP% %syslogtag% %msg%\n"

#
# Where to place spool and state files
#
$WorkDirectory /var/spool/rsyslog

#
# Include all config files in /etc/rsyslog.d/
#
$IncludeConfig /etc/rsyslog.d/*.conf
*.* @[3ffe:501:ffff:100:20c:29ff:fe53:b7de]:514
```

Link-local addresses are displayed in a text format per RFC 5952:



```

root@cmlabs-refdutipv6:~# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::20c:29ff:fee7:2867 prefixlen 64 scopeid 0x20<link>
    inet6 3ffe:b01:ffff:100:20c:29ff:fee7:2867 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:e7:28:67 txqueuelen 1000 (Ethernet)
    RX packets 2674891 bytes 276476288 (276.4 MB)
    RX errors 0 dropped 147772 overruns 0 frame 0
    TX packets 324122 bytes 33163255 (33.1 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@cmlabs-refdutipv6:~#

root@Linux_client:~# ifconfig eth0
eth0: Link encap:Ethernet HWaddr 00:0c:29:53:b7:de
    inet6 addr: fe80::20c:29ff:fe53:b7de/64 Scope:Link
    inet6 addr: 3ffe:b01:ffff:100:20c:29ff:fe53:b7de/64 Scope:Global
    UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
    RX packets:630841 errors:0 dropped:490 overruns:0 frame:0
    TX packets:26697 errors:0 dropped:0 overruns:0 carrier:0
    collisions:0 txqueuelen:1000
    RX bytes:55178257 (55.1 MB) TX bytes:3023780 (3.0 MB)

root@Linux_client:~# sudo tail -f /var/log/authpriv.log
Jan 22 17:53:46 Linux_client sudo: pam_unix(sudo:session): session closed for user root
Jan 22 17:53:46 Linux_client sudo: pam_unix(sudo:session): session closed for user root
Jan 22 17:53:53 Linux_client sudo: root : TTY=pts/14 ; PWD=/root ; USER=root ; COMMAND=/u
sr/bin/tail -f /var/log/authpriv.log
Jan 22 17:53:53 Linux_client sudo: root : TTY=pts/14 ; PWD=/root ; USER=root ; COMMAND=/u
sr/bin/tail -f /var/log/authpriv.log
Jan 22 17:53:53 Linux_client sudo: pam_unix(sudo:session): session opened for user root by ro
ot(uid=0)
Jan 22 17:53:53 Linux_client sudo: pam_unix(sudo:session): session opened for user root by ro
ot(uid=0)
Jan 22 12:24:02 fe80::20c:29ff:fee7:2867 eth0 sshd[58793]: Accepted password for root from f
e80::20c:29ff:fe53:b7de@ens160 port 50340 ssh2
Jan 22 12:24:02 fe80::20c:29ff:fee7:2867 eth0 sshd[58793]: Accepted password for root from f
e80::20c:29ff:fe53:b7de@ens160 port 50340 ssh2
Jan 22 12:24:02 fe80::20c:29ff:fee7:2867 eth0 sshd[58793]: pam_unix(sshd:session): session o
pened for user root(uid=0) by root(uid=0)
Jan 22 12:24:02 fe80::20c:29ff:fee7:2867 eth0 sshd[58793]: pam_unix(sshd:session): session o
pened for user root(uid=0) by root(uid=0)
Jan 22 12:24:11 fe80::20c:29ff:fee7:2867 eth0 sshd[58793]: Received disconnect from fe80::20
c:29ff:fe53:b7de@ens160 port 50340:11: disconnected by user
Jan 22 12:24:11 fe80::20c:29ff:fee7:2867 eth0 sshd[58793]: Disconnected from user root fe80:
:20c:29ff:fe53:b7de@ens160 port 50340
Jan 22 12:24:11 fe80::20c:29ff:fee7:2867 eth0 sshd[58793]: Received disconnect from fe80::20
c:29ff:fe53:b7de@ens160 port 50340:11: disconnected by user
Jan 22 12:24:11 fe80::20c:29ff:fee7:2867 eth0 sshd[58793]: Disconnected from user root fe80:
:20c:29ff:fe53:b7de@ens160 port 50340
Jan 22 12:24:11 fe80::20c:29ff:fee7:2867 eth0 sshd[58793]: pam_unix(sshd:session): session c
losed for user root
Jan 22 12:24:11 fe80::20c:29ff:fee7:2867 eth0 sshd[58793]: pam_unix(sshd:session): session c
losed for user root

root@Linux_client:~#

root@cmlabs-refdutipv6:~# ssh root@fe80::20c:29ff:fee7:2867 eth0
root@fe80::20c:29ff:fee7:2867 eth0's password:
Welcome to Ubuntu 24.04.1 LTS (GNU/Linux 6.8.0-51-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/pro

System information as of Wed Jan 22 12:24:02 PM UTC 2025

System load:  0.0          Swap usage:  1%          Users logged in:  1
Usage of /:   48.1% of 14.66GB    Temperature: 100.0 C
Memory usage: 28%            Processes:   148

Expanded Security Maintenance for Applications is not enabled.

31 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Last login: Wed Jan 22 12:21:11 2025 from fe80::20c:29ff:fe53:b7de@ens160
root@cmlabs-refdutipv6:~# exit
logout
Connection to fe80::20c:29ff:fee7:2867 eth0 closed.
root@Linux_client:~#

```

The DUT successfully sends the device event logs to the IPv6 Destination Server (i.e., Linux\_Client: showed in right tab)



Global addresses are displayed in a text format per RFC 5952:

```

root@cnlabs-refdutipv6:/etc# ifconfig ens160
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet6 fe80::20c:29ff:fee7:2867  prefixlen 64  scopeid 0x20<link>
        inet6 3ffe:501:ffff:100:20c:29ff:fee7:2867  prefixlen 64  scopeid 0x0<global>
        ether 00:0c:29:fe:f2:86  txqueuelen 1000  (Ethernet)
        RX packets 2837986  bytes 287451885 (287.4 MB)
        RX errors 0  dropped 152241  overruns 0  frame 0
        TX packets 330051  bytes 34024922 (34.0 MB)
        TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

root@cnlabs-refdutipv6:/etc#

root@Linux_client:~# ifconfig eth0
eth0:  Link encap:Ethernet  HWaddr 00:0c:29:53:b7:de
        inet6 addr: fe80::20c:29ff:fe53:b7de/64 Scope:link
        inet6 addr: 3ffe:501:ffff:100:20c:29ff:fe53:b7de/64 Scope:Global
        UP BROADCAST RUNNING MULTICAST  HWaddr:00:0c:29:53:b7:de
        RX packets:826969 errors:0 dropped:714 overruns:0 frame:0
        TX packets:30677 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:70466707 (70.4 MB)  TX bytes:3709251 (3.7 MB)

root@Linux_client:~# sudo tail -f /var/log/authpriv.log
Jan 23 15:55:35 Linux_client sudo: pam_unix(sudo:session): session closed for user root
Jan 23 15:55:35 Linux_client sudo: pam_unix(sudo:session): session closed for user root
Jan 23 15:55:46 Linux_client sudo: root : TTY=pts/9 ; FWD=/root ; USER=root ; COMMAND=/usr
/bin/tail -f /var/log/authpriv.log
Jan 23 15:55:46 Linux_client sudo: root : TTY=pts/9 ; FWD=/root ; USER=root ; COMMAND=/usr
/bin/tail -f /var/log/authpriv.log
Jan 23 15:55:46 Linux_client sudo: pam_unix(sudo:session): session opened for user root by roo
t(uid=0)
Jan 23 15:55:46 Linux_client sudo: pam_unix(sudo:session): session opened for user root by roo
t(uid=0)
Jan 23 10:26:10 3ffe:501:ffff:100:20c:29ff:fee7:2867 sshd[61320]: Accepted password for root
from 3ffe:501:ffff:100:20c:29ff:fe53:b7de port 44416 ssh2
Jan 23 10:26:10 3ffe:501:ffff:100:20c:29ff:fee7:2867 sshd[61320]: Accepted password for root
from 3ffe:501:ffff:100:20c:29ff:fe53:b7de port 44416 ssh2
Jan 23 10:26:10 3ffe:501:ffff:100:20c:29ff:fee7:2867 sshd[61320]: pam_unix(sshd:session): ses
sion opened for user root(uid=0) by root(uid=0)
Jan 23 10:26:10 3ffe:501:ffff:100:20c:29ff:fee7:2867 sshd[61320]: pam_unix(sshd:session): ses
sion opened for user root(uid=0) by root(uid=0)
Jan 23 10:26:15 3ffe:501:ffff:100:20c:29ff:fee7:2867 sshd[61320]: Received disconnect from 3f
fe:501:ffff:100:20c:29ff:fe53:b7de port 44416:11: disconnected by user
Jan 23 10:26:15 3ffe:501:ffff:100:20c:29ff:fee7:2867 sshd[61320]: Disconnected from user root
3ffe:501:ffff:100:20c:29ff:fe53:b7de port 44416
Jan 23 10:26:15 3ffe:501:ffff:100:20c:29ff:fee7:2867 sshd[61320]: pam_unix(sshd:session): ses
sion closed for user root
Jan 23 10:26:15 3ffe:501:ffff:100:20c:29ff:fee7:2867 sshd[61320]: Received disconnect from 3f
fe:501:ffff:100:20c:29ff:fe53:b7de port 44416:11: disconnected by user
Jan 23 10:26:15 3ffe:501:ffff:100:20c:29ff:fee7:2867 sshd[61320]: Disconnected from user root
3ffe:501:ffff:100:20c:29ff:fe53:b7de port 44416
Jan 23 10:26:15 3ffe:501:ffff:100:20c:29ff:fee7:2867 sshd[61320]: pam_unix(sshd:session): ses
sion closed for user root

root@cnlabs-refdutipv6:/etc#
root@Linux_client:~# ssh root@3ffe:501:ffff:100:20c:29ff:fee7:2867
root@3ffe:501:ffff:100:20c:29ff:fee7:2867's password:
Welcome to Ubuntu 24.04.1 LTS (GNU/Linux 6.8.0-51-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

System information as of Thu Jan 23 10:26:10 AM UTC 2025

System load:          0.0
Usage of /:            48.1% of 14.66GB
Memory usage:         28%
Swap usage:           1%
Temperature:          100.0 C
Processes:            147
Users logged in:      1
IPV6 address for ens160: 3ffe:501:ffff:100:20c:29ff:fee7:2867

Expanded Security Maintenance for Applications is not enabled.

31 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Failed to connect to https://changelogs.ubuntu.com/meta-release. Check your Internet connecti
on or proxy settings

Last login: Thu Jan 23 10:24:20 2025 from 3ffe:501:ffff:100:20c:29ff:fe53:b7de
root@cnlabs-refdutipv6:~# exit
logout
Connection to 3ffe:501:ffff:100:20c:29ff:fee7:2867 closed.
root@Linux_client:~#

```

The DUT successfully sends the device event logs to the IPv6 Destination Server (i.e., Linux\_Client: showed in right tab)

----- End of Test Report -----