NSG Exo
Super Quick Start Guide

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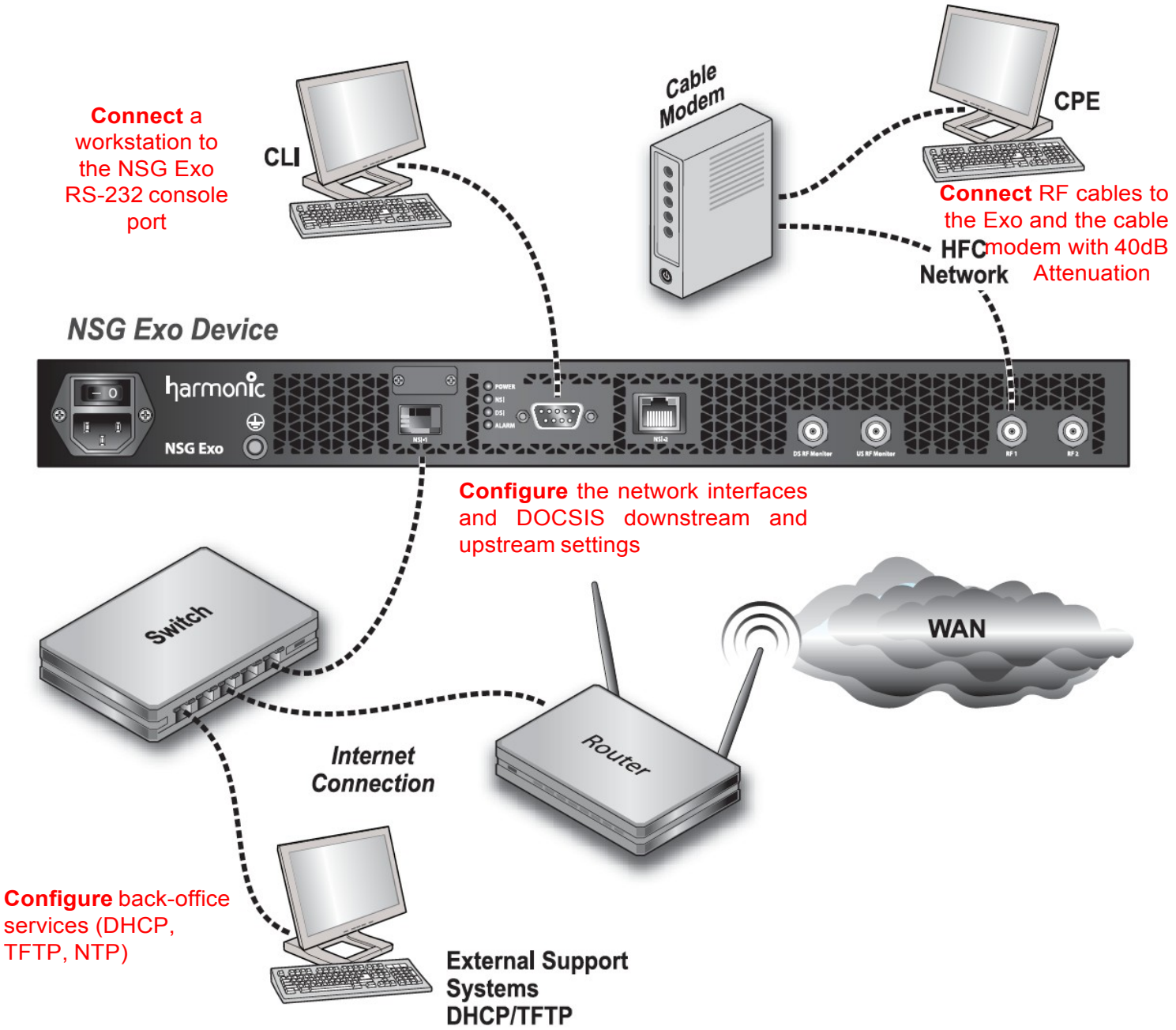
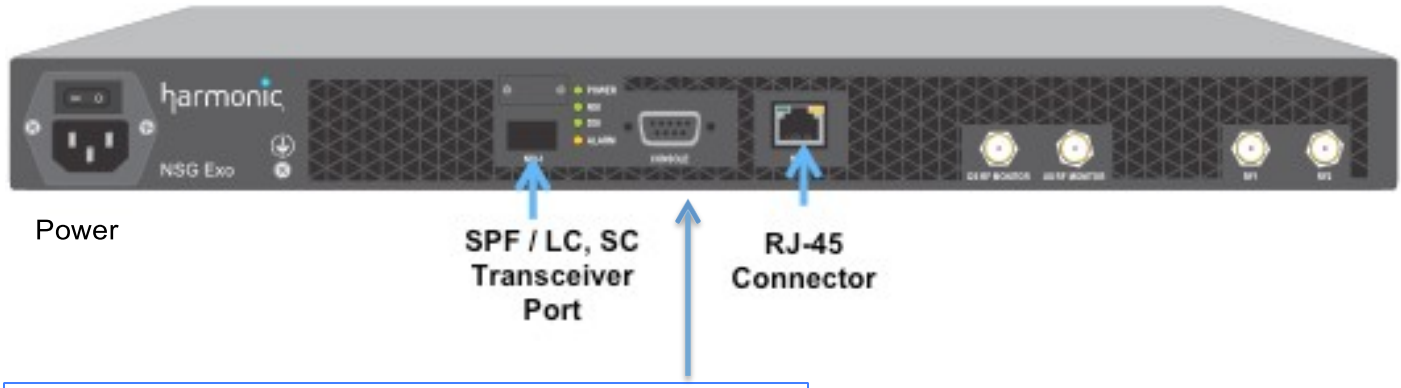
Congratulations!

Follow these steps to get the NSG Exo up and running and get cable modems online as fast as possible on software version 1.9 or later!



Power Up!

Connect the AC power and toggle the on/off switch to ON. The power LED shines in steady green when switched on.



Connect a computer to the NSG Exo console port with a M-M RS-232 serial cable (USB-to-serial adapters are acceptable). Use any terminal application such as Putty to establish a console connection.

- Use a "?" to reveal the available options to enter.
- Use the TAB key to auto-complete a command

Enter the default login and password:

Username: admin
Password: nsgadmin

Set the terminal application for:
Port Speed 115,200 bps
8- Data bits
1- Stop bit
no Parity
Flow Control – NONE

Network Connections

The NSG Exo is fixed at 1Gbps and full duplex regardless of the physical port used. The RJ-45 is enabled by default. To use the SFP interface for an optical connection, run the following command at the CLI prompt (not in configure mode):

admin#nsg-exo> interface gigabit phy-type sfp

The NSG Exo uses multiple sub-interfaces to separate the traffic of DOCSIS devices, CPE devices and network management but the Gigabit Ethernet interface does not have its own IP address.

- Two sub-interfaces are for DOCSIS cable modems (cm) and EMTA's (emta).
- One sub-interface is for network management (mng)
- One sub-interface is for CPE (cpe).
- One sub-interface is called Generic, and is used to classify and segregate devices based on DHCP Option values you select with a "match" statement.

Enter configure mode and edit the NSG Exo device management sub-interfaces.

```
admin#nsg-exo> configure
(config) # interface gigabit 0
(if-gigabit 0) # sub-interface mng
(sub-interface mng) # ip-address 192.168.20.2/24
```

While in configure mode, set up your sub-interfaces with addresses that work in a lab setting by running these commands:

```
(sub-interface mng)# sub-interface cm
(sub-interface cm)# ip-address 30.31.32.2/24
(sub-interface cm)# default-gateway 30.31.31.1
(sub-interface cm)# sub-interface cpe
(sub-interface cpe)# ip-address 40.41.42.2/24
(sub-interface cpe)# default-gateway 40.41.42.1
(sub-interface cpe)# sub-interface emta
(sub-interface emta)# ip-address 50.51.52.2/24
(sub-interface emta)# default-gateway 50.51.52.1
(sub-interface emta)# exit      (drops you to the main config level)
```

Edit the default-gateway for the network management sub-interface using the IP address of the upstream router.

```
(config)# default-gateway 192.168.20.1
```

DHCP Relay

If your DHCP/TFTP server is behind a router, and the router handles DHCP Relay (ip helper-address), configure the Exo for DHCP Relay “Layer-2 Mode” as shown below. If you need the Exo to perform DHCP Relay, set the Exo to DHCP Relay “Layer-3 Mode”. DHCP Option 82 and Option 60 are supported in Layer-3 mode.

Paste this in for Layer-2 Mode

```
(config)# network dhcp-relay
(dhcp-relay)# mode l2
(dhcp-relay)# host-type cm
(dhcp-relay cm)# dhcp-server 192.168.20.1
(dhcp-relay)# host-type cpe
(dhcp-relay cpe)# dhcp-server 192.168.20.1
(dhcp-relay)# host-type emta
(dhcp-relay emta)# dhcp-server 192.168.20.1
(dhcp-relay emta)# exit
```

Paste this in for Layer-3 Mode

```
(config)# network dhcp-relay
(dhcp-relay)# mode l3
(dhcp-relay)# option82 circuit-id exo1
(dhcp-relay)# host-type cm
(dhcp-relay cm)# dhcp-server 192.168.20.1
(dhcp-relay)# host-type cpe
(dhcp-relay cpe)# dhcp-server 192.168.20.1
(dhcp-relay)# host-type emta
(dhcp-relay emta)# dhcp-server 192.168.20.1
(dhcp-relay emta)# exit
```

I use a Raspberry Pi to perform a lot of the network tasks in my lab setup, including DHCP and TFTP services, NTP service, and many other network services that the NSG Exo would need. My lab switch is a simple Gigabit switch. You can change the dhcp-server values, just make sure the servers are pingable from the NSG Exo console.

RF & DOCSIS Configuration

The NSG Exo needs only a few tweaks for the U.S. cable modem market. The default modulation values are 256QAM. It WILL be necessary to configure the Exo to “Annex B”. At the configure prompt enter the following commands to set the annex type. This resets the downstream channels starting at 123Mhz. You can change the range for downstream carriers using the auto-assignment command:

```
(config)# cable ds-rf-port 0
(ds-rf-port 0)# annex b
(ds-rf-port 0)# auto-assign-freqs 561
```

Next, set up your upstream carriers with the upstream auto-assign command:

```
(ds-rf-port 0)# exit
(config)# cable us-rf-port 0
(us-rf-port 0)# auto-assign-freqs 16.8 width 6.4
(us-rf-port 0)# exit
(config)#
```

Save Your Work!

The changes are in stored a “pending-configuration”. Push the changes to the running-configuration with the “commit” command, then save the running configuration to the startup-config with the “write” command and reboot the Exo:

```
(config)# commit
admin#nsg-exo> write
admin#nsg-exo> reboot
```

Need Multicast?

There is an ACL for IP Multicast that enables all IP Multicast traffic by default. Read the Quick Start Guide, or for even more in-depth information read the Software Installation and Configuration Guide to learn about using the access control lists on the NSG Exo.

Back Office Services

You need a DHCP and TFTP server configured for your cable modem and CPE devices to get IP addresses, and serve the DOCSIS configuration file. You probably already have that set up, but, look in the Appendix for a very simple standalone config for the Linux isc-dhcp-server and tftp-hpa server. Some routers or switches have DHCP and TFTP servers that can be enabled for basic capabilities, so this may be a viable option. I use a Raspberry Pi for this.

The NSG Exo has an internal DHCP and TFTP server that can be used for cable modems only. Your upstream router must have “local-proxy-arp” enabled. Some devices call this “proxy-arp-pvlan”. This is required for the TFTP requests from cable modems to be reflected back to the NSG Exo internal TFTP server. You also need to upload the DOCSIS config file(s) to the NSG Exo.

You can use the NSG Exo for DHCP only, and use an external TFTP server if you can’t get the local-proxy-arp functionality working. Please refer to the Harmonic NSG Exo Software Installation and Configuration Guide for instructions for configuring the internal DHCP and TFTP services.

Check Your Work

There is a command alias for the “show cable modem” called “scm” that can be used to shorten the amount of typing to run those related command:

- show cable modem – see a list of the cable modems and their status
- show cable modem bonding - see DOCSIS 3.0 bonding properties of cable modems
- show cable modem phy – see the DS/US power and SNR values
- show cable modem verbose – very detailed information on DOCSIS operating parameters
- show cable modem 7896.84e4.1717 service-flow – see the breakdown of traffic by classification
- show access-list cm – details on the hits against an ACL for a CM
- show access-list cpe – details on the hits against an ACL for a CPE
- show cable downstream 0 – details on the RF channel characteristics
- show cable upstream 0 – details on the RF channel characteristics

Appendix - A simple DHCP server configuration for isc-dhcp-server

This is an example configuration taken from a Raspberry Pi /etc/dhcp/dhcpd.conf file that is configured to support the subnet ranges for the cable modems, cpe and emta's as described above. The Raspberry Pi is the next-hop for all subnets and is the DHCP / TFTP server for this exercise.

NOTE: The subnets described for the Cable Modems, eMTA's and CPE's are factory default values and are not for use on a network that is directly connected to the Internet without Network Address Translation (NAT) between the Exo and the Internet.

```
# These classes differentiate cable modems from EMTA's and CPE
class "cablemodem" {
    match if substring (option vendor-class-identifier, 0, 6) = "docsis";
}
class "voip" {
    match if substring (option vendor-class-identifier, 0, 4) = "pktc";
}
# This definition supports modems, emta's and consumer devices on specific
# subnets.

shared-network Exo {
    subnet 192.168.20.0 netmask 255.255.255.0 {}

    subnet 30.31.32.0 netmask 255.255.255.0 {
        pool {
            allow members of "cablemodem";
            option routers 30.31.32.1;
            option subnet-mask 255.255.255.0;
            default-lease-time 3600;
            max-lease-time 3600;
            option time-servers 192.168.20.1;
            option log-servers 192.168.20.1;
            next-server 192.168.20.1;
            option time-offset 0;
            filename "R103_50_50.cfg";
            range 30.31.32.10 30.31.32.100;
        }
    }
    subnet 40.41.42.0 netmask 255.255.255.0 {
        pool {
            deny members of "cablemodem";
            deny members of "voip";
            option routers 40.41.42.1;
            option subnet-mask 255.255.255.0;
            default-lease-time 3600;
            max-lease-time 3600;
            range 40.41.42.10 40.41.42.100;
        }
    }
```

```
    subnet 50.51.52.0 netmask 255.255.255.0 {
        pool {
            allow members of "voip";
            option routers 50.51.52.1;
            option subnet-mask 255.255.255.0;
            default-lease-time 3600;
            max-lease-time 3600;
            option time-servers 192.168.20.1;
            option log-servers 192.168.20.1;
            next-server 192.168.20.1;
            option time-offset 0;
            filename "R103_50_50.cfg";
            range 50.51.52.10 50.51.52.100;
        }
    }
}
```

This is an excerpt from a Raspberry Pi /etc/network/interfaces file, showing the primary and virtual IP addresses on the eth0 physical interface.

```
auto lo
iface lo inet loopback

# eth0 - the internal RJ-45 adapter on the Pi
auto eth0
iface eth0 inet static
  address 192.168.20.1
  netmask 255.255.255.0

auto eth0:0
iface eth0:0 inet static
  address 30.31.32.1
  netmask 255.255.255.0

auto eth0:1
iface eth0:1 inet static
  address 40.41.42.1
  netmask 255.255.255.0

auto eth0:2
iface eth0:2 inet static
  address 50.51.52.1
  netmask 255.255.255.0
```