Lanner

Whitepaper

Lanner Launches OpenNSL CDP in ONL for its Hyper-converged HybridTCA™ HTCA-6000 Series

Abstract

The disaggregated network infrastructure driven by the widespread phenomenon of SDN/NFV has encouraged CSP (Communication Service Providers) and data centers to implement white box uCPE/vCPE in mission-critical applications and services to save CAPEX and OPEX. The trends of deploying white-box server hardware indicate growing adoption of open network orchestration.

To meet the demand for open networking environment, Lanner has made further breakthrough for its data center appliance HTCA-6000 series with software enhancement by supporting Open Network Linux (ONL) and Open Network Install Environment. Customers deploying HTCA-6000 series will be benefited with Lanner's software library to develop their custom applications based on open Linux and Broadcom StrataXGS® Trident II switch with reduced time-to-market.

Lanner's HTCA-6000 series converges switching, computing and storage capability in a single hardware server, meeting the requirements of today's hyper-convergence platform in telecommunication and network service providers. The following will discuss the software technology of Lanner's usage in Open NSL in our HTCA-6000 series.

Customized Software Kit

Since the current version of Open Network Linux software kit does not support Broadcom Switch fabric, Lanner has adopted Broadcom OpenNSL version to customize our Broadcom-empowered switching blade HLM-1000 to optimize the functionality of the module.

The Open Network Switch Layer of Lanner's OpenNSL software library is virtually a network switching API library, offering programming and software development for Broadcom based networking switching platform.

To shorten the efforts in developments, Lanner will provide the following software files for customers deploying our HTCA-6000 series to optimize HLM-1000 switching blades:

ONIE Install binary and boot Image :
* onie-recovery-x86_64-lanner_hmb_1000-r0.iso : ONIE boot iso image
* onie-update-x86_64-lanner_hmb_1000-r0 : ONIE update binary

ONL + Broadcom OpenNSL CDP binary :
* ONL-2.0.0_ONL-OS_2018-03-05.0300-5b3db59_AMD64_INSTALLER :
* ONL binary (including OpenNSL CDP modules and library)
*
Broadcom OpenNSL CDP Package file :
* opennsl-3.2.0.5-cdp-lanner-x86-trident2-hlm1000-cent72.tar
Note: ONL git version : 5b3db5947f93f673f1815c343fab7d43afa530e9 Broadcom CDP version : 3.2.0.5

Setting Up ONIE/ONL in HTCA-6000 Series

The following will provide a walkthrough about how to set up ONIE/ONL (Open Network Install Environment/Open Network Linux) onto our HTCA-6000 series and perform execution test of Broadcom OpenNSL.

Before proceeding, please make sure the following hardware requirements are met:

- USB disk x 2 (minimum 500MB each)
- HMB-1000 x 1
- HTCA-6200 x 1
- HLM-1000 x 1

1. Setup ONIE Boot USB Disk

Before conducting this step, please backup your data first as this procedure will eliminate all the data in the USB disk.

```
~ # su
password
~ # dd if=onie-recovery-x86_64-lanner_hmb_1000-r0.iso of=/dev/sdb
42240+0 records in
42240+0 records out
21626880 bytes (22 MB) copied, 3.41785 s,6.3 MB/s
~ # sync
~ # exit
~ #
```

The USB Disk A will be designated as "sdb" by system default. Please check the device mode for this USB disk.

2. Duplicate Files into USB Disk

The partition table format is FAT or FAT32 file system.

```
~ # su
password
~ # mount /dev/sdc1 /tmp
~ # cp onie-update-x86_64-lanner_hmb_1000-r0 /tmp/
~ # cp ONL-2.0.0_ONL-OS_2018-03-05.0300-5b3db59_AMD64_INSTALLER /tmp/
~ # sync
~ # umount /tmp
~ # exit
```

The USB Disk B will be designated as "sdc" by system default. Please check the device mode for this USB disk.

3. Bootup from ONIE Boot USB Disk Procedure

Insert USB Disk A into an available USB port of HTCA-6000 series appliance. Then, enter BIOS.

Please go to "Boot" -> "USB Device BBS Priorities" under your BIOS menu.

Please double check if Boot Option #1 displays the actual USB Disk name.

Force BIOS select "USB DIsk Boot" option

4.   Installation of ONIE

Select "ONIE: Embed ONIE" in the Boot menu.

5.   Remove all the mounted disk drives

The following is an example.

```
ONIE-RECOVERY:/ # df
Filesystem          1K-blocks     Used Available Use% Mounted on
devtmpfs            16386476         0  16386476   0% /dev
tmpfs                  10240        36     10204   0% /run
tmpfs                  10240         0     10240   0% /run/lock
tmpfs               16394728        20  16394708   0% /tmp
tmpfs               16394728         0  16394728   0% /var/tmp
tmpfs               16394728         0  16394728   0% /run/shm
/dev/sda2             122835     12892    100769  11% /mnt/onie-boot
ONIE-RECOVERY:/ #
ONIE-RECOVERY:/ # umount /mnt/onie-boot
```

6.   Mount USB Disk B

Remember to change USB Disk A to USB Disk B

Under ONIE/ONL, please do NOT use "/mnt/" or "/tmp/" to Mount.

```
ONIE-RECOVERY:/ # onie-discovery-stop
discover: ONIE embed mode detected.
Stopping: discover... done.
ONIE-RECOVERY:/ #
ONIE-RECOVERY:/ # cat /proc/partitions
major minor  #blocks  name

   1        0     32768 ram0
   1        1     32768 ram1
   1        2     32768 ram2
   1        3     32768 ram3
   1        4     32768 ram4
   1        5     32768 ram5
   1        6     32768 ram6
   1        7     32768 ram7
   1        8     32768 ram8
   1        9     32768 ram9
   1       10     32768 ram10
   1       11     32768 ram11
   1       12     32768 ram12
   1       13     32768 ram13
   1       14     32768 ram14
   1       15     32768 ram15
   8        0 312571224 sda
   8        1      2048 sda1
   8        2    131072 sda2
   8       16  30523392 sdb
   8       17  30522368 sdb1
ONIE-RECOVERY:/ # mkdir 1
ONIE-RECOVERY:/ # mount /dev/sdb1 1
```

7.   Erase the Existing Disk Drives and Install ONIE Kit

The following example assumes the system drive is "sda".

Please note that this procedure will eliminate all the data in the disk. Please make sure the disk in use acts as the system drive.

```
ONIE-RECOVERY:/ # dd if=/dev/zero of=/dev/sda bs=1M count=20
20+0 records in
20+0 records out
20971520 bytes (20.0MB) copied, 0.540895 seconds, 37.0MB/s
ONIE-RECOVERY:/ # fdisk /dev/sda
Device contains neither a valid DOS partition table, nor Sun, SGI, OSF or GPT dl
Building a new DOS disklabel. Changes will remain in memory only,
until you decide to write them. After that the previous content
won't be recoverable.


The number of cylinders for this disk is set to 38913.
There is nothing wrong with that, but this is larger than 1024,
and could in certain setups cause problems with:
1) software that runs at boot time (e.g., old versions of LILO)
2) booting and partitioning software from other OSs
   (e.g., DOS FDISK, OS/2 FDISK)

Command (m for help): p

Disk /dev/sda: 320.0 GB, 320072933376 bytes
255 heads, 63 sectors/track, 38913 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id System

Command (m for help): w
The partition table has been altered.
Calling ioctl() to re-read partition table
ONIE-RECOVERY:/ #
ONIE-RECOVERY:/ # onie-self-update -e 1/onie-updater-x86_64-lanner_hmb_1000-r0
discover: ONIE embed mode detected.
Stopping: discover... done.
Notice:  Invalid TLV header found.  Using default contents.
Notice:  Invalid TLV checksum found.  Using default contents.
ONIE: Unable to find 'Serial Number' TLV in EEPROM data.
ONIE: Executing installer: 1/onie-updater-x86_64-lanner_hmb_1000-r0
Verifying image checksum ... OK.
Preparing image archive ... OK.
ONIE: Version        : master-201803020834-dirty
ONIE: Architecture : x86_64
ONIE: Machine       : lanner_hmb_1000
ONIE: Machine Rev   : 0
ONIE: Config Version: 1
ONIE: Build Date    : 2018-03-02T08:34-0500
Installing ONIE on: /dev/sda
ERROR: Problems accessing sys_eeprom
Notice:  Invalid TLV header found.  Using default contents.
Notice:  Invalid TLV checksum found.  Using default contents.
ERROR: Cannot open I2C device
ONIE: ERROR: Firmware update URL: 1/onie-updater-x86_64-lanner_hmb_1000-r0
ONIE: ERROR: Firmware update version: master-201803020834-dirty
Failure: Unable to install image: 1/onie-updater-x86_64-lanner_hmb_1000-r0
ONIE-RECOVERY:/ # reboot
```

8.   Remove the USB Disk and Recheck BIOS Boot Priority

Please make sure USB Disk B is removed, and make sure BIOS boot priority is system harddisk.

```
   Aptio Setup Utility - Copyright (C) 2017 Amer
Main  Advanced  IntelRCSetup  Security  Boot  Sa

Boot Configuration
Setup Prompt Timeout       1
Bootup NumLock State       [On]

Quiet Boot                 [Disabled]

Boot Option Priorities
Boot Option #1             [SATA0 P1: WDC WD320...]
Boot Option #2             [IBA GE Slot 0D00 v1404]
Boot Option #3             [Disabled]

Network Device BBS Priorities
Hard Drive BBS Priorities
```

ONL Installation

1.   Select "ONIE: Install OS".

```
             GNU GRUB   version 2.02

+-----------------------------------------------
|*ONIE: Install OS
| ONIE: Rescue
| ONIE: Uninstall OS
| ONIE: Update ONIE
| ONIE: Embed ONIE
|
|
```

2.   Mount USB Disk B

Under ONIE/ONL, please do NOT use "/mnt/" or "/tmp/" to Mount.

```
ONIE:/ # cat /proc/partitions | grep sd
   8        0  312571224 sda
   8        1       2048 sda1
   8        2     131072 sda2
   8       16   30523392 sdb
   8       17   30522368 sdb1
ONIE:/ # mkdir 1
ONIE:/ # mount /dev/sdb1 1
FAT-fs (sdb1): Volume was not properly unmounted. Some data may be corrupt. Ple.
ONIE:/ #
```

3.   Install ONL Kit

```
ONIE:/ # onie-discovery-stop
discover: installer mode detected.
Stopping: discover...start-stop-daemon: warning: killing process 825: No such ps
 done.
ONIE:/ # cd /etc/
ONIE:/etc # cp machine-build.conf machine.conf
ONIE:/etc # echo "onie_platform=x86_64-lanner_hmb_1000-r0" >> machine.conf
ONIE:/etc # onie-nos-install /1/ONL-2.0.0_ONL-OS_2018-03-05.0300-5b3db59_AMD64_INSTALLED_INSTALLER
```

4.   The system will automatically reboot afterwards.

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Setting Up OpenNSL

The ONL kit supplied by Lanner already includes Broadcom OpenNSL driver and programming. No more download is required.

The following will provide a walkthrough about how to validate OpenNSL functionality.

1.   Log-in ONL
The default user account and password:
User: root
Password: onl

```
Open Network Linux OS ONL-2.0.0, 2018-03-05.03:00-5b3db59

localhost login: root
Password:
Linux localhost 3.16.39-OpenNetworkLinux #1 SMP Mon Mar 5 03:07:03 UTC 2018 x864
root@localhost:~#
```

2.   Install OpenNSL Driver

```
root@localhost:~# cd /opennsl-cdp/
root@localhost:/opennsl-cdp# ls
example_stat  linux-bcm-knet.ko  linux-kernel-bde.ko  linux-user-bde.ko  run.sh
root@localhost:/opennsl-cdp# sh ./run.sh
root@localhost:/opennsl-cdp# lsmod
Module                    Size  Used by
linux_bcm_knet           44089  0
linux_user_bde           11751  0
linux_kernel_bde         39683  2 linux_user_bde,linux_bcm_knet
x86_pkg_temp_thermal      4275  0
root@localhost:/opennsl-cdp#
```

3.   Execute "example_stat"

This will display or erase the statistics of a port.

```
root@localhost:/opennsl-cdp# ./example_stat
Initializing the system.
Platform default configuration is used
Platform Boot flags: 0x0
DMA pool size: 16777216
PCI unit 0: Dev 0xb854, Rev 0x03, Chip BCM56854_A2, Driver BCM56850_A0

Initializing platform
Device Configuration - SUCCESS!
SOC unit 0 attached to PCI device BCM56854_A2
Boot flags: Cold boot
rc: unit 0 device BCM56854_A2
rc: MMU initialized
0:phy_84740_init: 84740 init u=0 port=1 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=2 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=3 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=4 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=5 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=6 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=7 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=8 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=9 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=10 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=11 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=12 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=13 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=14 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=15 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=16 rom code ver. 0x106: MDIO_TO_RAM boot
rc: Port modes initialized
Common SDK init completed
OF-DPA is initialized successfully.
Adding ports to default vlan.
Initializing the stat module.

User Menu: Select one of the following options
1. Display statistics of a port.
2. Clear statistics of a port.
0. Quit the application.
```

Download & Compile OpenNSL on GitHub

The following shows how to compile "example_stat" under OpenNSL

1.   Download the development environment
2.   Login (use "root" as user account)
3.   Network connection is established properly.

```
~ # dhclient -i eth1
~ # apt-get update
~ # apt-get install gcc make git vim
```

4.   Download Broadcom OpenNSL source under ONL.

The current version is v3.2.0.5.

```
~ # cd /home/
~ # git clone https://github.com/Broadcom-Switch/OpenNSL.git
.....
~ # mv OpenNSL OpenNSL-3.3.0.2
~ # cd OpenNSL-3.3.0.2
~ # git checkout tags/v3.2.0.5
Checking out files: 100% (979/979), done.
Note: checking out 'tags/v3.2.0.5'.

You are in 'detached HEAD' state. You can look around, make experimental
changes and commit them, and you can discard any commits you make in this
state without impacting any branches by performing another checkout.

If you want to create a new branch to retain commits you create, you may
do so (now or later) by using -b with the checkout command again. Example:

  git checkout -b new_branch_name

HEAD is now at 13226ca... Sep-15 Release
~ #
```

5.   Place CDP package into "bin" directory

```
~ # cd /home/OpenNSL-3.3.0.2/bin
~ # cp -a /opennsl-cdp lanner-x86-trident2-hlm1000-cent72
```

6.   Compile/modify "Makefile"

The environment is set as "x86". Please make sure the designated platform is

"lanner-x86-trident2-hlm1000-cent72"

```
--- Makefile.org       2018-03-05 03:27:18.526234136 -0500
+++ Makefile    2018-03-05 03:31:40.133439303 -0500
@@ -24,10 +24,10 @@
 CROSS_COMPILE_x86 = /usr/bin/

 # Default to GTO cross compile
-export CROSS_COMPILE = $(CROSS_COMPILE_GTO)
+export CROSS_COMPILE = $(CROSS_COMPILE_x86)

 #directory where the shared library resides
-platform := gto-trident-brl20
+platform := lanner-x86-trident2-hlm1000-cent72

 export AR       = $(CROSS_COMPILE)ar
 export AS       = $(CROSS_COMPILE)as
```

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7.   To fix Port initial sequence

The default of API "example_port_default_config (unit)" is "autoneg off".

However, if a 1Gbps copper LAN is present in HLM-1000, it must be set as "autoneg.on".

```
--- example_stat.c.org  2018-03-05 03:32:05.071458864 -0500
+++ example_stat.c       2018-03-05 03:32:26.725475848 -0500
@@ -115,13 +115,14 @@
            rc, opennsl_errmsg(rc));
    return 0;
  }
-
+#if 0
/*
    API example_port_default_config will disable autoneg per port.
    But HLM-1000 have Gage Port.
*/
    /* cold boot initialization commands */
    rc = example_port_default_config(unit);
    if (rc != OPENNSL_E_NONE) {
      printf("\r\nFailed to apply default config on ports, rc = %d (%s).\r\n",
            rc, opennsl_errmsg(rc));
    }
+#endif

    /* Add ports to default vlan. */
    printf("Adding ports to default vlan.\r\n");
```

8.   Compile and modify "example_stat"

```
~ # cd OpenNSL-3.3.0.2/examples
~ # make
~ # ls example_stat
example_stat
```

Testing OpenNSL

The following will provide a walkthrough to compile/modify "example_stat".

1.   Boot up HTCA-6000 series and enter the system
2.   Login user and password

User name: root

Password: onl

```
Starting watchdog daemon....

Open Network Linux OS ONL-2.0.0, 2018-03-05.03:00-5b3db59

localhost login: IPMI message handler: Event queue full, discarding incoming evs
root
Password:
Last login: Tue Mar  6 03:22:05 UTC 2018 on ttyS0
Linux localhost 3.16.39-OpenNetworkLinux #1 SMP Mon Mar 5 03:07:03 UTC 2018 x864
root@localhost:~#
root@localhost:~#
```

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3.　　　Login user and password

User name: root

Password: onl

4.　　　Mount OpenNSL driver and node

User name: root

Password: onl

```
root@localhost:~# cd /opennsl-cdp/
root@localhost:/opennsl-cdp# sh ./run.sh
root@localhost:/opennsl-cdp# lsmod
Module                    Size  Used by
linux_bcm_knet           44089  0
linux_user_bde           11751  0
linux_kernel_bde         39683  2 linux_user_bde,linux_bcm_knet
x86_pkg_temp_thermal      4275  0
root@localhost:/opennsl-cdp#
```

5.　　　Test the API

```
root@localhost:~# cd /home/OpenNSL-3.3.0.2/examples
root@localhost:~# ./example_stat
Initializing the system.
Platform default configuration is used
Platform Boot flags: 0x0
DMA pool size: 16777216
PCI unit 0: Dev 0xb854, Rev 0x03, Chip BCM56854_A2, Driver BCM56850_A0

Initializing platform
Device Configuration - SUCCESS!
SOC unit 0 attached to PCI device BCM56854_A2
Boot flags: Cold boot
rc: unit 0 device BCM56854_A2
rc: MMU initialized
0:phy_84740_init: 84740 init u=0 port=1 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=2 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=3 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=4 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=5 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=6 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=7 rom code ver. 0x106: MDIO_TO_RAM boot
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0:phy_84740_init: 84740 init u=0 port=10 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=11 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=12 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=13 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=14 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=15 rom code ver. 0x106: MDIO_TO_RAM boot
0:phy_84740_init: 84740 init u=0 port=16 rom code ver. 0x106: MDIO_TO_RAM boot
rc: Port modes initialized
Common SDK init completed
OF-DPA is initialized successfully.
Adding ports to default vlan.
Initializing the stat module.

User Menu: Select one of the following options
1. Display statistics of a port.
2. Clear statistics of a port.
0. Quit the application.
```

The software library is available upon request. Please contact Lanner sales for details. http://www.lannerinc.com/Contact-us