1. Work Environment

NAS: Synology DS211+ with DSM 4.0-2228
OS for Cross Compiling: Ubuntu 12.04

2. Bootstrap (only if needed)

```
DS211plus> cd /volume1/@tmp
DS211plus> wget http://wizjos.endofinternet.net/synology/archief/      ⏎
                                  synomvkw-bootstrap_1.2-7_arm-ds111.xsh
DS211plus> chmod +x syno-mvkw-bootstrap_1.2-7_arm-ds111.xsh
DS211plus> sh syno-mvkw-bootstrap_1.2-7_arm-ds111.xsh

#-- needed since DSM 4.0
DS211plus> /opt/bin/nano /root/.profile
#-- add /opt/bin:/opt/sbin: after PATH=
#-- PATH=/opt/bin:/opt/sbin:/sbin:/bin:/usr/sbin:/usr/bin:/usr/syno/...

DS211plus> reboot
```

2.1. *Dependencies for Compiling*

```
DS211plus> ipkg update
DS211plus> ipkg upgrade

DS211plus> ipkg install optware-devel
DS211plus> ipkg install git
DS211plus> ipkg install openssl
DS211plus> ipkg install gcc
DS211plus> ipkg install openssl-dev
```

3. TVHeadend

```
DS211plus> mkdir -p /opt/tvheadend
DS211plus> git clone https://github.com/andoma/tvheadend.git \
                                                        /opt/tvheadend
DS211plus> cd /opt/tvheadend

#-- edit the Makefile
DS211plus> nano Makefile
#-- add bash after MKBUNDLE =
#-- MKBUNDLE = bash $(CURDIR)/support/mkbundle

#-- copy some libraries
DS211plus> cp /opt/arm-none-linux-gnueabi/lib/libpthread-2.5.so \
                    /opt/arm-none-linux-gnueabi/lib/libpthread-2.5.so.bk
DS211plus> cp /lib/libpthread.so.0 /opt/arm-none-linux-              ⏎
                                        gnueabi/lib/libpthread-2.5.so
DS211plus> cp /opt/lib/libssl.so.0.9.8 /opt/arm-none-linux-gnueabi/lib
DS211plus> cp /opt/lib/libssl.so.0.9.8 /lib
DS211plus> cp /opt/lib/libcrypto.so.0.9.8 /lib

#-- configure compilation
DS211plus> export CC=gcc
DS211plus> bash configure \
--host=armle-unknown-linux \
--target=armle-unknown-linux \
--build=i686-pc-linux \
--disable-avahi \
--release \
--openssl=/opt/lib \
--prefix=/opt/tvheadend
DS211plus> make
DS211plus> make install

#-- start TVDeadend for testing purposes (-C for login without user/pwd)
DS211plus> /opt/tvheadend/bin/tvheadend –C
#-- http://DS211plus:9981 and create an admin user
```

4. SiliconDust Driver & Tool

```
DS211plus> cd /opt
DS211plus> wget http://download.silicondust.com/hdhomerun/            ⏎
                                               libhdhomerun_20120405.tgz
DS211plus> tar -xpf libhdhomerun_20120405.tgz
DS211plus> cd /opt/libhdhomerun
DS211plus> make
```

5. DVB Drivers

5.1. Kernel Part (compiled with Ubuntu 12.04)

```
#-- Ubuntu 12.04 needs the package libncurses5-dev
#-- 'make menuconfig' requires the ncurses libraries
root@ubuntu> apt-get install libncurses5-dev

root@ubuntu> cd /home/administrator/Downloads

#-- Synology Kernel Sources -- has to match with the cpu in your NAS
DS211plus> wget http://sourceforge.net/projects/dsgpl/files/          ⏎
 Synology%20NAS%20GPL%20Source/1337branch/synogpl-1373-6281.tbz/download

#-- DSM Tool Chain -- has to match with the cpu in your NAS
root@ubuntu> wget http://sourceforge.net/projects/dsgpl/files/        ⏎
          DSM%204.0%20Tool%20Chains/Marvell%2088F628x%20Linux%202.6.32/

root@ubuntu> cp gcc421_glibc25_88f6281-GPL.tgz /usr/local/
root@ubuntu> cd /usr/local
root@ubuntu> tar -xpf gcc421_glibc25_88f6281-GPL.tgz –C /usr/local/
root@ubuntu> cd /home/administrator/Downloads
root@ubuntu> tar -xpf synogpl-1372-6281.tbz

#-- compile DVB Core Driver
root@ubuntu> cd /home/administrator/Downloads/source/linux-2.6.32/
root@ubuntu> cp /home/administrator/Downloads/source/linux-2.6.32/    ⏎
       synoconfigs/88f6281/home/administrator/Downloads/source/linux-  ⏎
                                                          2.6.32/.config

root@ubuntu> make ARCH=arm CROSS_COMPILE=/usr/local/arm-none-linux-   ⏎
                          gnueabi/bin/arm-none-linux-gnueabi- menuconfig

#-- a menu appears, where you have to set the kernel config
#-- select System Type
#-- change the system type to ARM system type (Marvel Kirkwood)
#-- (has to match with the cpu in your NAS)
#-- select Marvell Kirkwood Implementations
#-- select Synology 6281 series NAS
#-- go back to main screen of kernel config
#-- select Device Drivers
#-- go to Multimedia support, press Y to include
#-- select Multimedia support
#-- go to DVB for Linux, press M to include as module
#-- go back to main screen and exit (yes to save the new config)

root@ubuntu> make ARCH=arm CROSS_COMPILE=/usr/local/arm-none-linux-    ⏎
                      gnueabi/bin/arm-none-linux-gnueabi- prepare scripts
root@ubuntu> make ARCH=arm CROSS_COMPILE=/usr/local/arm-none-linux-    ⏎
                              gnueabi/bin/arm-none-linux-gnueabi- modules

#-- compile DVB Drivers for HDHomeRun
root@ubuntu> cd /home/administrator/src
root@ubuntu> cvs -z3 -d:pserver:anonymous@dvbhdhomerun.cvs.            ⏎
                 sourceforge.net:/cvsroot/dvbhdhomerun co -P dvbhdhomerun
root@ubuntu> cd /home/administrator/src/dvbhdhomerun/kernel

#-- edit the Makefile
root@ubuntu> nano Makefile
#-- change KERNEL_VERSION
#-- KERNEL_VERSION := 2.6.32.12
#-- change KERNEL_DIR
#-- KERNEL_DIR := /home/administrator/Downloads/source/linux-2.6.32

root@ubuntu> make ARCH=arm CROSS_COMPILE=/usr/local/arm-none-linux-    ⏎
                                     gnueabi/bin/arm-none-linux-gnueabi-

#-- dvb-core.ko is located at:
#-- /home/administrator/Downloads/source/linux-2.6.32/drivers ⏎
/media/dvb/dvb-core

#-- dvb_hdhomerun_core.ko
#-- dvb_hdhomerun_fe.ko
#-- dvb_hdhomerun.ko are located at:
#-- /home/administrator/src/dvbhdhomerun/kernel
```

Copy the four driver files to **/opt/dvb_native** of your NAS

5.2. Userspace Part

Copy the dvbhdhomerun folder from **/home/administrator/src** to **/opt** of your nas

```
#-- compiling userspace part requires cmake, not available through ipkg
#-- CMAKE Sources
DS211plus> cd /opt
DS211plus> wget http://www.cmake.org/files/v2.8/cmake-2.8.8.tar.gz
DS211plus> tar -xpf cmake-2.8.8.tar.gz
DS211plus> cd /opt/cmake-2.8.4
DS211plus> ./bootstrap
DS211plus> make
DS211plus> make install

#-- compile userspace part
DS211plus> cd /opt/dvbhdhomerun/userhdhomerun

#-- edit CMakeLists.txt
DS211plus> nano CMakeLists.txt
#-- change LIBHDHOMERUN_PATH to where the
#-- compiled SiliconDust driver/tools are
#-- SET(LIBHDHOMERUN_PATH /opt/libhdhomerun)

DS211plus> make
```

6. Startup Script

```
#-
#-- create device nodes for HDHomerun
mkdir -p /dev/dvb/adapter0
mknod /dev/dvb/adapter0/demux0 c 212 0
mknod /dev/dvb/adapter0/dvr0 c 212 1
mknod /dev/dvb/adapter0/frontend0 c 212 2
mkdir -p /dev/dvb/adapter1
mknod /dev/dvb/adapter1/demux0 c 212 3
mknod /dev/dvb/adapter1/dvr0 c 212 4
mknod /dev/dvb/adapter1/frontend0 c 212 5
#-
#-- set permissions
chmod 755 /dev/dvb/adapter*
chmod 666 /dev/dvb/adapter*/*
chown root:root /dev/dvb/adapter*/*
#-
insmod /opt/dvb_native/dvb-core.ko
insmod /opt/dvb_native/dvb_hdhomerun_core.ko
insmod /opt/dvb_native/dvb_hdhomerun_fe.ko
insmod /opt/dvb_native/dvb_hdhomerun.ko
#-
DYNAMIC_ID=$(grep hdhomerun_control /proc/misc | awk "{print \$1}")
if [ "$DYNAMIC_ID" != "" ]; then
  echo "making node hdhomerun_control" $DYNAMIC_ID
  mknod /dev/hdhomerun_control c 10 $DYNAMIC_ID
else
  echo "Unable to detect hdhomerun_control inside /proc/misc."
fi
#-
#-- set permissions
chmod 666 /dev/hdhomerun_control
chown root:root /dev/hdhomerun_control
#-
#-- clear userhdhomerun log
rm -f "/opt/dvbhdhomerun/dvbhdhomerun.log"
#-
#-- run userhdhomerun with LD_PRELOAD
#-- (because libhdhomerun.so is inside dvbhdhomerun folder)
/opt/dvbhdhomerun/userhdhomerun/build/userhdhomerun \
              -f -u root -g root -l "/opt/dvbhdhomerun/dvbhdhomerun.log"
#-
sleep 1
#-
DYNAMIC_ID=$(grep hdhomerun_data /proc/devices | awk "{print \$1}")
if [ "$DYNAMIC_ID" != "" ]; then
  echo "making node hdhomerun_data" $DYNAMIC_ID
  mknod /dev/hdhomerun_data0 c $DYNAMIC_ID 0
  mknod /dev/hdhomerun_data1 c $DYNAMIC_ID 1
else
  echo "Unable to detect hdhomerun_data inside /proc/devices."
fi
#-
#-- set permissions
chmod 666 /dev/hdhomerun_data*
chown root:root /dev/hdhomerun_data*
```