

Build Your Custom OpenWrt Image

🝵 2021/05/10 | 访问量: 2687 次 🕞 OpenWrt

This guides to build your OpenWrt Image integrated with custom application step by step.

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- Create your own application
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 - Import image and test
- Patch your application
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Setup OpenWrt

Pre-requisites

Debian / Ubuntu

```
sudo apt update
sudo apt install build-essential ccache ecj fastjar file g++ gawk \
gettext git java-propose-classpath libelf-dev libncurses5-dev \
libncursesw5-dev libssl-dev python python2.7-dev python3 unzip wget \
python3-distutils python3-setuptools rsync subversion swig time \
xsltproc zlib1g-dev
```

CentOS / Fedora

```
sudo dnf --skip-broken install bash-completion bzip2 gcc gcc-c++ git \
make ncurses-devel patch perl-Data-Dumper perl-Thread-Queue python2 \
python3 rsync tar unzip wget perl-base perl-File-Compare \
perl-File-Copy perl-FindBin diffutils which
```

For other Linux distributions, you can take this for reference.

Build OpenWrt form source code

You need leave the sudo privileged mode to get better cross-compile by ctrl + d or exit.

1. Get the OpenWrt source code

```
git clone https://git.openwrt.org/openwrt/openwrt.git
cd openwrt
```

2. Build from main branch or stable release branch

```
# To build from a specific version
git branch
git checkout <branch name>
# Or just skip to 3 to build from main branch
```

3. Update and install feeds

```
./scripts/feeds update -a
./scripts/feeds install -a
```

4. Configure

```
make menuconfig
```

E.g. for target "TL-WR841N v11" Wi-Fi router do following:

- "Target System" ⇒ "Select" ⇒ "Atheros AR7xxx/AR9xxx" ⇒ "Select"
- \circ "Subtarget" \Rightarrow "Select" \Rightarrow "Devices with small flash" \Rightarrow "Select"
- "Target Profile" ⇒ "Select" ⇒ "TP-LINK TL-WR841N/ND v11" ⇒ "Select"

To exit OpenWrt configuration and save target with options settings do following:

```
"Exit" ⇒ "Yes"
```

5. Tool Chain

```
make toolchain/install
```

The target-independent tools and the toolchain are deployed to the staging_dir/host/ and staging_dir/toolchain/ directories. This applies to the executables built in the above section as well the pre-built executables available in the SDK. We can adjust the PATH variable:

```
export PATH=/home/icn/openwrt/staging_dir/host/bin:$PATH
```

6. Build image

```
make
# For faster compiling, use `make -j N`, where N is the number of CPU cores +
```

And the target image will be generated into ./bin/target/...

Create your own application

Locate your application

Suppose we create a project named hellosdewan.

```
mkdir hellosdewan
cd hellosdewan
pwd
# /home/icn/hellosdewan
```

We create the sole source code file named hellosdewan.c.

```
touch hellosdewan.c
```

And input the following content:

```
#include <stdio.h>
int main(void)
{
```

```
printf("\nHello, sdewan!\n\n");
  return 0;
}
```

Compile and test

Our example application is a c application.

```
gcc -c -o hellosdewan.o hellosdewan.c -Wall
gcc -o hellosdewan hellosdewan.o
```

And then, run the hellosdewan binary

```
./hellosdewan
# Hello, sdewan!
```

Generate the application package

Create package and configure it

Firstly create a directory to store your own application, like the openwrt,

```
mkdir -p myapps/test/hellosdewan
cd myapps/test/hellosdewan
pwd
# /home/icn/myapps/test/hellosdewan
```

Then we need deliver a package manifest file for hellosdwan application, which is responsible for describing the package, what it does and provide instructions on where to obtain the source code, how to build it and which should be contained in the final installable package.

In current directory, create a Makefile:

```
include $(TOPDIR)/rules.mk

# Name, version and release number

# The name and version of your package are used to define the variable to point t
PKG_NAME:=hellosdewan
PKG_VERSION:=1.0
PKG_RELEASE:=1

# Source settings (i.e. where to find the source codes)
```

```
# This is a custom variable, used below
SOURCE_DIR:=/home/icn/myapps/test/hellosdewan
include $(INCLUDE_DIR)/package.mk
# Package definition; instructs on how and where our package will appear in the
define Package/hellosdewan
        SECTION:=test
        CATEGORY:=MyApps
        TITLE:=Hello, sdewan!
endef
# Package description; a more verbose description on what our package does
define Package/hellosdewan/description
        A simple "Hello, sdewan!" -application.
endef
# Package preparation instructions; create the build directory and copy the source
# The last command is necessary to ensure our preparation instructions remain com
define Build/Prepare
        mkdir -p $(PKG_BUILD_DIR)
        cp $(SOURCE_DIR)/* $(PKG_BUILD_DIR)
        $(Build/Patch)
endef
# Package build instructions; invoke the target-specific compiler to first compil
define Build/Compile
        $(TARGET_CC) $(TARGET_CFLAGS) -o $(PKG_BUILD_DIR)/hellosdewan.o -c $(PKG_
        $(TARGET_CC) $(TARGET_LDFLAGS) -0 $(PKG_BUILD_DIR)/$1 $(PKG_BUILD_DIR)/he
endef
# Package install instructions; create a directory inside the package to hold our
define Package/hellosdewan/install
        $(INSTALL_DIR) $(1)/usr/bin
        $(INSTALL_BIN) $(PKG_BUILD_DIR)/hellosdewan $(1)/usr/bin
endef
# This command is always the last, it uses the definitions and variables we give
$(eval $(call BuildPackage, hellosdewan))
```

Integrate the package to build system

OpenWrt build system uses a file named feeds.conf.default which indicates the package feeds that will be made available during the firmware configuration stage.

```
pwd
# /home/icn/openwrt
cat feed.conf.default
.
src-git packages https://git.openwrt.org/feed/packages.git
```

```
src-git luci https://git.openwrt.org/project/luci.git
src-git routing https://git.openwrt.org/feed/routing.git
src-git telephony https://git.openwrt.org/feed/telephony.git
#src-git video https://github.com/openwrt/video.git
#src-git targets https://github.com/openwrt/targets.git
#src-git management https://github.com/openwrt-management/packages.git
#src-git oldpackages http://git.openwrt.org/packages.git
#src-link custom /usr/src/openwrt/custom-feed
`
```

Modify the file to link to myapps package feed with vim or other editor in feeds.conf.default:

```
src-link myapps /home/icn/myapps
```

Updating and installing feeds

The new feed is defined, so update the build system

```
pwd
# /home/icn/openwrt
./scripts/feeds update myapps
./scripts/feeds install -a -p myapps
```

Build image and test

Build image with custom application

Re-configure your openwrt build system

```
pwd
# /home/icn/openwrt
make menuconfig
```

In the menu list, we could find the category named MyApps and enter into this category and choose the application we deployed named hellosdewan here. Save the configuration and exit.

The changes will be stored to .config , then start to build the image

```
make -j 70
```

```
# To locate the error, you can run `make -j1 V=sc`
```

Import image and test

After finishing the image build, we can find the rootfs of the image in the ./bin directory

```
pwd
# /home/icn/openwrt
# Dive into the target to find the `rootfs` image
cd ./bin/targets/x86/64
ls openwrt-x86-64-generic-rootfs.tar.gz
```

Import the image to docker as a docker container

```
sudo docker import openwrt-x86-64-generic-rootfs.tar.gz myapps:hellosdewan
```

Then the image is imported into docker as myapps and tag is hellosdewan . We can run the docker image and test the application hellosdewan

```
sudo docker run -ti myapps:hellosdewan hellosdewan
# Hello, sdewan!
```

Note you can build the opkg package solely

```
pwd
# /home/icn/openwrt
make package/hellosdewan/compile
# The `hellosdewan_1.0-1_x86_64.ipk` will be on `./bin/packages/x86_64/myapps`
# And you can use `opkg` to directly install it
opkg install <path-to-package>/hellosdewan_1.0-1_x86_64.ipk
# Or you can remove the installation
opkg remove hellosdewan
```

Patch your application

Prepare

Check the tool for patch is ready

```
pwd
# /home/icn/openwrt
quilt --version
# the path of tools like quilt in under `./staging_dir/host/bin/`
```

Prepare the source code and navigate into the build directory.

```
make package/hellosdewan/{clean,prepare} QUILT=1
cd build_dir/target-x86_64_musl/hellosdewan-1.0
quilt push -a
```

Create a simple patch

```
quilt new 000-add.patch
# If editing existing files
quilt edit hellosdewan.c
# If adding new fiels
quilt add function.c
quilt add function.h
touch function.h
quilt edit function.c
quilt edit function.h
```

function.c

```
int add(int a, int b)
{
   return a + b;
}
```

function.h

```
int add(int, int);
```

And we can review the change and accept changes as content of patch

```
quilt diff
quilt refresh
```

Include the patch

Migrate the patch data into package

```
pwd
# /home/icn/openwrt
make package/hellosdewan/update
```

We now can review the package feed folder and see the changes

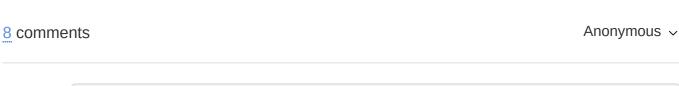
(豆)(女)

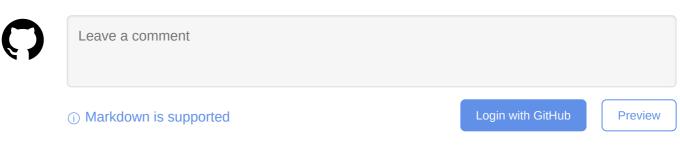
```
ls -la /home/icn/myapps/test/hellosdewan
ls -la /home/icn/hellosdewan
```

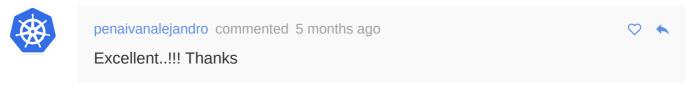
OpenWrt build system have migrated the patch to the package manifest folder.

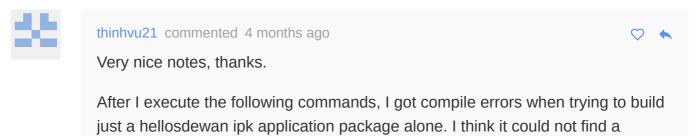
Then build and check the new files and changes are present in the build directory











package manifest and other files? Do you know how what is missing?



leyao-daily commented 3 months ago





@thinhvu21

Very nice notes, thanks.

After I execute the following commands, I got compile errors when trying to build just a hellosdewan ipk application package alone. I think it could not find a package manifest and other files? Do you know how what is missing?

make package/hellosdewan/compile

Hi, do you config the source dir of the source code correctly. And we should replace space with tab of the makefile in this webpage either. Do you have any logs for your errors.



thinhvu21 commented 3 months ago





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You are right! It works after I replace "8 spaces" with a "tab"...Thanks.

Do you have a document or a web link to the Docker tool that you are using? I ran the Docker commands you wrote in the above notes but it did not work. I might have missing something. Here is the log after I ran the Docker commands (Note: my rootfs file name is different from yours because of the different in Target):

sudo docker import openwrt-ath79-generic-8dev_carambola2-rootfs.tar.gz openwrt-ath79-generic-8dev carambola2-rootfs

sha256:6d1d6d3266aa2b6f784aa2ab56775867e6556eb9166cdfee1762b47 245fc160a

sudo docker images

REPOSITORY TAG IMAGE ID CREATED SIZE

openwrt-ath79-generic-8dev carambola2-rootfs latest 6d1d6d3266aa 13 seconds ago 9.46MB

myapps hellosdewan f025f9d31e12 3 days ago 9.46MB

ae13cb54c0a5 3 days ago 9.46MB

ff20c0ac9923 3 days ago 9.46MB

477072121e0d 3 days ago 9.46MB

myhelloworldcxx sdk helloworldcxx 8e76709de225 5 days ago 1.01GB

sudo docker import openwrt-ath79-generic-8dev carambola2-rootfs.tar.gz myapps:hellosdewan

sha256:6dda9483a18e83d2b13c29d21b5754d7800984d997b7ff3946219e5 b71a64a7b

sudo docker run -ti myapps:hellosdewan hellosdewan

docker: Error response from daemon: failed to create shim task: OCI

runtime create failed: runc create failed: unable to start container process:

exec: "hellosdewan": executable file not found in \$PATH: unknown.

ERRO[0000] error waiting for container: context canceled



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sudo docker images
REPOSITORY TAG IMAGE ID CREATED SIZE
openwrt-ath79-generic-8dev_carambola2-rootfs latest 6d1d6d3266aa
13 seconds ago 9.46MB
myapps hellosdewan f025f9d31e12 3 days ago 9.46MB
ae13cb54c0a5 3 days ago 9.46MB
ff20c0ac9923 3 days ago 9.46MB
477072121e0d 3 days ago 9.46MB
myhelloworldcxx_sdk helloworldcxx 8e76709de225 5 days ago
1.01GB

sudo docker import openwrt-ath79-generic-8dev_carambola2-rootfs.tar.gz myapps:hellosdewan sha256:6dda9483a18e83d2b13c29d21b5754d7800984d997b7ff39462 19e5b71a64a7b

sudo docker run -ti -ti myapps:hellosdewan hellosdewan docker: Error response from daemon: failed to create shim task: OCI runtime create failed: runc create failed: unable to start container process: exec: "hellosdewan": executable file not found in \$PATH: unknown.

ERRO[0000] error waiting for container: context canceled

My host kernel is 5.4.0-88-generic Ubuntu 20.04.3 and docker version is 20.10.9 I think to run it correctly, you can start with docker run -ti myapps:hellosdewan bash Or docker run -ti myapps:hellosdewan sh ,, make sure the command you exec in docker exactly exist.







Docker still gives errors when I run myapps:hellosdewan. If the commands I entered are correct, then there is a problem with Docker to run an openWrt image as a container. I captured a log below:

sudo docker version

Client: Docker Engine - Community

Version: 20.10.21 API version: 1.41 Go version: go1.18.7 Git commit: baeda1f

Built: Tue Oct 25 18:02:21 2022

OS/Arch: linux/amd64

Context: default Experimental: true

uname -a

Linux Dell 5.15.0-52-generic #58~20.04.1-Ubuntu SMP Thu Oct 13 13:09:46 UTC 2022 x86 64 x86 64 x86 64 GNU/Linux

sudo docker import openwrt-ath79-generic-8dev_carambola2-rootfs.tar.gz myapps:hellosdewan

sudo docker images

REPOSITORY TAG IMAGE ID CREATED SIZE myapps hellosdewan 1005e3ba0150 13 minutes ago 9.46MB

Is /usr/bin/bash /usr/bin/bash

sudo docker run -ti myapps:hellosdewan /usr/bin/bash

docker: Error response from daemon: failed to create shim task: OCI runtime create failed: runc create failed: unable to start container process: exec: "/usr/bin/bash": stat /usr/bin/bash: no such file or directory: unknown.

ERRO[0000] error waiting for container: context canceled

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ERRO[0000] error waiting for container: context canceled

It seems that your image can not work, whar your target platform and arch? Is sudo docker run -ti myapps:hellosdewan ls works?



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It seems that your image can not work, whar your target platform and arch?

It works after I install Docker Desktop on Linux. Thank you so much for your helps and the documents...

ERRO[0000] error waiting for container: context canceled

Is sudo docker run -ti myapps:hellosdewan ls works?

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