Appending SMACK for webOS on Raspberry Pi 4: A Guide

Duc, Ta Minh
duc.ta@lge.com

LGEDV — December 12, 2024

Introduction

This document serves as a guide to append the Simplified Mandatory Access Control Kernel feature onto webOS Open Source Edition (webOS OSE) version 2.20. The image of this version of webOS is supposed to be flashed and used on Raspberry Pi 4. The hardware specifications for building machine will not be mentioned in this document. This document aims to fix current issue with some fetch commands in the bitbake build files, along with some patches that were obsolete and thus cannot be used anymore, but still persist on the remote repository.

This document was originally meant for the lecturers and educators at Da Nang University of Technology (DUT) to use as a guide, for setting up environments and building the image for Raspberry Pi 4. Reproduction and copying is permitted, as this is an educational document.

> **Info:** This document is not meant to be used as a guide for other branches/version of webOS. Such application would require further modifications of the fixes mentioned in this document. If further support is needed, contact the author.

1 Prerequisites

In this section, information regarding the prerequisites for building the webOS image will be listed. This includes setting up the correct build environment and some commands to prepare for the build section.

1.1 Setting up the build environment

1.1.1 Preparation

Update & Upgrade the system:

Command Line

```
$ sudo apt update && upgrade -y
```

1.1.2 Dependencies

Command Line

```
$ sudo apt install build-essential cmake git curl
$ sudo apt install autoconf automake bison flex gawk libtool pkg-config
```

1.2 Clone webOS OSE from remote repository

1.2.1 Install git

Command Line

```
    $ sudo apt install git-all
```

1.2.2 Cloning source and check out branch 2.20

Command Line

```
    $ git clone https://github.com/webosose/build-webos.git
    $ cd build-webos
    $ git checkout 2.20
```

1.2.3 Install and configure the build

Command Line

```
    $ sudo scripts/prerequisites.sh
    $ ./mcf -p 0 -b 0 raspberrypi4-64
```

1.2.4 Additional modifications

In /build-webos/meta-webosose/meta-webos-raspberrypi/recipes-kernel/linux/linux-raspberrypi :

- Append to bridge.cfg:

  ```
  CONFIG_NETFILTER_XT_MATCH_CONNBYTES=y
  CONFIG_NETFILTER_XT_MATCH_CONNLIMIT=y
  CONFIG_NETFILTER_XT_MATCH_IPRANGE=y
  CONFIG_NETFILTER_XT_MATCH_LENGTH=y
  CONFIG_NETFILTER_XT_MATCH_LIMIT=y
  CONFIG_NETFILTER_XT_MATCH_MAC=y
  CONFIG_NETFILTER_XT_MATCH_QUOTA=y
  CONFIG_NETFILTER_XT_TARGET_NFLOG=y
  CONFIG_NF_LOG_IPV4=y
  CONFIG_NETFILTER_XT_MATCH_RECENT=y
  CONFIG_NETFILTER_XT_MATCH_TCPMSS=y
  CONFIG_NETFILTER_XT_TARGET_TCPMSS=y
  CONFIG_NETFILTER_XT_MATCH_HASHLIMIT=y
  CONFIG_NETFILTER_XT_MATCH_NFACCT=y
  ```

- Append to security.cfg:

  ```
  CONFIG_SECURITY_SMACK=y
  CONFIG_DEFAULT_SECURITY="smack"
  CONFIG_DEFAULT_SECURITY_SMACK=y
  CONFIG_TMPFS_XATTR=y
  CONFIG_SECURITY_SMACK_BRINGUP=y
  ```

```
CONFIG_LSM="lockdown,yama,loadpin,safesetid,integrity,smack,selinux,tomoyo,
apparmor"
#kernel config to enable access to /proc/config.gz
CONFIG_IKCONFIG_PROC=y
CONFIG_IKCONFIG=y
CONFIG_PROC_FS=y
CONFIG_EXPERT=y
```

In /build-webos/meta-webosose/meta-webos/recipes-core/images :

- Append to webos-image.bb:

```
WEBOS_IMAGE_EXTRA_INSTALL:append = " \
 htop \
 tcpdump \
 kernel-module-xt-hashlimit \
 ipset \
 apt \
 \
"
```

In /build-webos/conf :

- Append to local.conf:

```
DISTRO_FEATURES:append = " smack "
DISTRO_FEATURES:append = " smack-bringup "
```

In /build-webos/meta-webosose/meta-webos/recipes-webos/localization-tool :

- Replace SRC_URI of localization-tool-native.bb :

```
SRC_URI = "git://github.com/iLib-js/ilib-loctool-webos-dist.git;
branch=main;protocol=https"
```

In /build-webos/meta-webosose/meta-webos/recipes-upstreamable/arm-compute-library :

- Replace SRCBRANCH of arm-compute-library_22.08.bb :

```
SRCBRANCH = "main"
```

In /build-webos/oe-core/meta/recipes-support/bmap-tools :

- Replace SRC_URI of bmap-tools_git.bb :

```
SRC_URI = "git://github.com/intel/${BPN};branch=main;protocol=https"
```

In /build-webos/meta-updater/recipes-sota/aktualizr :

- Replace the last line of SRC_URI of aktualizr_git.bb :

```
${@ d.expand("https://garage-sign.s3.eu-west-1.amazonaws.com/cli-
${GARAGE_SIGN_PV}.tgz;unpack=0;name=garagesign") if not
oe.types.boolean(d.getVar('GARAGE_SIGN_AUTOVERSION')) else ''} \
```

In /build-webos/meta-webosose/meta-webos-smack/recipes-core/systemd/files :
Replace the content of 0001-meson-add-smack-default-process-label-option.patch :

0001-meson-add-smack-default-process-label-option.patch

```
diff --git a/meson.build b/meson.build
index cb9936e..23ef44b 100644
--- a/meson.build
+++ b/meson.build
@@ -1085,6 +1085,11 @@ if have
         conf.set_quoted(’SMACK_RUN_LABEL’, get_option(’smack-run-label’))
 endif

+smack_default_process_label = get_option(’smack-default-process-label’)
+if smack_default_process_label != ’’
+        conf.set_quoted(’SMACK_DEFAULT_PROCESS_LABEL’,
smack_default_process_label)
+endif
+
 want_polkit = get_option(’polkit’)
 install_polkit = false
 install_polkit_pkla = false
diff --git a/meson_options.txt b/meson_options.txt
index 401f093..18b2226 100644
--- a/meson_options.txt
+++ b/meson_options.txt
@@ -340,6 +340,8 @@ option(’smack’, type : ’boolean’,
        description : ’SMACK␣support’)
 option(’smack-run-label’, type : ’string’,
        description : ’run␣systemd␣--system␣itself␣with␣a␣specific
SMACK␣label’)
+option(’smack-default-process-label’, type : ’string’,
+       description : ’run␣systemd␣services␣with␣a␣specific
SMACK␣label’)
 option(’polkit’, type : ’combo’, choices : [’auto’, ’true’, ’false’],
        description : ’polkit␣support’)
 option(’ima’, type : ’boolean’,
```

Replace the content of 0001-fileio.c-fix-build-with-smack-enabled.patch :

0001-fileio.c-fix-build-with-smack-enabled.patch

```
diff --git a/src/basic/fileio.c b/src/basic/fileio.c
index 8d92da3..34902dd 100644
--- a/src/basic/fileio.c
+++ b/src/basic/fileio.c
@@ -24,6 +24,7 @@
 #include "parse-util.h"
 #include "path-util.h"
 #include "socket-util.h"
+#include "smack-util.h"
 #include "stdio-util.h"
 #include "string-util.h"
 #include "sync-util.h"
diff --git a/src/basic/meson.build b/src/basic/meson.build
index 49e1e7f..f22caad 100644
--- a/src/basic/meson.build
+++ b/src/basic/meson.build
@@ -421,7 +421,7 @@ libbasic = static_library(
         'basic',
         basic_sources,
         fundamental_sources,
-        include_directories : basic_includes,
+        include_directories : [basic_includes,
include_directories('../shared')],
        dependencies : [versiondep,
                        threads,
                        libcap,
```

2 Start the build process

After finishing all the presequisitions and getting the correct build environment, the build process can be started by using the following commands:

Command Line

```
$ source oe-init-build-env
$ bitbake webos-image
```

The build command will take some time before completion. If this is the first build, or if the sstate-cache is clear, then it might take up to 10 hours of building (depending on internet connection speed and system hardware).

Info: If there is any issue occured during the build process regarding the do_install or do_compile functions, it is highly likely that the system has ran out of resources, leading to corruption. A simple solution is to clean the sstate-cache using the command: bitbake -c clean <recipe-name>, then install it separately again using the command: bitbake <recipe-name>.

Multiple issues might still persist during the build process. Consult the aforementioned guide before contacting the author.

3 Testing

After sucessfully building the image, the output will look like below:

Command Line

```
admin@lgedvit:~/build-webos-clean$ bitbake webos-image
Loading cache: 100% |#######################################################################
Loaded 4567 entries from dependency cache.
NOTE: Resolving any missing task queue dependencies
WARNING: preferred version 14.0.3 of llvm-native not available (for item llvm-native)
WARNING: versions of llvm-native available: 13.0.1

Build Configuration:
BB_VERSION           = "2.0.0"
BUILD_SYS            = "x86_64-linux"
NATIVELSBSTRING      = "universal"
TARGET_SYS           = "aarch64-webos-linux"
MACHINE              = "raspberrypi4-64"
DISTRO               = "webos"
DISTRO_VERSION       = "2.20.1.g"
TUNE_FEATURES        = "aarch64 armv8a crc cortexa72"
TARGET_FPU           = ""
WEBOS_DISTRO_RELEASE_CODENAME = "webos-master"
WEBOS_DISTRO_BUILD_ID = "unofficial"
WEBOS_DISTRO_TOPDIR_REVISION = "dfde71fc99eb0ad40628693939f984b11fa65234"
WEBOS_DISTRO_TOPDIR_DESCRIBE = "v2.20.1"
DATETIME             = "20241211061411"
meta-security        = "kirkstone:c79262a30bd385f5dbb009ef8704a1a01644528e"
meta-webos-smack
meta-webos-virtualization
meta-webos-updater
meta-webos-raspberrypi = "2.20:bf4b084c9de61f196a4c0eb6173cc344b95b03d6"
meta-raspberrypi     = "kirkstone:dacad9302a92b0b7edf8546cdcad1f8ef753e462"
meta-webos
meta-webos-backports-4.2
meta-webos-backports-4.1 = "2.20:bf4b084c9de61f196a4c0eb6173cc344b95b03d6"
meta-qt6             = "6.4.1:0c3060bd186af0b9352da89c9ff74f8cdf88978c"
meta-virtualization  = "kirkstone:9a94fa2ad76990b0eca40837a98aaf4cd83a7248"
meta-updater         = "kirkstone:ffbbc2b9f46a60bd2d51be53079252f8e6304a8b"
meta-clang           = "kirkstone:b7c0dcc4bc7f0d273f14cc0a70bcad5555a4be04"
meta-filesystems
meta-python
meta-networking
meta-multimedia
meta-oe              = "kirkstone:1f31570d0795da90083d1dbf28127c90908e30ee"
meta                 = "kirkstone:a8c82902384f7430519a31732a4bb631f21693ac"

Initialising tasks: 100% |##################################################################
Sstate summary: Wanted 49 Local 0 Mirrors 0 Missed 49 Current 4440 (0% match, 98% complete)
Removing 48 stale sstate objects for arch raspberrypi4_64: 100% |############################
NOTE: Executing Tasks
WARNING: webos-image-1.0-r3 do_image: Android repo tool not found; manifest not copied.
WARNING: webos-image-1.0-r3 do_image_ostreepush: SOTA_PACKED_CREDENTIALS not set. Please add
NOTE: Tasks Summary: Attempted 10879 tasks of which 10775 didn't need to be rerun and all suc
NOTE: Writing buildhistory
NOTE: Writing buildhistory took: 22 seconds
NOTE: Build completion summary:
NOTE:   do_populate_sysroot: 0.0% sstate reuse(0 setscene, 1 scratch)
NOTE:   do_deploy_source_date_epoch: 0.0% sstate reuse(0 setscene, 1 scratch)
NOTE:   do_package_qa: 0.0% sstate reuse(0 setscene, 15 scratch)
NOTE:   do_package: 0.0% sstate reuse(0 setscene, 5 scratch)
NOTE:   do_packagedata: 0.0% sstate reuse(0 setscene, 5 scratch)
NOTE:   do_package_write_ipk: 0.0% sstate reuse(0 setscene, 15 scratch)
NOTE:   do_populate_lic: 0.0% sstate reuse(0 setscene, 1 scratch)

Summary: There were 4 WARNING messages.
```

The image for Raspberry Pi 4 can be found in the directory: /build-webos/BUILD/deploy/images/raspberrypi4-64 . The image is called webos-image-raspberrypi4-64.rootfs.wic.bz2 . This file is supposed to be extracted before flasing onto a microSD card, which will then be inserted into the Raspberry Pi 4. In case of successful installation, the below commands will have some output.

Command Line

```
$ mount | grep smack
$ chsmack
$ smackctl
```

Notice: In case of unfixable issue, contact the author.