# Debug Packages in OpenBSD

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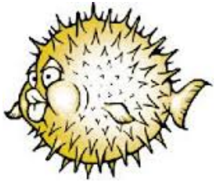

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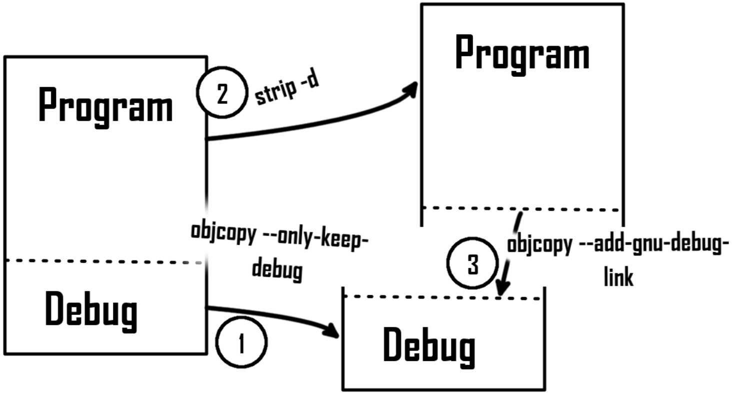
## The origins

- Like most things in OpenBSD, it started at a hackathon,
- the p2k19 hackathon, organized by Paul Irofti in Bucarest.
- ... and the original idea was Paul's as well:
- "hey, there's this command we can use to split off the debug info from an executable. How about we make some debug packages."

## Specifically

```
objcopy --only-keep-debug program .debug/program.dbg
strip -d program
objcopy --add-gnu-debug-link=program .debug/program.dbg
```



## The end

And that's about all folks!

Wait what ?

Of course there are fun details to take care of!

## A more elaborate plan

- Add the debug package to "visible packages" ?
- This requires a lot of changes, so let's not
- Debug packages should be "fantom packages that don't really exist"
- As for update use the exact same update signature as the normal package

## Rapid development

- At that point, `make package` is more or less `make package-cookies`
- so we just need to make extra cookies for the debug packages
- Naming convention: add `debug-` to the front (to avoid cluttering the normal list)
- Do the debug part manually at first: for each `DEBUG_FILES`, we apply the magic `objcopy` transformation
- ... and write the packing-list (manifest) manually, at first
- This allowed us to check that `egdb` was happy with it

## Rapid development II

- generation of `DEBUG_PACKAGES` is triggered by the presence of `DEBUG_FILES`
- we add extra `DEBUG_CONFIGURE_ARGS` to configure
- ... show that to crash-test developers (we're at a hackathon, remember ?). Many thanks to all the folks who tested !

## Very fast turn-around

- Turns out most people are interested in debug packages !
- ... so I got a lot of developers to test things and offer suggestions !

## Some code I

```
#[...]

DEBUG_PACKAGES ?=
DEBUG_FILES ?=
DEBUG_CONFIGURE_ARGS ?=

.for _S in ${MULTI_PACKAGES}
_PKGFILE${_S} = ${FULLPKGNAME${_S}}.tgz
_DBG_PKGFILE${_S} = debug-${_PKGFILE${_S}}
.  if ${PKG_ARCH${_S}} == "*" && ${NO_ARCH} != ${MACHINE_ARCH}/all
_PACKAGE_COOKIE${_S} = ${PACKAGE_REPOSITORY}/${NO_ARCH}/${_PKGFILE${_S}}
.  else
_PACKAGE_COOKIE${_S} = ${PACKAGE_REPOSITORY}/${MACHINE_ARCH}/all/${_PKGFILE${_S}}
_DBG_PACKAGE_COOKIE${_S} = ${PACKAGE_REPOSITORY}/${MACHINE_ARCH}/all/${_DBG_PKGFI
.  endif
.endfor

```

## Some code II

```
#[...]
.if !empty(DEBUG_PACKAGES) || !empty(DEBUG_FILES)
INSTALL_STRIP =
DEBUG_FLAGS = -g
CONFIGURE_ARGS += ${DEBUG_CONFIGURE_ARGS}
.else
DEBUG_FLAGS =
.endif

.for _S in ${MULTI_PACKAGES}
PKG_ARGS${_S} += -A'${PKG_ARCH${_S}}'

_create_pkg${_S} = \
        tmp=${_TMP_REPO}${_PKGFILE${_S}} pkgname=${_PKGFILE${_S}} && \
        ${_PBUILD} ${_PKG_CREATE} -DPORTSDIR="${PORTSDIR}" \
                $$deps ${PKG_ARGS${_S}} $$tmp && \
        ${_check_lib_depends} $$tmp && \
```

## Some code III

```
		${_register_plist${_S}} $$tmp && \
		${_checksum_package}

_move_tmp_pkg${_S} = ${_PBUILD} mv ${_TMP_REPO}${_PKGFILE${_S}} ${_PACKAGE_COOKIE
_tmp_pkg${_S} = ${_TMP_REPO}${_PKGFILE${_S}}

.  if ${DEBUG_PACKAGES:M${_S}}
_DBG_PKG_ARGS${_S} := ${PKG_ARGS${_S}}
_DBG_PKG_ARGS${_S} += -P${FULLPKGPATH${_S}}:${FULLPKGNAME${_S}}:${FULLPKGNAME${_S
_DBG_PKG_ARGS${_S} += -DCOMMENT="debug info for ${FULLPKGNAME${_S}}"
_DBG_PKG_ARGS${_S} += -d"-debug info for ${FULLPKGNAME${_S}}"
_DBG_PKG_ARGS${_S} += -DFULLPKGPATH=debug/${FULLPKGPATH${_S}}
_DBG_PKG_ARGS${_S} += -f ${PLIST${_S}}-debug
_create_pkg${_S} += && \
		tmp=${_TMP_REPO}${_DBG_PKGFILE${_S}} pkgname=${_DBG_PKGFILE${_S}} && \
		${_PBUILD} ${_PKG_CREATE} -DPORTSDIR="${PORTSDIR}" \
			$$deps ${_DBG_PKG_ARGS${_S}} $$tmp && \
```

## Some code IV

```
        ${_check_lib_depends} $$tmp && \
        ${_register_plist${_S}} $$tmp && \
        ${_checksum_package}
_move_tmp_pkg${_S} += && ${_PBUILD} mv ${_TMP_REPO}${_DBG_PKGFILE${_S}} ${_DBG_PAC
_tmp_pkg${_S} += ${_TMP_REPO}${_DBG_PKGFILE${_S}}
.   endif

#[...]

_copy_debug_info:
.for P in ${DEBUG_FILES:N*.a}
        @dbgpath=${PREFIX}/${P:H}/.debug; \
        dbginfo=$${dbgpath}/${P:T}.dbg; \
        p=${PREFIX}/$P; \
        ${INSTALL_DATA_DIR} $${dbgpath}; \
        echo "> move debug info from $$p into $${dbginfo}"; \
        objcopy --only-keep-debug $$p $${dbginfo}; \
```

## Some code V

```
		objcopy --strip-debug $$p; \
		objcopy --add-gnu-debuglink=$${dbginfo} $$p
.endfor
.for P in ${DEBUG_FILES:M*.a}
		@dbgpath=${PREFIX}/${P:H}/.debug; \
		dbginfo=$${dbgpath}/${P:T}; \
		p=${PREFIX}/$P; \
		${INSTALL_DATA_DIR} $${dbgpath}; \
		echo "> copy debug info from $$p into $${dbginfo}"; \
		cp $$p $${dbginfo}; \
		strip $$p
.endfor
```

## Reuse of previous work

**Introducing `build-debug-info`**

This just reuses an existing framework

- we read existing packing-lists in `update-plist`
- let's just do the same to create the debug-plists
- ... except we generate temporary information
- and generate a `DEBUG_FILES` equivalent dynamically

## Reuse II

- `update-plist` is fully OO
- The "parsing the existing lists part" is just common code with `pkg_create`
- There's a common class that parses parameters, with a derived subclass for `update-plist`
- This class requires very few changes to generate a `build-debug-info` tool

## Clunky clunky

```
cat ${_WRKDEBUG}/debug-info| \
                while read dbgpath p dbginfo; do \
                ${INSTALL_DATA_DIR} $${dbgpath}; \
                echo "> copy debug info from $$p into $${dbginfo}"; \
                case $$p in *.a) \
                        cp $$p $${dbginfo}; \
                        strip $$p;; \
                *) \
                        objcopy --only-keep-debug $$p $${dbginfo}; \
                        objcopy --strip-debug $$p; \
                        objcopy --add-gnu-debuglink=$${dbginfo} $$p; \
                esac; done
```

## Feedback from friends

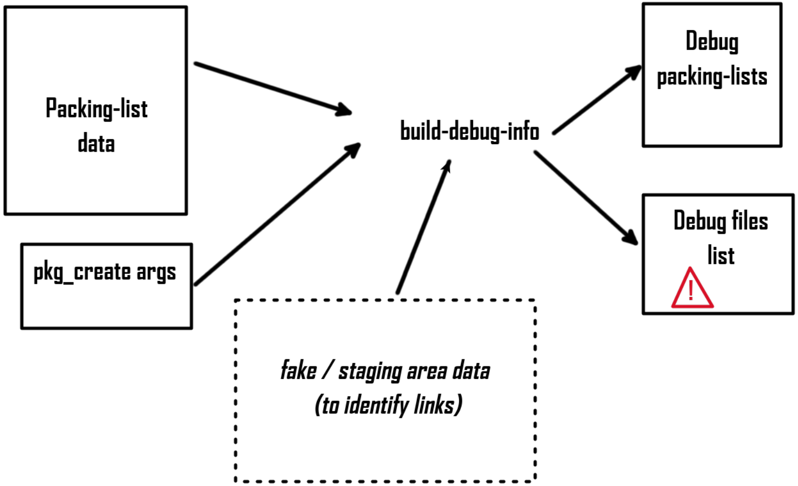
### Stuart

- debug packages might be big
- ... so we do them opt-in
- ... also make this arch-dependent: amd64 first then we'll figure out other architectures
- 32 bit arches are likely to be out in the cold

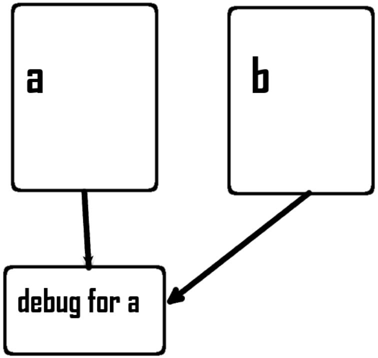
### Antoine

- Hey, it doesn't work with some python packages!
- That's because of hardlinks.
- Obviously, if you have two links to the same binary, `objcopy --split-debug-info` will only work once !

## A better picture



## All about links



- nothing to do with most binaries
- however the debug link does not have a path
- so we still need to do something for different directories
- most annoying part was tests!

## Second issue (a simpler one)

- we're actually in multi-packages land...
- So we set `DEBUG_PACKAGES` to the subpackages for which we want debug packages.
- This will get trimmed automatically depending on architecture (exactly like for "normal" multi-packages: don't deal with stuff that's `NOT_FOR_ARCHS`. and don't do debug for arch independent stuff: a subpackage that does not contain binaries does NOT need a debug-package

## How it ends up

- we set up `MULTI_PACKAGES = -a -b -c` bsd.port.arch.mk generates `BUILD_PACKAGES` by possibly trimming it according to pseudo-flavors *and* `NOT_FOR_ARCHS/ONLY_FOR_ARCHS`.
- so we just need to set `DEBUG_PACKAGES = ${BUILD_PACKAGES}`.
- A small piece of code in bsd.port.mk *will* strip `PKG_ARCH=*`

## Next problem

When we update a port, we need to run update-plist, but in order to do that, we need for fake to finish...
Current "wedge" for debug packages looks like this:

- set `DEBUG_PACKAGES=${BUILD_PACKAGES}` (trimmed through bsd.port.arch.mk)
- trim it through `PKG_ARCH != *`
- if it's not empty use possible `DEBUG_CONFIGURE_ARGS` during configure, build as usual
- at the end of "fake", we run an extra `_copy_debug_info` target
- that target runs `build_debug_info`
- ... and then either links .dbg or create .dbg through `objcopy`
- `make package` iterates over normal subpackage with `pkg_create`... if there is a debug-subpackage, we also call `pkg_create` on the sly for the debug subpackage

so make fake can't fail, we just warn in case of issues.

## The solution

- We may run `build-debug-info` during `make package`
- but it doesn't extract the debugging information, it creates a Makefile that does that !
- so `make package` depends on that Makefile, and it depend on fake being finished.
- and each file is handled independently to extract debug info just once
- Hindsight is 20/20. It was obvious we might debug-info extraction to be applied several times, so doing that with real dependencies solves our problem.

## For instance I

```
# Makefile generated by build-debug-info $OpenBSD: build-debug-info,v 1.38 2020/1
# No serviceable parts
# Intended to run under the stage area after cd ${WRKINST}

OBJCOPY_RULE = ${INSTALL_DATA_DIR} ${@D} && \
	perm=`stat -f "%p" $?` && chmod u+rw $? && \
	echo "> Extracting debug info from $?" && \
	if readelf 2>/dev/null -wi $?|cmp -s /dev/null -; then \
		echo "Warning: no debug-info in $?"; \
	fi && \
	objcopy --only-keep-debug $? $@ && \
	${DWZ} $@ && \
	strip -d $? && \
	objcopy --add-gnu-debuglink=$@ $? && \
	chmod $$perm $? && \
	touch $@

```

## For instance II

```
LINK_RULE = ${INSTALL_DATA_DIR} ${@D} && \
    echo "> Link debug info from $? to $@" && ln $? $@

all:
.PHONY: all

all: /vide/build/usr/ports/pobj/libarchive-3.5.1/fake-amd64/usr/local/bin/.debug/b
/vide/build/usr/ports/pobj/libarchive-3.5.1/fake-amd64/usr/local/bin/.debug/bsdcat
        @${OBJCOPY_RULE}

all: /vide/build/usr/ports/pobj/libarchive-3.5.1/fake-amd64/usr/local/bin/.debug/b
/vide/build/usr/ports/pobj/libarchive-3.5.1/fake-amd64/usr/local/bin/.debug/bsdcpi
        @${OBJCOPY_RULE}

all: /vide/build/usr/ports/pobj/libarchive-3.5.1/fake-amd64/usr/local/bin/.debug/b
/vide/build/usr/ports/pobj/libarchive-3.5.1/fake-amd64/usr/local/bin/.debug/bsdtar
        @${OBJCOPY_RULE}
```

## For instance III

```

all: /vide/build/usr/ports/pobj/libarchive-3.5.1/fake-amd64/usr/local/lib/.debug/l
/vide/build/usr/ports/pobj/libarchive-3.5.1/fake-amd64/usr/local/lib/.debug/libarc
	@${OBJCOPY_RULE}
```

## Workflow for people

### Old process

- run fake (which generates SOME debug info which may or may not be accurate).
- Run update-plist (which might invalidate the meta info necessary for which file to debug),
- so needs to `make clean=fake` before packaging.

### New process

- make fake (no debug info involved)
- update-plist
- create debug info
- and package.

If we did the debug info by accident, we can run it again and again WITHOUT needing to wipe the fake stage, because it's a Makefile !
(actually `_copy-debug-info` is re-run doing EACH packaging step: it depends on the fake dir being up-to-date and the generated debug Makefile, and it just rechecks all .dbg files are accounted for)
Since the debug Makefile doesn't have "simple" dependencies, we just wipe it at the end of update-plist.

## Highlights

And here is the full process in a nutshell. Highlights:

- need to declare which packages we want debug stuff for (so that the repo doesn't grow too much).
- declaring is (mostly) `DEBUG_PACKAGES = ${BUILD_PACKAGES}` get stripped automatically)
- configuring will automatically handle `INSTALL_STRIP/DEBUG` in most cases, plus adding `DEBUG_CONFIGURE_ARGS` to `CONFIGURE_ARGS`. In a few ports, a bit more glue will be needed.
- the whole magic happens after fake... we use the existing packing-lists
- the fake data is used to generate plists for the debug-packages AND run objcopy
- the debug packages are "fantom" packages that depend on the main package, no independent registration.

## DWZ

- dwz (dwarf compress), imported and maintained by bcallah@, in order to make the debug packages a bit smaller.
- So every debug package `BUILD_DEPENDS` on `devel/dwz`, except for `devel/dwz` which uses the just build binary (and for mozilla which has weird debug info ??? or dwz which is subtly broken)
- Turns out to be a really nice stress-test for debug-info !

## The pkg_add side

- initial usage was simply to manually `pkg_add` debug-* stuff
- SHEARING
- run into a bug on an installed package, and find out the debugging package is obsolete: debug info has a kind of signature which must match the debugging binary *EXACTLY*.

## Two ways around that

- add an option (`-d`) to `pkg_add` to (silently/automatically) install/update debug packages when available (a bit of a size hog)
- configure `pkg_add` through an env variable to keep a stash of debug packages for installed packages (`DEBUG_PKG_CACHE`), so that you always have an up-to-date debug package.

## open issues

- some frameworks make things more complicated (cmake!)
- how do the debug options change things ?
- what platforms want debug packages

## Questions

That's about all. Many thanks to my fellow developers !