



All For One Port, One Port For All

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**Presentation given by Bram Moolenaar at the European BSD conference,
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You may know my name for being the main author of Vim, the editor.

My current daytime work is the A-A-P project. I'm the project leader.

For my daily work I use FreeBSD (still version 4.5, should upgrade soon).
Mostly using lots of xterms with Vim in them.



terminology

port	minimal set of files to build and install an application from sources
package	installable set of files with binaries
source package	installable set of files with sources

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I assume I do not have to explain what the ports system is and how it works..

In this presentation I will be using the FreeBSD terminology.

NetBSD uses different terms, because they use "port" for using NetBSD on a different platform.

A source package is more or less a port with the used source files included.

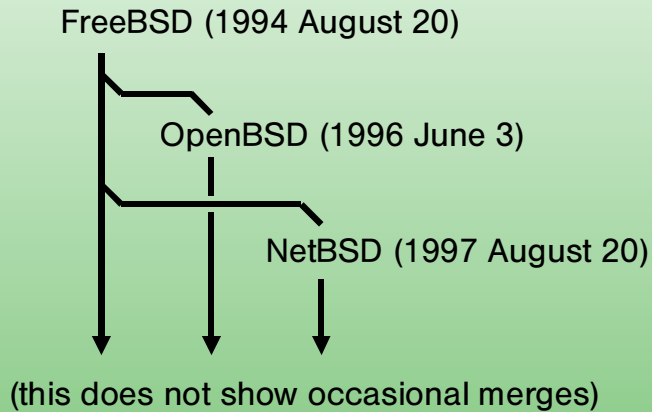


overview

1. **The Great Divide**
2. A New Solution
3. Introducing A-A-P
4. The Port Recipe
5. Conclusions



1. The Great Divide history



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Jordan K. Hubbard started the ports system, originally with just a few features.

All systems still contain the credits for Jordan with the date in 1994. This clearly shows their common root.

The figure only shows the first split-off for each system. There were various exchanges of modifications in between.

The split-offs mostly happened to add features or solve problems, with the intention to feed the changes back to FreeBSD.

These days each system appears to be developed independently, without the desire to include each others modifications. It has also become more difficult to include each others changes.

The three systems are growing further apart. Not intentional, but because of the lack of motivation to to work together. Being able to make changes directly instead of having to convince someone else to include them also plays an important role.



1. The Great Divide **differences**

FreeBSD	Limited feature growth. Largest number of ports.
OpenBSD	A few more features than FreeBSD: fake install, flavors, multi-packages, generated packing list, etc.
NetBSD	Many more features than FreeBSD and growing fastest. Support for multiple platforms essential.

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Ironically the OpenBSD documentation refers to the FreeBSD handbook. Thus besides the extra features it appears to be mostly the same.

Overall the differences are not that big, still using the same mechanisms.

However, the differences are big enough to make the ports files incompatible and taking over changes difficult.



1. The Great Divide reasons to reunite

Disadvantages of the current situation:

- every port has to be done three times
- bugs need to be solved three times
- porting tricks are to be invented three times
- improvements of the ports system done three times

Benefits of reuniting:

- More eyes to detect a bug, more hands to solve it
- More ports available on each system
- Each BSD system will become more attractive
- Allows a user to chose an OS on features

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Obviously, maintaining three systems with ports is three times as much work. Since there are thousands of ports, the amount of duplicated work is significant.

Currently a user might chose one of the BSD systems because it is the only one that has a port he needs to use. If all systems have the same ports he can make his selection based on other features.

For a group of developers this may seem unimportant. Look at it from the point of view of a user. He just wants to have the port he needs to use.

One thing will not change when reuniting: testing still needs to be done for each platform.



1. The Great Divide attempts to reunite

The most promising attempt: **OpenPackages**

This project has stalled, there is no usable solution. Why?

- It started out as a good idea to reunite the different ports systems.
- The supporters got carried away with all kinds of nice features.
- It became too much work, developers started dropping out.
- An attempt to split the work up in manageable pieces did not help.

Recent change: use the infrastructure of DarwinPorts.

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Originally this project started with the intention to make one ports system for all BSD systems.

Whether the cooperation with DarwinPorts will really work is unclear. It is not mentioned on the DarwinPorts maillist. No messages in the OpenPackages-tech maillist since the announcement.



1. The Great Divide attempts to reunite

Why did developers not join in and make OpenPackages a success?

- It was not clear that the BSD distributions would ever switch to OpenPackages.
- There were not enough advantages from the viewpoint of each BSD distribution.
- There was too much, too complicated work while there are not many skilled developers available.
- Skilled developers prefer to work on their own solution.

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OpenPackages did sound like a good idea, so why did it not work out?

The project leader is not a developer himself, thus he had to rely on others to do the implementation.



1. The Great Divide ways to reunite

Possible ways to reunite; what would work?

1. Use one of the ports systems for all BSD systems.
2. Merge the systems.
3. Make a new system that works for everyone.

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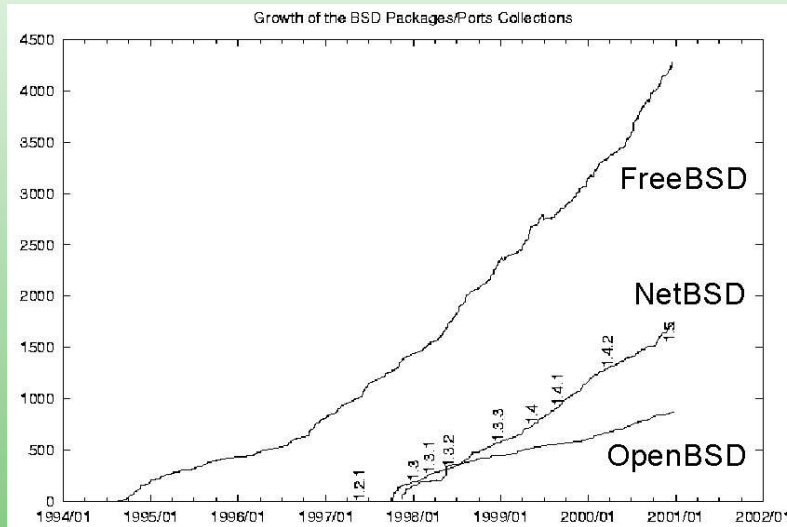
Let's make a list of possible ways to get back to one ports system.

If wanted, it's always possible to take over one of the other systems. This didn't happen, and is extremely unlikely to happen in the future.

SEE NEXT SLIDE



1. The Great Divide ports system growth



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Since FreeBSD has the smallest number of extra features, it is the most likely one to take over one of the other ports system implementation. However, since FreeBSD has the largest number of ports, the incompatibilities are a big problem.

Graph made by Hubert Feyrer in 2001.



1. The Great Divide ways to reunite

Possible ways to reunite; what would work?

1. Use one of the ports systems for all BSD systems.
2. Merge the systems.
3. Make a new system that works for everyone.

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The tendency is that merging of individual changes is decreasing. There appears to be no reason why this would turn around.

OpenPackages has shown that making a new system is unlikely to work.

Main problem here is that the port files are incompatible. Switching to another system would mean thousands of ports are suddenly unusable.

So what will work...?



overview

1. The Great Divide
2. **A New Solution**
3. Introducing A-A-P
4. The Port Recipe
5. Conclusions



2. A New Solution method

Main problem with the solutions tried so far:
The switch to a new system causes too many
incompatibilities.

Solution:
Don't switch but add a new system that works
side-by-side with the traditional system.

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This is the essential choice for the proposed solution. Other choices that follow depend on personal preferences..

Note the terminology: traditional ports system and new ports system



2. A New Solution goals

- Work side by side with the traditional ports system
- Include good ideas from all traditional ports systems (e.g., fake install)
- No need to be backward compatible
- Use a good implementation base
- Make it as simple as possible to write a port, automate as much as possible

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The idea is that gradually more and more ports will be done for the new system. Eventually the traditional system can be discarded.

Although the port files do not need to be backwards compatible, it would be nice to use a similar structure to avoid scaring of port maintainers.

Not having to be backwards compatible leaves room for a better and more powerful implementation.

An example of what can be automatized is the list of files. Especially because this may change often.



2. A New Solution choices

Essential: package administration.
Use the traditional package system.

This is not without disadvantages...

- Dependency handling limited
- Not possible to install two versions of one package
- Deleting a package may remove files from another (version of the) package

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Only when the traditional package system is used is it possible to keep the registration of installed packages consistent.

The disadvantages are generic, they should be solved anyway. And these can be solved without incompatibilities with the traditional ports system.

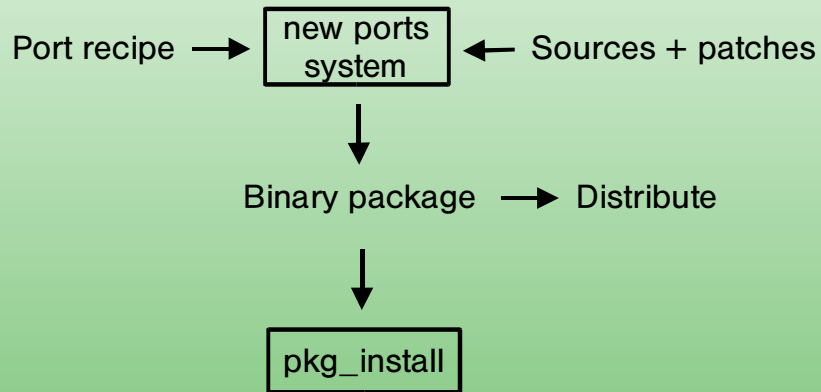
Example: Install version 1.1, install version 1.2, delete version 1.1. Files that are identical in both releases will be deleted (on FreeBSD at least).

Adding a new set of package tools is not a good alternative, since dependencies between the traditional and the new system cannot be handled.

There is no big need for a reunited package system. The new ports system can be made to work with all package systems.



2. A New Solution design



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The Binary package can be distributed and used just like a package created with the traditional ports system.



2. A New Solution implementation

Makefile with shell scripts is not a good way to implement a ports system:

- Easy to make mistakes
- Not portable
- Relies on many external tools
- Tricks needed to make it work
- Picks up arbitrary environment variables

Choice: Use A-A-P.

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External tools that are standard UNIX items should be OK. But it's too easy to rely on specific versions (e.g., GNU tools instead of BSD ones).

The choice for A-A-P is more or less a personal preference. There are alternatives that others might find a better choice.

To verify that these ideas are really possible, a proof of concept has been made with A-A-P.



overview

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A-A-P is a system for developing, distributing and installing software. Here we will use the build tool part of it. That's also the only part that's currently available.

Even if you don't like my ideas for the new ports system, you might still want to use A-A-P.

I'm just giving an overview here, this is not a lecture. If you want to learn using A-A-P read the tutorial on the A-A-P web site.



3. Introducing A-A-P **Hello World example**

```
SOURCE = hello.c  
TARGET = hello
```

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Most computer languages start with an example that just prints "Hello World". This is an A-A-P recipe to compile the C version of this program.

This is really the whole thing. Store this recipe as "main.aap" and run the "aap" command. Let's see what happens



3. Introducing A-A-P Hello World example

```
% aap
1 Aap: Creating directory "/home/mool/tmp/build-
  FreeBSD4_5_RELEASE"
2 Aap: cc -I/usr/local/include -g -O2 -E -MM hello.c >
  build-FreeBSD4_5_RELEASE/hello.c.aap
3 Aap: cc -I/usr/local/include -g -O2 -c -o build-
  FreeBSD4_5_RELEASE/hello.o hello.c
  Aap: cc -L/usr/local/lib -g -O2 -o hello build-
  FreeBSD4_5_RELEASE/hello.o
4 % touch hello.c
% aap
%
```

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(1) First of all a directory is created to put the intermediate results in. The name is different for every platform, so that compilation for multiple platforms is automatically supported.

(2) The first invocation of "cc" obtains the dependencies on header files. A-A-P automatically detects these dependencies, which is a lot simpler and more reliable than doing this by hand.

(3) The next two invocations of "cc" compile and link the program.

(4) When touching the source file A-A-P knows it does not need to be compiled, because it uses signatures. This is more reliable than timestamps, especially when working with networked file systems, unpacking an archive or restoring an older version.



3. Introducing A-A-P Hello World example

```
# recipe for compiling hello.c
all : hello
hello : hello.c
    :system $CC $CPPFLAGS $CFLAGS
        $LDFLAGS -o $target $source
```

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This is an example that doesn't use the automatic mechanism for SOURCE and TARGET.

The recipe format is mostly like a Makefile, but there are a number of important differences.

The comments and dependencies are just like in a Makefile.

Build commands can be more than shell commands. A comprehensive set of often used commands is available. Therefore shell commands need to be preceded with ":system" or ":sys".

Line continuation does not require a backslash at the end of the line. The indent shows where the next command starts.

There is mostly no need to put parenthesis or braces around variable names, but it is allowed.



3. Introducing A-A-P web site example

```
# A-A-P recipe for uploading changed files to a web site
FILES =
    index.html
    design.html
    manpage.html
    download.html
    examples.html
    `glob("images/*.png")`
:attr {publish = scp://user@foo.sf.net/dir/%file%} $FILES
```

execute this with: aap publish

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This recipe is used to upload modified files to a web site.
There are a few things here that you might find interesting

The list of file names that is to be uploaded is given one name per line. No backslashes are needed, the indent shows where the list ends. Wildcards are expanded with the Python glob() function. A Python expression is given in backticks, similar to how this is done in a shell.

NOTE: the glob() command is in backticks, but this font has a strange glyph for backticks.

The ":attr" or ":attribute" command attaches an attribute to each item in \$FILES. Attributes is a generic mechanism to specify what is to be done with a file.

In the example the "publish" attribute specifies where files are to be uploaded to.



3. Introducing A-A-P web site example

```
# A-A-P recipe for maintaining a web site
FILES =
    index.html
    design.html
    manpage.html
    download.html
    examples.html
    `glob("images/*.png")`
:attr {publish = scp://user@foo.sf.net/dir/%file%} $FILES

all : $FILES
publish: $FILES
    :publishall

:rule %.html : start.part %_title.part middle.part %.part end.part
    :cat $source >! $target
```

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This adds generating the HTML files from parts.

The "all" target is used to build the HTML files from five parts. The ":rule" command at the end specifies how this is done with the ":cat" command. This works just like the UNIX "cat" command and also works on non-UNIX systems.

The ":rule" command specifies a generic way to make a .html file from .part file.

\$source stands for the list of sources used in the dependency.

Note the use of the percent sign, you cannot do this in a Makefile.

The ":publishall" command uploads all modified files to the URL specified with the "publish" attribute.



3. Introducing A-A-P download example

```
# A-A-P recipe for building a program from
# remote files
SITE = ftp://ftp.foo.org/pub/foo/files
:recipe {fetch = $SITE/main.aap}

SOURCE = main.c version.c util.c
INCLUDE = common.h
TARGET = foobar

:attr {fetch = $SITE/%file%} $SOURCE $INCLUDE
```

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This recipe is used to download individual files for an application.

The ":recipe" command is used to obtain a new version of the recipe itself. This makes it possible to modify the recipe and let the user download it without typing the URL.

The build commands are automatically generated from SOURCE and TARGET.

Since the URL is given as an attribute to the files, A-A-P will know where to download them from.



3. Introducing A-A-P CVS example

```
VERSION = 1.013
CVSROOT =
  :ext:$CVSUSER_FOO@cvs.foo.sf.net:/cvsroot/foo

FILES =  COPYING
         README.txt
         main.aap
         `glob("*.py")`

:attr {commit = cvs://$CVSROOT} $FILES
:attr {logentry = updated for version $VERSION}
      $FILES
```

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I will not try explain everything here.

Using CVS is like another way to upload and download files. The CVSROOT is specified like a URL. This is especially useful for people who don't know CVS very well.

CVS can be used for downloading only, this is a simple way of getting the latest version of an application.



3. Introducing A-A-P use of Python

```
INCDIR = test
@if OSTYPE == "posix":
    LISTCMD = ls
@elif OSTYPE == "mswin":
    LISTCMD = dir

@try:
    :system $LISTCMD $INCDIR >!tt
@except UserError, err:
    :print Could not list directory $INCDIR:
        `str(err)`
```

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When you need to add flow control, expressions or something complicated, Python script can be used. It mixes with the other items in a recipe.



3. Introducing A-A-P built-in commands

```
all: mirrors.html

:attr {publish = scp://user@foo.sf.net/dir/%file%}
      mirrors.html

mirrors.html : MIRRORS
:print Generating $-target from $-source
@import txt2html
:cat $source
| :eval txt2html.filter(stdin)
| :cat head.html -
>! $target
:print `"/>
```

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There are many built-in commands to use for common tasks. This avoids using shell commands, which are not portable.

This example shows how an HTML file is generated from a plain text file.

The "@import txt2html" command imports a Python module. The "filter()" function it defines is used in an ":eval" command.

Note that a pipe is supported, much like it is in a shell.

This is just to show what is possible with an A-A-P recipe, I will skip the details here.



overview

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4. **The Port Recipe**
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So far you have seen the generic items in an A-A-P recipe. It is a super-make tool.

Now lets see how the A-A-P recipe can be used for a port. This is more or less like a Makefile is used for a traditional port.



4. The Port Recipe goals

Since the A-A-P port does not need to be backwards compatible, let's try to make it easy to use:

- Be able to let a port refresh itself
- Avoid doing work as root
- Allow installing a port for a single user
- Support for updating to a new version
- Etc.

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Not having the restriction to be backwards compatible gives us quite a few possibilities.

Not having to update the whole ports tree before installing one is a big advantage. For me it takes over half an hour to run cvsup, and that's with a fast internet connection.

Security becomes more important every day. To avoid building a port while being root helps a bit.

Installing for a single user is required for trying it out and when the system administrator is not cooperative.

Some applications are updated very often. Being able to update a port in a simple way is very much desired. The dependencies often make it complicated though.



4. The Port Recipe **traditional port use**

1. Become root
2. Update the whole ports tree:
`cvsup`
3. Build and test:
`cd group/appname`
`make`
`make test`
4. Install:
`make install`

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This is how you mostly install a traditional port.



4. The Port Recipe new port use

1. Download the port recipe (one file)
2. Build and test:

```
aap  
aap test
```
3. Try it out:

```
aap install DESTDIR=$HOME
```
4. Install:

```
aap install
```

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This is how you normally install an A-A-P port.

Usually the system maintainer would have his own directory with the port tree somewhere. He does not need to be root to use it.

If the port has dependencies, the port recipes for those packages may be automatically downloaded as well.

The "try out" step is very important on a multi-user system. You don't want to break tools that are being used.

Note that there is no step to become root. In the final install step you will be prompted to enter the root password. It is only needed once, also when several dependencies are to be installed. This is done in a separate shell, so that the building isn't done by root.



4. The Port Recipe **port recipe format**

Starting point: use common items from traditional ports system. A few differences:

- Name archives directly instead of letting them depend on a dozen variables; automatically recognize the method to be used for unpacking
- Python script is often used instead of shell script
- Put most things inside the recipe: checksums, comment, description
- Generate the list of files when possible
- Always use a fake install

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Using useful items from the traditional ports system has the advantage that it's easier to switch to the new system.

Shell script can still be used when it's needed.

The fake install is required to be able to generate a binary package without overwriting files on the system.

Example: Vim contains hundreds of syntax files, therefore it is very convenient to generate the list of files automatically.

Always using a fake install might have some problems, perhaps it should be allowed to install in another way in specific situations.



4. The Port Recipe example overview

```
# A-A-P port recipe for Vim
AAPVERSION = 1.0

PORTNAME = vim
PORTVERSION = 6.1
MAINTAINER = Bram@vim.org

CATEGORIES = editors
PORTCOMMENT = Vim - Vi Improved, the text editor
PORTDESCR << EOF
This is the description for the Vim package.
A very nice editor indeed.
URL: http://www.vim.org
EOF

# Where to obtain an update of this recipe from.
AAPROOT = http://www.a-a-p.org/vim
:recipe {refresh = $AAPROOT/main.aap}

WRKSRC = vim61 # Vim doesn't use vim-6.1
DEPENDS = gtk>=1.2<2.0 | motif>=1.2 # GTK 2.0 doesn't work yet
BUILDPROG = make

# This is used when CVS is available
CVSROOT ?= :pserver:anonymous@cvcs.vim.sf.net:/cvsroot/vim
CVSMODULES = vim
CVSTAG = vim-6-1-003

# This is used when CVS is not available and when
# disabled with "CVS=no".
MASTER_SITES = ftp://ftp.vim.org/pub/vim
PATCH_SITES = $MASTER_SITES/patches
DISTFILES = unix/vim-6.1.tar.bz2 extra/vim-6.1-lang.tar.gz
PATCHFILES = 6.1.001 6.1.002 6.1.003

#>>> automatically inserted by "aap makesum" <<<
do-checksum:
    checksum $DISTDIR/vim-6.1.tar.bz2 {md5 = 7Ed0f915adc7c0dab89772884268b030}
    checksum $DISTDIR/vim-6.1-lang.tar.gz {md5 = ed6742805866d11d6a28267330980ab1}
    checksum $PATCHDISTDIR/6.1.001 {md5 = 97bd9e37193b9d25400618b58b5332}
    checksum $PATCHDISTDIR/6.1.002 {md5 = f56455248658f019dcf3e2a56a470080}
    checksum $PATCHDISTDIR/6.1.003 {md5 = 0e000eba66562473a5f1e9b5b269bb8}
#>>> end <<<
```

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Most things in the port recipe look just like the traditional port Makefile. It is a bit longer, because of including the description and checksums.

Don't worry if you can't read this, I'll explain each part.



4. The Port Recipe example part 1

```
# A-A-P port recipe for Vim
AAPVERSION =      1.0

PORTNAME =        vim
PORTVERSION =     6.1
MAINTAINER =      Bram@vim.org

CATEGORIES =       editors
PORTCOMMENT =     Vim - Vi IMproved, the text editor
PORTDESCR << EOF
This is the description for the Vim package.
A very nice editor indeed.
URL: http://www.vim.org
EOF
```

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Most things in the port recipe look just like the traditional port Makefile.

The comment and description is given right here. That's easier than using a separate file for this. It avoids the inefficiency caused by a large number of small files in the port collection.



4. The Port Recipe example part 2

```
# Where to obtain an update of this recipe from.
AAPROOT =      http://www.a-a-p.org/vim
:recipe {refresh = $AAPROOT/main.aap}

WRKSRC =      vim61           # Vim doesn't use vim-6.1
DEPENDS =     gtk>=1.2<2.0 | motif>=1.2
                                   # GTK 2.0 doesn't work yet
BUILDPROG =   make
```

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The `:recipe` command is used to obtain a fresh copy of the recipe when desired. Thus the recipe knows where to download itself from.

The dependencies specify which items this port depends on. It can be a list of specific versions or use ranges. More about the implementation of this further on.

It is possible to specify any build command, including configure, without the need to overrule the default dependency.



4. The Port Recipe example part 3

```
# This is used when CVS is available
CVSROOT ?= :pserver:anonymous@cvs.vim.sf.net:/cvsroot/vim
CVSMODULES = vim
CVSTAG = vim-6-1-003

# This is used when CVS is not available and when
# disabled with "CVS=no".
MASTER_SITES = ftp://ftp.vim.org/pub/vim
PATCH_SITES = $MASTER_SITES/patches
DISTFILES = unix/vim-6.1.tar.bz2
             extra/vim-6.1-lang.tar.gz
PATCHFILES = 6.1.001 6.1.002 6.1.003
```

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This port can be obtained through CVS or using archives and patches.

Obtaining files through CVS is possible, but you can leave it out if you don't like it. For stable ports it's probably better not to use CVS, for the latest version it may be the only way to get the files.

Note that two archives are specified, with a different extension. This is much simpler than using various variables to form the archive name.



4. The Port Recipe example part 4

```
#>>> automatically inserted by "aap makesum" <<<
do-checksum:
  :checksum $DISTDIR/vim-6.1.tar.bz2
    {md5 = 7fd0f915adc7c0dab89772884268b030}
  :checksum $DISTDIR/vim-6.1-lang.tar.gz
    {md5 = ed6742805866d11d6a28267330980ab1}
  :checksum $PATCHDISTDIR/6.1.001
    {md5 = 97bdbe371953b9d25f006f8b58b53532}
  :checksum $PATCHDISTDIR/6.1.002
    {md5 = f56455248658f019dcf3e2a56a470080}
  :checksum $PATCHDISTDIR/6.1.003
    {md5 = 0e000edba66562473a5f1e9b5b269bb8}
#>>> end <<<
```

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These lines are automatically added or replaced when using "aap makesum".

It's nice to have it in one file, so that there can't be any mistake in using the wrong checksum file. It can be in a separate recipe if needed.



4. The Port Recipe dependencies

new -> new

Dependency from an A-A-P port recipe on another A-A-P port recipe:

Find a recipe with a matching version:

- Search locally (user, system)
- Use a specified URL
- Search on a list of sites
- May use binary package

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There are three kinds of dependencies for a new port.

Using a binary package for a dependency greatly speeds up the install. It can only be done when the dependencies do not require tuning the way the port is build (which is mostly true).



4. The Port Recipe dependencies

new -> traditional

Dependency from an A-A-P port recipe on a traditional port:

- "make install" just like a traditional port would do

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This is quite simple, but it does require becoming root.



4. The Port Recipe dependencies

traditional -> new

Dependency from a traditional port on a new port

Make a traditional port that is a wrapper around the A-A-P port. The wrapper should contain:

- Required items such as the port name and version number
- Dependencies on traditional ports (not necessarily all of them)
- A dependency on A-A-P
- The fetch target obtains the port recipe
- Override targets to invoke A-A-P on the port recipe

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This is a bit clumsy, perhaps it would be possible to generate the wrapper port.

Alternatively, the traditional ports system could be expanded with functionality to handle a dependency on a new port itself.



overview

1. The Great Divide
2. A New Solution
3. Introducing A-A-P
4. The Port Recipe
5. **Conclusions**



5. Conclusions status

The current implementation is only a proof of concept. There is still a lot of work to do before it is useful for a larger group of people. Most of this can be copied from other ports systems.

Tricky parts are:

- Insufficient support for dependencies in `pkg_install`
- Adjusting configuration files in a portable way
- Dependency on the new ports system itself

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Most of the port recipe works. Main part that is missing is the dependency handling. This could be solved by adding a pre-install shell script that handles the dependencies. Not a very nice solution though.

The adjustment of configuration files is to be done in a binary package. This should probably be a shell script. An alternative is to use an A-A-P recipe and add a dependency on the A-A-P package.

When fetching individual port recipes, some of them may depend on another version of the ports system files. In the traditional ports system this is solved by the brute force method of updating everything. For A-A-P a smarter solution is needed.



5. Conclusions Advantages

- Being able to use the A-A-P ports side by side with the traditional ports system is the main advantage.
- Should also work on non-BSD systems
- A-A-P recipes are much easier to use than Makefile with shell script
- Support for using ports by a single user
- Avoids root usage, better security
- No backwards compatibility restrictions, can include all the good features of other ports systems

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It will be possible to use the A-A-P ports system side by side with a traditional ports system. Gradually more A-A-P ports can be made.



5. Conclusions will it work?

- Further enhancements of package tools is needed as well.
- Development of A-A-P will continue anyway, the question is how much effort is spend on the port recipe. This depends on feedback and volunteers.
- The success of the A-A-P ports system remains to be seen.

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The development of A-A-P will be concentrated on the generic items. Only when there is sufficient interest for the port recipe will work be done on it. Help from others will be needed, I cannot do this all by myself.



The end

Questions?

www.A-A-P.org

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Whether the A-A-P recipe will be successful or not, I hope this presentation has inspired you to think of ways to use one port for all systems.

I will be around for more information.



The end

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