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> #: \$ ' 3 2 / 1 % ? 1 % 6 # \$: ' - ' FreeBSD ' + / < \$ 0 1 % 3 % " % - # + + ' \$ 3 # , ' " ' 4 ' " / 2 - # 4 ; - # 1 / 0 # ? ' \$ # 1 ' / 3 . @ , " % - # " / - # \$ # 1 8 / 1 % ? 1 % 6 # \$: ' - ' " / ' + / < \$ % - ' A 0 1 % 3 , ' : % 2 \$; ' " 5 # 1 + % & ' ' ? , / 2 ; 0 1 ' + / " ' + % ' - " ' + . (B % 0 1 ' + / 1 , " / - # \$ # 1 8 / 4 < , ' ' + / < \$ 0 1 % 3 % \$ # 4 ; - # , 4 (1 % 6 # \$ 8 2 6 % ? # C , % " 8 A # \$: D \$ # 3 # 0 1 # 6 4 / + % A .) E # 0 # 4 " ' \$ / 4 ; " . < ' " 5 # 1 + % & ' < + # 9 " # " % C \$ ' 3) # 0 1 # 2 8 .

F \$ # \$, # - . + / " \$ % - 9 / + # 9 / \$ 6 8 \$; ' " \$ / 1 / 2 / " . : % 2 \$ " ' - % + 2 # # 6 7 / 2 \$ 3 % FreeBSD , - # \$ # 1 8 / A # \$ (\$. ? " % \$; 6 # 4 ; G / # \$ # + , - % - 1 % 6 # \$ % / \$ 0 1 # / - \$.

6 \$ & + , D - / * +

1. ! , + ' " ' 2 \$ 1 % \$ ' 3 " 8 / , / \$ % 4 '	2
2. I 4 < : ' OpenPGP , 4 (FreeBSD	3
3. Kerberos ' LDAP 3 / 6 - 0 % 1 # 4 ; , 4 (- 4 % 2 \$ / 1 % FreeBSD	4
4. N ' 0 8 6 ' \$ # 3 - # + + ' \$ % (0 1 % 3 " % - # + + ' \$)	5
5. J. - # 3 # , 2 \$ 3 # 0 # Git	7
6. M 2 \$ # 1 ' (2 ' 2 \$ / + 8 - # " \$ 1 # 4 (3 / 1 2 ' C	46
7. B % 2 \$ 1 # C - % , 2 # = 4 % G / " ' ' (' \$ 1 % , ' & ' '	46
8. > 1 / , 3 % 1 ' \$ / 4 ; " % (0 1 # 3 / 1 - % 0 / 1 / , - # + + ' \$ # +	52
9. ^ . 1 " % 4 2 # # 6 7 / " ' C # - # + + ' \$ % A	53
10. > 1 / , 0 # ; \$ ' \$ / 4 ; " % (4 ' & / " ? ' (, 4 (" # 3 8 A 5 % C 4 # 3	63
11. @ \$ 2 4 / 9 ' 3 % " ' / 4 ' & / " ? ' C , 0 1 / , # 2 \$ % 3 4 / " " 8 A 0 1 # / - \$. FreeBSD	64
12. N / = ' SPDX 3 , / 1 / 3 /	65
13. @ \$ " # G / " ' ' (2 1 % ? 1 % 6 # \$: ' - % + '	65
14. Q 2 4 ' 2 # + " / 3 % / \$ / 2 ; É	66
15. Bugzilla	67
16. Phabricator	67
17. I \$ # / 2 \$; - \$ #	68
18. J. - # 3 # , 2 \$ 3 # 0 # 6 8 2 \$ 1 # + . " % : % 4 . 1 % 6 # \$ 8 2 SSH	69
19. E # 2 \$. 0 " # 2 \$; Coverity " , 4 (- # + + ' \$ \$ / 1 # 3 FreeBSD	70
20. T # 4 ; G # C 2 0 ' 2 # - 0 1 % 3 ' 4 - # + + ' \$ \$ / 1 # 3 FreeBSD	70
21. > # , , / 1 9 - % + " # 9 / 2 \$ 3 / " " 8 A % 1 A ' \$ / - \$. 1	80

22. LO/&' 5' : " 8/ FAQ O# O#1\$%+	85
23. >1#64/+8, A%1%- \$/1" 8/ , 4(1%?1%6#\$: ' - #3, " / (34(< 7' A2(- #++' \$\$/1%+ '	92
24. M" 5#1+%&' (# Google Analytics.	92
25. J%?" 8/ 3#01#28	92
26. >1/' +. 7/2\$3% ' 01' 3' 4/= ' ' , 4(- #++' \$\$/1#3 FreeBSD	93

1. . &) * / * ' (, - (* % / O + & + (- 1 *

! "#\$%&#' () *	ssh(1) , \$#4 ; - # 01#\$#- #4 3/12' ' 2
+&*,) - . /#\$O 1&2 , /#1* , ##ř	freefall FreeBSD.org
678797) \$) - 7: *; () -	ref* . FreeBSD.org , uni verse* . freeBSD.org (2+. \$%- 9/ 2284- . H#2\$8 01#/- \$% FreeBSD)
<=7& SMTP	smtp.FreeBSD.org:587 (2+. \$%- 9/ B%2\$1#C- % , #2\$. 0% SMTP).
src/ Git-1/O#?' \$#1' C	ssh://git@git.trepo.FreeBSD.org/src.git
doc/ Git-1/O#?' \$#1' C	ssh://git@git.trepo.FreeBSD.org/doc.git
ports/ Git-1/O#?' \$#1' C	ssh://git@git.trepo.FreeBSD.org/ports.git
>) 5O97)) (7 \$" (\$4(9*\$-\$- &4(developers (\$/A" ' : /2- ' " %?83%/+ 8C all-developers), doc-developers, doc-committers, ports-developers, ports-committers, src-developers, src-committers. (I %9, 8C 1/O#?' \$#1' C 01#/- \$% ' +// \$ 23#' 2#62\$3/" " 8/ 20' 2- ' 1%2284- ' -developers ' -committers. ! 1A' 38 *\$' A 20' 2- #3 + #9" # " %C\$' 3 5%C4%A /local/mail/repository-name-developers-archive ' /local/mail/repository-name-committers-archive " % freefall FreeBSD.org .)
?@7: 7\$23) - 7 #O3AO- # \$) #,) #. 4#: *) 1- (Core Team)	/home/core/public/reports " % - 4%2\$/1/ FreeBSD.org .
?@7: 7\$23) - 7 #O3AO- 4#: *) 1- 5"9*, &7) (2 "#9O*: (/home/portmgr/public/monthly-reports 3 - 4%2\$/1/ FreeBSD.org .
>*@) - 7, 7O4(Git , src/:	stable/n (n-STABLE), main (-CURRENT)

E4(O#, - 4<: /" ' (- A#2\$%+ 01#/- \$% \$1/6. /\$2([ssh\(1\)](#). E#0#4" ' \$/4; " . < ' " 5#1+%&' < + #9" # "%C\$' 3 J. - #3#, 2\$3/ O# 682\$1#+. " %: %4. 1%6#\$8 2 SSH.

>#4/?" 8/ 2284- ' :

- ¥) " . \$1/" " ' / 2\$1%" ' &8 01#/- \$% FreeBSD
- ¥ K?48 01#/- \$% FreeBSD

2. 2134* OpenPGP & 15 FreeBSD

I 1' 0\$#=1%5' : /2- ' / -4<: ' , 2##\$3/\$2\$3. < 7' / 2\$%" , %1\$. OpenPGP (*Pretty Good Privacy*), ' 20#4; ? . < \$2(01#/- \$#+ FreeBSD , 4(%.\$/" '\$ 5' -%&' ' -#++' \$\$/1#3. L##67/" ' (, 2# , /19%7' / 3%9" . < ' " 5#1+%&' < , \$%- ' / -%- 0.64' : " 8/ SSH-- 4<: ' , +#= . \$ 68\$; 0# , 0' 2%" 8 2 0#+ #7; < OpenPGP-- 4<: % , : \$#68 , #- %?%; , : \$# #"' , /C2\$3' \$/4; " # # \$01%34/" 8 -#++' \$\$/1#+. E#0#4" ' \$/4; " . < ' " 5#1+%&' < + #9" # " %CS' 3 PGP & GPG: Email for the Practical Paranoid # \$ Michael Lucas ' https://en.wikipedia.org/wiki/Pretty_Good_Privacy.

2.1. 6\$7&- /* + #134-

L. 7/2\$3. < 7' / -4<: ' + #9" # ' 20#4; ?#3\$; , " # 2" %: %4% ' A 24/ , . /\$ 01#3/1' \$; 2 0#+ #7; < documentation/tools/checkkey.sh.) *\$##+ 24. : %/ . 6/ , ' \$/2; , : \$# . -4<: % /2\$; FreeBSD user ID.

E4(\$/A , . -#=# /7D " /\$ -4<: % OpenPGP ' 4' \$1/6. /\$2(" #38C -4<: , 2##\$3/\$2\$3. < 7' C \$1/6#3%" ' (+ 6/?#0%2" #2\$' FreeBSD , ? , /2; 0#- %?" # , -% - /=# 2="/ /1' 1#3\$; .

1. K2\$%" #3' \$/ security/gnupg. E#6%3; \$/ 24/ , . < 7' / 2\$1#- ' 3 ~/.gnupg/gpg.conf, : \$#68 % , %\$; + ' " ' +%4; " # 01' /+4/+8/ "%2\$1#C- ' , 4(0# , 0' 2' ' 01/ , 0#: \$/" ' C " #38A -4<: /C (0# , 1#6" // 2+ . 3 , #- . +/" \$%&' ' 0# #0&' (+ GnuPG):

```
# Sorted list of preferred algorithms for signing (strongest to weakest).
personal-digest-preferences SHA512 SHA384 SHA256 SHA224
# Default preferences for new keys
default-preference-list SHA512 SHA384 SHA256 SHA224 AES256 CAMELLIA256 AES192
CAMELLIA192 AES CAMELLIA128 CAST5 BZIP2 ZLIB ZIP Uncompressed
```

2. L="/ /1' 1#3\$; -4<: :

```
% gpg --full-gen-key
gpg (GnuPG) 2.1.8; Copyright (C) 2015 Free Software Foundation, Inc.
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
```

```
Warning: using insecure memory!
Please select what kind of key you want:
  (1) RSA and RSA (default)
  (2) DSA and Elgamal
  (3) DSA (sign only)
  (4) RSA (sign only)
Your selection? 1
RSA keys may be between 1024 and 4096 bits long.
What keysize do you want? (2048) 2048 !
Requested keysize is 2048 bits
```

Please specify how long the key should be valid.

É 0 = key does not expire

É <n> = key expires in n days

É <n>w = key expires in n weeks

É <n>m = key expires in n months

É <n>y = key expires in n years

Key is valid for? (0) 3y "

Key expires at Wed Nov 4 17:20:20 2015 MST

Is this correct? (y/N) y

GnuPG needs to construct a user ID to identify your key.

Real name: Chucky Daemon #

Email address: notreal@example.com

Comment:

You selected this USER-ID:

"Chucky Daemon <notreal@example.com>"

Change (N)ame, (C)omment, (E)mail or (O)kay/(Q)uit? o

You need a Passphrase to protect your secret key.

! 2048-6' \$" 8/ -4<: ' 2 \$1DA4/\$" ' + 21#- #+ , /C2\$3' (#6/20/: ' 3%<\$, #2\$%\$#: " . < ?%7' \$. "% , %" " 8C +##+/" \$ (2022-10).

" L1#- , /C2\$3' (-4<: % 3 \$1' =#, % , #2\$%\$#: " # +%4, : \$#68 . 2\$%1/3G' / -4<: ' , #24%64/" " 8/ 1%2\$. 7/C +#7" #2\$; < -#+0; <\$ /1#3, 0/1/2\$%4' ' 20#4; ?#3%\$; 2(, " # , #2\$%\$#: " # 3/4' -, : \$#68 . +/" ; G' \$; 01#64/+8 . 01%34/" ' (-4<: %+ ' .

M20#4; ?. C\$/ ? , /2; 23#D "%2\$#(7// ' +(, 01/, 0#: \$' \$/4; " # 2#30%, %< 7// 2 . -%?" " 8+ 3 . , #2\$#3/1/" ' ' 4' : " #2\$' , 38, %" " #+ =#2. , %12\$3#+, : \$#68 , 1. = ' + 684# 01#7/ 0#, \$3/1, ' \$; 3%G. 4' : " #2\$; . N/-2\$, -#\$#18C +#9/\$ 0##+; ; , 1. = ' + ' , /" \$' 5' &' 1#3%\$; 3%2, +#9" # 33/2\$' 3 1%?, /4 \$%&&' ()*+, -. >#24/ 33#, % %, 1/2% *4/- \$1#" "#C 0#: \$8 ?%01%G' 3%/\$2(0%1#4; "%(51%?%. O/\$#, 8 2#?, %" ' (6/?#0%2" #C 0%1#4; " #C 51%?8 38?83%<\$ 20#18.) +/2\$# \$#=# : \$#68 01/, 4%=%\$; #, " " 20#2#6, 3#\$ " /2- #4; - # 2284#- "% 2%CS8, #0' 283%< 7' / 1%?4' : " 8/ +/\$#, 8: <https://world.std.com/~reinhold/diceware.html>, <https://www.iusmentis.com/security/passphrasefaq/>, <https://xkcd.com/936/>, <https://en.wikipedia.org/wiki/Passphrase>.

P%7' \$' \$/ ?%- 18\$8C -4<: ' 0%1#4; " . < 51%?.. Q24' ?%- 18\$8C -4<: ' 4' 0%1#4; "%(51%?% +#=#4' 68\$; 2- #+01##+/\$' 1#3%" 8 ' 4' 1%2- 18\$8, " /+/, 4/" " # . 3/, #+ ' \$/ accounts@FreeBSD.org ' #?#3' \$/ -4<: .

R' - 2%&' (" #3#=# -4<: % 0#- %?" "% 3 S %=' , 4(" #38A -##+ ' \$\$/1#3.

3. Kerberos * LDAP %+8-9- , \$1: &15 #1- ' (+, - FreeBSD

I 4%2\$/1 FreeBSD \$1/6. /\$ 0%1#4; Kerberos , 4(, #2\$. 0% - #01/, /4D" " 8+ 2/13' 2%+. >%1#4; Kerberos \$%- 9/ 24. 9' \$ 3/6-0%1#4/+ LDAP, 0#2- #4; -. LDAP 01#-2' 1. /\$?%01#28 - Kerberos 3

-4%2\$/1/. B/- #\$\$\$18/' ? 2/13' 2#3, \$1/6. < 7' A /=#, 3- 4< : %< \$:

¥ Bugzilla

E4(2#?, %" ' (" #3#C . : D\$" #C ?%O' 2' Kerberos 3 - 4%2\$/1/ FreeBSD ' 4' 261#2% O%1#4(Kerberos , 4(2. 7 /2\$3. < 7/C . : D\$" #C ?%O' 2' 2' 20#4; ?#3%" ' /+ =/" /1%\$#1% 24. : %C" 8A O%1#4/C:

```
% ssh kpasswd.freebsd.org
```



F\$# , #49" # 68\$; 380#4"/" # 2 -#+0; < \$/1% ?% O1/, /4%+' - 4%2\$/1% FreeBSD.org.

>%1#4; Kerberos \$%- 9/ +#9" # .2\$%" #3' \$; 31.: ".<, 3#C, (3 [freefall.FreeBSD.org](#) ' 380#4" ' 3:

```
% kpasswd
```



Q24' 1%" // " / ' 20#4; ?#3%4' 2; %.\$/" \$' 5' &' 1#3%" " 8/ : /1/? Kerberos 24. 968 - 4%2\$/1% FreeBSD.org, 6. , /\$ #\$\$\$61%9/" # 2##67/" ' / [Client unknown](#). F\$% #G' 6-% #?" %: %/\$, : \$# 2" %: %4% "/#6A#, ' +# ' 20#4; ?#3%; +/\$#, [ssh kpasswd.freebsd.org](#), 0#- %?" " 8C 38G/, , 4(' "' &' %4' ?%&' ' . : D\$" #C ?%O' 2' Kerberos.

4. ; * 90 8* (\$% #%)) * (- (9, - % / - #%)) * ()

J/O#?' \$#1' C FreeBSD 2#, /19' \$ 1(, -#+0#" /" \$#3, -#\$\$\$18/ 3 2#3#-. 0" #2\$' 0#, , /19' 3%< \$ ' 2A#, " 8C -#, 6%?#3#C #O/1%&' #" " #C 2' 2\$/+8, , #- . +/" %&' <, ' " 51%2\$1. -\$. 1. O#1\$#3 2\$#1#" "' A O1' 4#9/" ' C ' 1%?4' : " 8/ 0#, , /19' 3%/+8/ . \$' 4' \$8. >1' 38, /4/" ' ' O1%3 "% -#++' \$ (commit bits) 3 FreeBSD . -%?83%< \$2(#64%2\$' , /1/3%, =, / *\$' O1%3% +#= . \$ 68\$; ' 20#4; ?#3%" 8. I %- O1%3' 4#, #64%2\$' , 23(?%" " 8/ 2 O1%3%+' , #51%9%< \$, - \$# %3\$#1' ?#3%4 ' A 38, /4/" ' / . E#O#4" ' \$/4; " 8/ #64%2\$' O#4" #++: ' C +#= . \$ 68\$; , #6%34/" 8 O#?9/: 3 *\$#+ 24. : %/ -#++' \$\$/1 , #49/" 24/, #3%\$; 2\$%" , %1\$" #C O1#&/, . 1/ 38, /4/" ' (O1%3 "% -#++' \$, 4(2##\$3/\$2\$3. < 7/C #64%2\$' , /1/3%, O#4. : ' 3#, #61/" ' / #5 2##\$3/\$2\$3. < 7/C ' " 2\$%" &' ' ' , 3#?+#9" #, "%2\$%3" ' -%, 4(*\$#C #64%2\$' " % " /- #\$\$\$18C O/1' #, 31/+/" ' .

B(" 4#: : (OO79*	CO, 7O\$O, 7)) - .	D#: "#) 7) O- 1797, * (\$/#1) #' # 4#1*
src	srcmgr@	src/
doc	doceng@	, #- . +/" %&' (doc/, ports/, src/
ports	portmgr@	ports/

T' \$8 -#++' \$#3, 38, /4/" " 8/ , # 1%?1%6#\$- ' -#" &/O&' ' #64%2\$/C #3/\$2\$3/" " #2\$' , +#= . \$ 68\$; O#, A#, (7' +', 4(' 20#4; ?#3%" ' (3# + "#=' A : %2\$(A , /1/3%. @, "%- # ?, 1%38C 2+824 O#, 2- %?83%/ \$, : \$# -#++' \$\$/1, 1%" // " / 1%6#\$%3G' C 3 #O1/, /4D" " #C #64%2\$' , /1/3%,

, #49/" 0/1/, -#++' \$#+ 0#4.: ' \$; 1/&/"?' 1#3%"' / (review), 2#-4%2#3%"' / # \$ 2##\$3/\$2\$3. < 7/=# #3/\$2\$3/" "#=# 4' &' /' 4' 1%6#\$%; 2 "%2\$%3"' -#+. >#2-#4; -. 01%3' 4% 0#, /19-' -#, % 1%?4' : %< \$2(3 ?%3' 2' + #2\$' # \$ #64%2\$' , /1/3%, *\$# 3%9" # -%- , 4(2%+## -#++' \$\$/1%, 1%6#\$%< 7/=# 3 +/" // ?" %-#+#C #64%2\$' , \$%- ' , 4(, 1.= ' A .: %2\$"' -#3, 1%6#\$%< 7' A 2 , /1/3#+.

I #++' \$\$/1%+ 1/-#+/ , ./ \$2(?%01%G' 3%; 1/&/"?' 1#3%"' / 23#/C 1%6#\$8 3 1%+-%A #68: "#=# 01#&/22% 1%?1%6#\$-' , "/?%3' 2' + # \$ #64%2\$' , /1/3%, 3 -#\$#1#C 01# 2A#, ' \$ 1%6#\$%.

4.1. < \$1 * (* #- - # (* % / \$ ' (* # \$)) * ((+ , \$ % % & , " = * > & + , + % : 5 >

¥) 2/ -#++' \$\$/18 +#=# \$ ' ?+/" (\$; 5%C48 src/share/misc/committers-*.dot, src/usr.bin/calendar/calendars/calendar.freebsd ' ports/astro/xearth/files.

¥ E#- . +/" \$%&' #" " 8/ -#++' \$\$/18 +#=# \$ 3" #2' \$; ' ?+/" /" ' (3 , #- . +/" \$%&' < 3 5%C48 src, \$%- ' / -%- 1. -#3#, 2\$3%, README, 6%?8 , %" " 8A fortune, -%4/" , %1" 8/ 5%C48 ' ' 201%34/" ' (-#++/" \$%1' /3, 6/? #, #61/" ' (-#++' \$\$/1% src, 01' .24#3' ' 2#64< , /" ' (#68: " 8A 01%3' 4' 3" ' +%" ' (-#++' \$%+.

¥ U<6#C -#++' \$\$/1 +#9/\$ 3" #2' \$; ' ?+/" /" ' (3 4<6#/ , 1.=#/ , /1/3# 2 0#+/\$- #C "Approved by" # \$ "/- . 1' 1. /+## -#++' \$\$/1% 2 2##\$3/\$2\$3. < 7' + ' 01%3%+ ' . I. 1' 1. /+8/ -#++' \$\$/18 (' +/< 7' / " %2\$%3"' -%) +#=# \$ 01/, #2\$%34(\$; 0#+/\$- . "Reviewed by", " # " / "Approved by".

¥ I #++' \$\$/18 +#=# \$ 0#4.: ' \$; , #0#4"' \$/4;" 8C 6' \$ 0# #68: "#+. 01#&/22.: "%CS' "%2\$%3"' -%, -#\$#18C 01/, 4#9' \$ ' A srcmgr, doceng ' 4' portmgr, 3 ?%3' 2' + #2\$' # \$ 2' \$.%&' ' . >#24/ #, #61/" ' (' A , #6%3(\$ 3 'access', ' "%: "D\$2(2\$%" , %1\$" 8C 0/1' #, "%2\$%3"' : /2\$3%, -#\$#18C 6. , /\$ 3-4< : %%; 01#, #49/" ' / # \$+/\$- ' "Approved by" 3 \$:/ /" ' / "/- # \$ #1#=# 31+/ /" ' .

4.1.1. ?+5%/\$+ (9\$ ") \$14- / * 3) \$&\$8, +/*+ &15 &\$#") +/(-@**

B/- # \$ #18/ \$' 08 ' 201%34/" ' C ' +/< \$ "#, #61/" ' / 0# . + #4: %" ' < " # \$ V1.00% O/" / , 9/1#3 E/1/3% E#- . +/" \$%&' ' <doceng@FreeBSD.org>, : \$# 0#?3#4(/\$ 4<6#+. -#++' \$\$/1. ' 201%34(\$; *\$' -%\$/=#1' ' 01#64/+ 3 4<6#C : %2\$' , /1/3%, #- . +/" \$%&' ' . FS' ' 201%34/" ' ("/ \$1/6. < \$ #, #61/" ' (' 4' 01#3/1-' # \$ -#++' \$\$/1% , #- . +/" \$%&' ' , /24' . %3\$#1% "/ \$ 01%3 "% -#++' \$ 3 , #- . +/" \$%&' <.

@67// #, #61/" ' / 01' +/" (/ \$2(- 24/, . < 7' + \$' 0%+ ' 201%34/" ' C:

¥ @O/: %\$- '

¥ N1' 3' %4; " 8/ ' 201%34/" ' (

>. "- \$.%&' (, URL-%, 1/2%, , %\$8, 0. \$' ' ' +/" % 5%C4#3 2 . 2\$%1/3G/C ' 4' " /- #11/- \$" #C ' " 5#1+%&' /C, % \$%-9/ , 1.= / 1%201#2\$1%" D" " 8/ #G' 6-' , -#\$#18/ +#=# \$ 33/2\$' : ' \$%\$4/C 3 ?%64. 9, /" ' /.

P% =#, 8 3 , /1/3/ , #- . +/" \$%&' ' 684' " / (3" # #, #61/" 8 " /- # \$ #18/ 24. : %' . FS\$ 20' 2#-

O#- %?83%/\$ "%' 6#4// 1%201#2\$1%" D" " 8/ ' ? "' A:

¥ M?+/" /"' (3 documentation/content/ru/books/porters-handbook/versions/_index.adoc

P" %: /"' ([_FreeBSD_version](#) (J. -#3#, 2\$3# 0# 2#?, %" ' < 0#1\$#3), 3 #2" #3" #+ ' 20#4; ?. /\$2(-#++' \$\$/1%+' src.

¥ M?+/" /"' (3 doc/shared/contrib-additional.adoc

L#01#3#9, /"' / 1%?, /4% E#0#4"' \$/4; " 8/ .: %2\$"' - ' FreeBSD.

¥) 2/ S %=' , 4(" #38A -#++' \$\$/1#3, 23(?%" " 8/ 2 , #- . +/" %&' /C

¥ J/- #+/" , %&' ' 0# 6/?#0%2" #2\$' ; K3/, #+4/"' (#6 #G' 6- %A; J/4' ?8;

I #+%" , % @5' &/1% T/?#0%2" #2\$' <security-officer@FreeBSD.org> ' V1.00%) 80. 2- % J/4' ?#3
FreeBSD <re@FreeBSD.org> ' 20#4; ?. < \$ *\$' 1%?, /48.

¥ M?+/" /"' (3 website/content/ru/donations/donors.adoc

I ##1, ' "%\$#1 0#9/1\$3#3%" ' C , 4(01#/- % Free BSD <donations@FreeBSD.org> ' 20#4; ?. /\$ *\$#\$, #- . +/" \$.

>/1/, 4<68+ -#++' \$#+ "/#6A#, ' ++ 380#4"' \$; \$/2\$#3. < 26#1-.; 0#, 1#6" #2\$' 2+. 3
1%?, /4%A Ç@6?#1È ' Ç>1#&/22 26#1-' , #- . +/" %&' ' FreeBSDÈ J. -#3#, 2\$3% , 4(" #38A
. : %2\$"' -#3 01#/- %\$, #- . +/" %&' ' FreeBSD.

5. ! " # \$ % & ' (% \$ 9 \$ Git

5.1. A' / \$ % O Git

>1' 0# 2- / 0# -4<: /38+ 24#3%+ "Git Primer" +#9" # "%CS' +" #9/2\$3# A#1#G' A
+ %\$ /1' %4#3. L\$1%" ' &8 E*" ' /4% O' 4/1%) 3/, /"' / 3 Git ')' 44')' 44. 2% Git - I 1%\$- #/
33/, /"' / (34(<\$2(A#1#G' +' #6?#1%+' . I "' =% 0# Git \$%-9/ O#4" % (, " # =#1%?, # , 4' " " //:
<https://git-scm.com/book/en/v2>. N%- 9/ #61%\$' \$/ 3"' +%" ' / "% 2%CS <https://dangitgit.com/>,
0#23(7D" " 8C 1%201#2\$1%" D" " 8+ 4#3. G- %+ ' 0#, 3#, " 8+ -%+" (+ Git, "% 24. : %C, /24' 3%+
. 9" # ' 201%3' \$; #G' 6- ' . B%- #"/&, 33/, /"' /, #1' /" \$' 1#3%" " #/ "% -#+0; <\$/1" 8A . : D" 8A,
#- %?%4#2; 0#4/?" 8+ , 4(" /- # \$ #18A 3 #6W(2" /"' ' +' 1#3#??1/"' (Git.

FS#\$, #- . +/" \$ 01/, 0#4%=%/\$, : \$# 38 . 9/ : ' \$%4' 01# *\$#, ' 0#2\$1%/S2(" / 0#3\$#1(\$; #2" #38
(A#\$(- 1%\$- # ' A 1%22+ # \$1' \$).

5.2. B * / * -, " # \$ % & ' (% \$ 9 \$ Git

FS# 1. -#3#, 2\$3# ' +// \$ +/" // % +6' &' #?" 8/ &/4' , : /+ 2\$1# / 1. -#3#, 2\$3# 0# Subversion, " #
, #49" # #A3%\$' \$; #2" #38.

5.2.1. A81- ' (: 9, *) +/+/* 5

```
Q24' 38 A#$' $/ ?%=1.?' $; FreeBSD, 2#61%$; /=#'?' 2A#, " 8A -#, #3 ' 3 &/4#+ 0#, , /19' 3%$;
%-$.%4;" #2$; $%- ' + 20#2#6#+, *$# 1. -#3#, 2$3# , 4( 3%2. @" # #A3%$83%/$ 0#4.: /"' /
' 2A#, " 8A -#, #3, ' A #6" #34/"' /, 6' "%1" 8C 0# ' 2- (bisect) ' - 1%$-# ?%$1%=' 3%/$ 20#2#68
1%6#$8 2 4#-%4;" 8+' ' ?+/"' ' (+'. ) " D+ ' ?4#9/" 8 #2" #38, % $%- 9/ , %" 8 0#4/" 8/
2284-' "% 6#4// =4.6#-' / +%$/1' %48 , 4( 24.: %/3, -#=#, % : ' %$/4< 6. , /$ " /, #2$%$#: " #
6%?#3#C ' " 5#1+%&' ' . E1.= ' / 1%?, /48 *$#=# 1. -#3#, 2$3# 0#23(7/" 8 6#4// 24#9" 8+ $/+#+,
23(?% " 8+ 2. : %2$' /+ 3 01#/- $/.
```

```
X/4; *$#=# 1%?, /4% Ñ 38, /4' $; $/ %20/- $8 Git, -#$#18/ "/#6A#, ' +8 , 4( #24/9' 3%" ' (
' 2A#, " 8A -#, #3. >1/, 0#4%=%/$2( 6%?#3#/ 0#" ' +%'' / Git. ) ' "$/1" /$ / 2$; + " #9/2$3#
33#, " 8A 1. -#3#, 2$3 0# Git, " # I "' =% 0# Git 01/, 4%=%/$ #, " #' ? 4. : G' A' ?4#9/"' C.
```

5.2.2. ?- 4- 1\$, - 8\$(O &15 , - 7, - 8\$(4* #\$\$%

```
FS#$ 1%?, /4 #0' 283%/$ , #2$. 0 "% : $/"' / ' ?%0' 2; , 4( -#+++' $$/1#3, : $68 #S01%34($;
-#+++' $8 # $ 1%?1%6#$: ' -#3' 4' -#" $1' 6; < $#1#3.
```

5.2.2.1. <\$%' +&/+%/ \$+ *' 9\$1: 7\$%- / * +

!

```
) 01' 3/, D" " 8A "' 9/ 01' +/1%A ?%+/"' '$/ ${repo} "% ' +( ". 9" #=#
1/0#?' $#1' ( FreeBSD: doc, ports ' 4' src.
```

¥ I 4#" ' 1#3%\$; 1/0#?' \$#1' C:

```
% git clone -o freebsd --config remote.freebsd.fetch='+refs/notes/*:refs/notes/*'
https://git.freebsd.org/${repo}.git
```

) 1/? . 4; \$\$\$/ . 3%2 3 -%: /2\$3/ . , %4D" " 8A (remote) , #49" 8 68\$; #5' &' %4; " 8/ ?/1- %4%:

```
% git remote -v
freebsd https://git.freebsd.org/${repo}.git (fetch)
freebsd https://git.freebsd.org/${repo}.git (push)
```

¥ B%2\$1#C- %, %" " 8A -#+++' \$\$/1% FreeBSD:

```
H. - , 4( -#+++' $% 3 repo.freebsd.org 01#3/1(/$, :$# 0#4/ "Commit" 2##$3/$2$3. /$
' " 5#1+%&' ' # -#+++' $$/1/ 3 FreeBSD.org. L%+8C 01#2$#C 20#2#6 0#4.: ' $;
01/, 4%=%/+. < -#" 5' =. 1%&' < Ñ 380#4"' $; 2- 1' 0$ /usr/local/bin/gen-gitconfig.sh "%
freefall:
```

```
% gen-gitconfig.sh
[...]
% git config user.name (your name in gecos)
% git config user.email (your login)@FreeBSD.org
```

¥ K2\$%" #3' \$/ URL , 4(#S01%3- ' (push URL):

```
% git remote set-url --push freebsd git@git.trepo.freebsd.org:${repo}.git
```

) \$%- #+ 24. :%/ . 3%2 , #49" 8 68\$; 1%?, /4; " 8/ URL , 4(' ?34/: /"' (fetch) ' #S01%3- ' (push) -%- " '% 6#4// *55/- '\$' 3" %(" %2\$1#C-%:

```
% git remote -v
freebsd https://git.freebsd.org/${repo}.git (fetch)
freebsd git@git.trepo.freebsd.org:${repo}.git (push)
```

Q7/ 1%? #61%\$' \$/ 3"' +%"' /, :\$# git.trepo.freebsd.org (34(/\$2(02/3, #"' +##+ , 4(repo.freebsd.org.

¥ K2\$%" #3- % A. - % , 4(G%64#" % 2##67 /"' (- #++ ' \$%:

E4(1/O#?' \$#1' (, #- . +/" \$%&' ' :

```
% cd .git/hooks
% ln -s ../../hooks/prepare-commit-msg
```

E4(1/O#?' \$#1' (0#1\$#3:

```
% git config --add core.hooksPath .hooks
```

E4(1/O#?' \$#1' (src:

```
% cd .git/hooks
% ln -s ../../tools/tools/git/hooks/prepare-commit-msg
```

5.2.2.2. C+(#- "admin"

R%C48 access ' mentors A1%" (\$2(3 #\$, /4; " #C (orphan) 3/\$-/ internal/admin 3 -%9, #+ 1/O#?' \$#1' ' .

L4/, . < 7' C 01' +/1 0#- %?83%/\$, -%- 0/1/- 4<: ' \$; 2((check out) "% 3/\$- . internal/admin 3 4#-%4; " #C 3/\$- / 2' +/" /+ admin:

```
% git config --add remote.freebsd.fetch '+refs/internal/*:refs/internal/*'
% git fetch
% git checkout -b admin internal/admin
```

) -%: /2\$3/ %4; \$/1" %\$' 38 38 +#9/\$/ , #6%3' \$; 1%6#: // , /1/3# , 4(3/\$- ' admin:

```
git worktree add -b admin ../${repo}-admin internal/admin
```

```
E4( 01#2+#$1% 3/$- ' internal/admin 3 3/6- ' "$/15/C2/: https://cgit.freebsd.org/\${repo}/log/?h=internal/admin
```

```
E4( #01%3- ' (push) . -%9' $/ 0#4" . < 20/&' 5' -%&' < 2284- ' :
```

```
git push freebsd HEAD:refs/internal/admin
```

5.2.3. 2- # 9\$&&+, D*%- (: - #(" - 1: /" 3 #9* 3 &+, +%- *' >\$&/O> #&&\$%

FreeBSD src

```
>/138C G%=: - 4#" ' 1#3%" ' / , /1/3%. FS# ?%=1. 9%/$ 32D , /1/3# &/4' - #+. L. 7/2$3. /$ , 3%  
20#2#6% ?%=1. ?- ' . T#4; G' " 2$3. 0#4; ?#3%$/4/C 0#$1/6. /$2( =4. 6#- #/ - 4#" ' 1#3%" ' /  
1/0#?' $#1' ( . @, "%- # 683%<$ 24. : '% , - #=, % + #9/$ 0#$1/6#3%; 2( 0#3/1A" #2$" #/  
- 4#" ' 1#3%" ' /.
```

5.2.3.1. ?- 7%- /* 5%+(\$#

FreeBSD-CURRENT ' 20#4; ?./ \$ 3/\$- . main.

```
main Ñ *$# 3/$- % 0# . + #4: %" ' < .
```

```
E4( FreeBSD-STABLE "%?3%" ' ( 3/$#- 3- 4<: %<$ stable/12 ' stable/13.
```

```
E4( FreeBSD-RELEASE, "%?3%" ' ( 3/$#- 1%?1%6#$- ' 380. 2- #3 3- 4<: %<$ releng/12.4 ' releng/13.2.
```

<https://www.freebsd.org/releng/> #61%9%/\$:

```
¥ 3/$- ' main ' stable/! # $- 18$8
```

```
¥ 3/$- ' releng/! , -%9, %(' ?- # $#18A ?%+ #1%9' 3%/$2( 01' 2#?, %" ' ' $/= % 1/4' ?%.
```

>1' +/18:

```
¥ $/= release/13.1.0 "% 3/$- / releng/13.1
```

```
¥ $/= release/13.2.0 "% 3/$- / releng/13.2.
```

5.2.3.2. !+9\$7* (\$, **

```
>#9%4. C2$%, #61%$' $/2; - 1%?, /4. !, + ' " 2$1%$' 3" 8/ , /$%4' , 4( 0#4. : /" ' ( %- $. %4; " #C  
' " 5#1+%&' ' # $#+, =, / 3?($; ' 2A#, " 8/ -#, 8 FreeBSD. P" %: /" ' / $URL " ' 9/ + #9" # 0#4. : ' $;  
2 *$#C 2$1%" ' &8.
```

```
>1' +/: %" ' /: >1#/- $ " / ' 20#4; ?./ $ 0#, +#, . 4' , $%- -%- #" ' 04#A# 0#, A#, ($ , 4( "%G' A  
1%6#: ' A 01#&/22#3 ' +#, /4' 1%?1%6#$- ' . N#, -%- +8 # $24/9' 3%/+ ' ?+/" /" ' ( 3 2$#1#" ' ' A  
01' 4#9/" ' (A, #62. 9, %/$2( 3 , 1. =#+ +/2$/ ' , -%- 01%3' 4#, +%4# ' " $/1/2. /$ #68: " #=#  
0#4; ?#3%$/4(.
```

5.2.3.3. <\$1/OE #1\$/

```
>#4" 8C -4#" ?%=1. 9%/$ 32D , /1/3# &/4' -#+, 3-4<: %( 32< ' 2$#1' < ' 3/$-' . FS# 2%+ 8C
01#2$#C 20#2#6. @" $%- 9/ 0#?3#4(/$ ' 20#4; ?#3%$; 5. "-&' < Git worktree, : $#68 32/
%-$' 3' 8/ 3/$-' 684' ' ?34/: /" 8 3 #$, /4; " 8/ -%$%4#=' , " # 2 /, ' " 2$3/" "#C -#0' /C
1/0#?' $#1' (.
```

```
% git clone -o freebsd $URL -b branch [<directory>]
```

```
ŸŸ#?, %2$ 0#4". < -#0' <. branch , #49"% 68$; #, "#C ' ? 3/$#-, 0/1/: ' 24/" " 8A 3
01/, 8, . 7/+ 1%?, /4/. Q24' 0%1%+/$1 branch " / .-%?%": 6. , /$ ' 20#4; ?#3%$; 2( 3/$-% 0#
.+ #4: %" ' < (main). Q24' 0%1%+/$1 <di rectory> " / .-%?%": ' +( "#3#=# -%$%4#=% 6. , /$
2##$3/$2$3#3%$; ' +/" ' 1/0#?' $#1' ( (doc, ports ' 4' src).
```

```
)%+ 0#"%, #6' $2( 0#4" 8C -4#" , /24' 3%2 ' "$/1/2. /$ ' 2$#1' (, 38 04%" ' 1. /$ / 3" #2' $;
4#-%4; " 8/ ' ?+/" /" ' ( ' 4' 1%6#$%$; 6#4// : /+ 2 #, "#C 3/$-#C. FS# $%- 9/ 2%+ 8C 01#2$#C
20#2#6 0#, , /19' 3%$; %-$. %4; " #2$; . Q24' 3%2 ' "$/1/2. /$ ' 2$#1' (, " # 38 1%6#$%/ $/ $#4; -# 2
#, "#C 3/$-#C ' . 3%2 +%4# +/2$, 38 $%- 9/ + #9/$ / ' 20#4; ?#3%$; --single-branch, : $#68
?%=1. ?' $; $#4; -# #, ". 3/$-. (A#$( "/-# $#18/ -#++' $8 24' (" ( "/ 6. , . $ 2284%$; 2( "%
3/$-. , ' ? -# $#1#C 01#?#G4# 24' (" /, : $# + #9/$ 68$; 3%9" # , 4( "/-# $#18A
0#4; ?#3%$/4/C, ' "$/1/2. <7' A2( , /$%4; " 8+' 3/12' (+ ' ' 2$#1' ' ).
```

5.2.3.4. F-' (*4/OE #1\$/

```
Z%2$' : " 8C -4#" -#0' 1. /$ $#4; -# 2%+ 8C %-$. %4; " 8C -#, , " # " / 3-4<: %/$ ' 4' 3-4<: %/$
4' G; +%4. < : %2$; ' 2$#1' ' . FS# + #9/$ 68$; 0#4/?" #, -#=#, % 3%+ ". 9" # 2#61%$;
#01/, /4D" ". < 1/3' ?' < FreeBSD ' 4' -#=#, % 38 $#4; -# "%: ' "%/$/ ' 04%" ' 1. /$ / 6#4// 0#4" #
#$24/9' 3%$; , /1/3#. N%- 9/ 38 + #9/$ / ' 20#4; ?#3%$; /=#, : $#68 #=1%" ' : ' $; ' 2$#1' < $#4; -#
#01/, /4D" " 8+ -#4' : /2$3#+ 1/3' ?' C. @, "%- # #61%$' $/ 3" ' +% " / " % 2. 7/2$3/" "# /
#=1%" ' : /" ' / *$#=# 0#, A#, %, #0' 2%" "# / " ' 9/.
```

```
% git clone -o freebsd -b branch --depth 1 $URL [dir]
```

```
FS# -4#" ' 1. /$ 1/0#?' $#1' C, " # 6. , /$ 2#, /19%$; $#4; -# 2%+. < 0#24/, "<< 3/12' < 3
1/0#?' $#1' ' . @2$%4; "%( ' 2$#1' ( " / ?%=1. 9%/$2(. Q24' 0#?9/ 38 0/1/, . +%/$/, 38 + #9/$/
380#4" ' $; git fetch --unshallow, : $#68 0#4. : ' $; 2$%1. < ' 2$#1' <.
```

||

```
>1' : %2$' : "#+ -4#" ' 1#3%" ' ' 38 0#$/1(/$ / 2: /$: ' - -#++' $#3 3 383#, /
-#+%" , 8 uname. FS# + #9/$ ?%$1. , " ' $; #01/, /4/" ' / " /#6A#, ' + #2$'
#6" #34/" ' ( 2' 2$ /+ 8 01' 380. 2- / 6< 44/$/" ( 6/?#0%2" #2$' .
```

5.2.3.5. 68\$, #-

```
>#24/ ?%=1. ?-' 26#1-% 380#4" (/S2( $%- , -%- #0' 2%" # 3 J. -#3#, 2$3/, "%01' +/1:
```

```
% cd src
% make buildworld
```

```
% make buildkernel
% make installkernel
% make installworld
```

\$%- : \$# ?, /2; *\$# " / 6. , /\$ 1%22+ %\$1' 3%\$; 2(0#, 1#6" #.

Q24' 38 A#\$' \$/ 2#61%\$; 2#62\$3/" " #/ (, 1#, 3 1%?, /4/ -#" 5' =. 1%&' ' (, 1% 1. -#3#, 2\$3% FreeBSD 1/- #+/" , . /\$2(2#?, %\$; 5%C4 MYKERNEL 3 sys/\$ {ARCH}/conf 2 3%G' + ' ' ?+/" /" ' (+ ' "% #2" #3/ GENERIC. Z\$#68 Git '=' #1' 1#3%4 MYKERNEL, /=# +#9" # , #6%3' \$; 3 .git/info/exclude.

5.2.3.6. A8/\$%1+/*+

E4(#6" #34/" ' (#6#' A \$' O#3 , /1/3; /3 ' 20#4; ? . < \$2(#, ' "%- #38/ -#+%" , 8. F\$# ?%=1. 9%/ \$ (pull) 32/ ' ?+/" /" ' (, 2, /4%" " 8/ 0#24/ 0#24/, "/=# #6" #34/" ' (.

```
% git pull --ff-only
```

#6" #3' \$, /1/3#.) Git 'O/1/+#\$- %' (fast forward) Ñ *\$# 24' (" /, -#\$#1#/ \$#4; -# 0/1/+ /7%/ \$. -%?%\$ /4; 3/\$- ' ' " / \$1/6. /\$ O/1/2#?, %" ' (-#++ ' \$#3. Q24' 32/=, % 380#4" (\$; 24' (" //??%=1. ?- . (merge/pull) 2 O/1/+#\$- #C, *\$# =%1%" \$' 1. /\$ \$#: " . < -#0' < , /1/3% FreeBSD. F\$# 3%9" #, /24' 38 A#\$' \$/ 0#, , /19' 3%\$; 4#-%4; " 8/ 0%\$: ' .

L+. " ' 9/, -%- . 01%34(\$; 4#-%4; " 8+ ' ' ?+/" /" ' (+ . L%+ 8C 01#2\$#C 20#2#6 Ñ ' 20#4; ?#3%\$; --autostash 3 -#+%" , / git pull , " # , #2\$. 0" 8 ' 6#4// 24#9" 8/ 3%1' %" \$8.

5.2.4. CO8\$, #\$/#, +(/\$E %+, ' * *

) Git -#+%" , % git checkout ' 20#4; ? . /\$2(, 4(0/1/- 4<: /" ' (-%- +/9, . 3/\$- %+' , \$%- ' +/9, . -#" -1/\$" 8+ ' 3/12' (+' .) /12' ' 3 Git 01/, 2\$%34(<\$ 2#6#C , 4' " " 8/ A/G' , % " / 0#24/, #3%\$ /4; " 8/ " #+ /1%.

I #=, % 38 ' ?34/- %/\$/ -#" - 1/\$" . < 3/12' < , 01#2\$# . -%9' \$/ " . 9" 8C A*G 3 -#+%" , "#C 2\$1#- / (-#+%" , % git log +#9/\$ 0#+#; : 3%+ #01/, /4' \$; 2(, -%- #C A*G 3861%\$;):

```
% git checkout 08b8197a74
```

' 3%+ *\$# 2- #0' 1#3%" # (checkout).) 8 . 3' , ' \$/ 2##67/" ' /, 0#A#9// "% 24/, . < 7//:

Note: checking out '08b8197a742a96964d2924391bf9fdfeb788865d' .

You are in a 'detached HEAD' state. You can look around, make experimental changes and commit them, and you can discard any commits you make in this state without impacting any branches by performing another checkout.

If you want to create a new branch to retain commits you create, you may do so (now or later) by using -b with the checkout command again. Example:

```
git checkout -b <new-branch-name>
```

```
HEAD is now at 08b8197a742a hook gpiokeys.4 to the build
```

```
=, / O#24/, " (( 2$1#-% 5#1+' 1./$2( ' ? A*G%, -#$#18C 38 ' 20#4; ?#3%4' , 4( ' ?34:/ /" ' ( 1%6#: /C -#0' ' , ' O/13#C 2$1#-' 2##67/"' ( -#++' $% ' ? *$#C 1/3' ?' ' . H*G +#9/$ 68$; 2#- 1%7/" , # + ' "' +%4; "#C . "' -%4; "#C , 4' " 8. L#+ Git " / 32/=, % O#24/, #3%$4/" 3 $#+, 2-#4; -# &' 51 # " # $ # 61%9%/$.
```

5.2.5. G* /- , /OE 9\$*' # (bisect)

```
M" #=, % : $#-$# ' , D$ " / $%- . >#24/, " (( 3/12' ( 1%6#$%4%, "# $#4; -# : $# #6" #34D" "%( Ñ " /$. J%?1%6#$: ' - + #9/$ O#01#2' $; 3%2 01#3/2$' 6' "%1" 8C O# 2- 01#64/+8, : $#68 #01/, /4' $; , -% - #C - #+++' $ 38?3%4 1/=1/22' <.
```

```
Git . 01#7%/$ O# 2- ' ?+/" /" ' C 2 O#++#7; < + #7" #C - #+%", 8 git bisect. ) $# - 1%$- #/ #O' 2%" ' /, -% - /D ' 20#4; ?#3%$; . E4( O#4. : /" ' ( , #O#4" ' $/4; "#C ' " 5#1+%&' ' 38 + #9/$/ O#2+ # $1/$; https://www.metaltoad.com/blog/beginners-guide-git-bisect-process-elimination ' 4' https://git-scm.com/docs/git-bisect. L$1%" ' &% man git-bisect A#1#G# #O' 283%/$, : $# + #9/$ O#C$' "/ $%- , : $# , /4%$; , - #=, % 3/12' ' " / 2#6' 1%< $2(, 3 - %-' A 2' $.%&' (A 3%+ 4. : G/ ' 20#4; ?#3%$; , 1. = ' / . 24#3' ( O# 2- %, % " / 'A#1#G# (good)' ' 'O4#A# (bad)', ' $%- , %4//, " # *$# ? , /2; " / 6. , /$ 1%22+%$1' 3%$; 2(.
```

```
git bisect start --first-parent ?%O. 2$' $ O1#&/22 6' "%1" #=# O# 2-%. E%4// " /#6A#, ' + # . -%?%$; , ' %O%?#" , 4( O1#3/1- ' . git bisect good XXXXXX . -%9/$ 1%6#: . < 3/12' <, % git bisect bad XXXXX Ñ " /1%6#: . < 3/12' <. B/1%6#: %( 3/12' ( O#: $' 32/=, % 6. , /$ HEAD (20/&' %4; " 8C $/= , 4( $/- . 7/=# 2#2$#( "' ). J%6#: %( 3/12' ( 6. , /$ O#24/, "/C, -#$#1. < 38 01#3/1(4' . ! 1= . +/" $ --first-parent " /#6A#, ' +, : $#68 O#24/, . < 7' / -#+%", 8 git bisect " / O8$%4' 2; O/1/- 4< : ' $; 2( "% 3/$- . 3/" , #1%, 3 -#$#1#C # $2. $2$3. /$ O#4' #/ , /1/3# ' 2A#, "' -#3 FreeBSD.
```

```
Q24' 38 A#$' $/ .?"%$; O#24/, "<< 3/12' <, -#$#1. < 38 ' ?34/- 4' , ' 20#4; ? . CS/ git reflog:
```

```
5ef0bd68b515 (HEAD -> main, freebsd/main, freebsd/HEAD) HEAD@{0}: pull  
--ff-only: Fast-forward  
a8163e165c5b (upstream/main) HEAD@{1}: checkout: moving from  
b6fb97efb682994f59b21fe4efb3fcfc0e5b9eeb to main  
...
```

!

```
O#- %?83%/$, -% - ( O/1/+ /7%< 1%6#: // , /1/3# 3 3/$- . main (a816É) ' ?%$/+ #6" #34(< /=# ' ? 38G/2$#(7/=# 1/O#?' $#1' ( (, # 5ef0É.) *$#+ 24. : %/, bad 6. , /$ HEAD (' 4' 5ef0bd68b515), % good Ñ a8163e165c5b. I%- 3' , "# ' ? 383#, %, HEAD@{1} $%- 9/ : %2$# 1%6#$%/$, "# " / (34(/$2( 6/?#G' 6#: " 8+, /24' 38 380#4" (4' , 1. = ' / , /C2$3' ( 2 , /1/3#+ Git O#24/ #6" #34/"' ( , "# , # $#=#, -% - #6" %1. 9' 4' " /#6A#, ' + #2$; 3 6' "%1" #+ O# 2- /.
```

K2\$%" #3' \$/ 2" %: %4% ÇA#1#G. <È 3/12' <, ?%\$/+ . 2\$%" #3' \$/ ÇO4#A. <È (A#\$ (O#1(, #- " / ' +//S
?" %: /" ' (). >1' . 2\$%" #3- / ÇO4#A#CÈ 3/12' ' 38 O#4. : ' \$/ " /- #S#1. < 2\$%" 2\$' - . O# O1#&/22. :

```
% git bisect start --first-parent
% git bisect good a8163e165c5b
% git bisect bad HEAD
Bisecting: 1722 revisions left to test after this (roughly 11 steps)
[c427b3158fd8225f6afc09e7e6f62326f9e4de7e] Fixup r361997 by balancing parens. Duh.
```

P%\$/+ 38 2#6' 1%/\$/ ' . 2\$%" %34' 3%/\$/ *\$. 3/12' <. Q24' #"% 1%6#S%/\$ - #11/- \$" #, 33/, ' \$/ git
bisect good, 3 O1#\$' 3" #+ 24. : %/ Ñ git bisect bad. Q24' 3/12' (" / - #+ O' 4' 1. /\$2(, 33/, ' \$/ git
bisect skip. >#24/ - %9, #=# G%=% 38 6. , /\$/ O#4. : %\$; 2##67/" ' /, %" %4#=' : " #/ O1' 3/, D" " #+.
38G/. ># ?%3/1G/" ' ' 2##67' \$/ # O1#64/+ "#C 3/12' ' 1%?1%6#S: ' - . (' 4' ' 201%3; \$/
#G' 6-. 2%+#2\$#(\$/4; " # ' #S01%3; \$/ O%\$;). I#+%", % git bisect reset ?%3/1G' \$ O1#&/22 ' 3/1" D\$ 3%2 \$. , #S- . , % 38 " %: %4' (#68: " # " % 3/1G' " . 3/\$- ' main). Q7D 1%?, 1. - #3#, 2\$3# O#
git-bisect (2284- % 38G/) Ñ *\$# A#1#G' C 1/2. 12 " % 24. : %C 3#?' ' - "#3/" ' (O1#64/+ ' 4'
"/2\$%" , %1\$" 8A 2' \$. %&' C.

5.2.6. < \$&9* ' - /* + #S)) * (\$%, (+=\$% * \$(9, - %\$# ' 9\$) \$H: 3 GnuPG

Git . +//S O#, O' 283%; - #++' \$8, \$/= ' ' #S01%3- ' (push). I #=#, % 38 O#, O' 283%/\$/ Git-- #++' \$
' 4' \$/=, 38 + #9/\$/ , #- %?%; , : \$# #S01%34/" " 8C - #, , /C2\$3' \$/4; " # O1' "%, 4/9' \$ 3%+ ' " /
684 ' ?+/" D" 3# 31/(O/1/, %: ' .) 8 \$%- 9/ + #9/\$/ O#, \$3/1, ' \$; , : \$# ' +/" " # 38 #S01%3' 4'
- #, , % " / - \$#-\$# , 1. =#C.

T#4// O#, 1#6" % (, #- . +/" \$%&' (O# O#, O' 2%" ' < - #++' \$#3 ' \$/= #3 , #2\$. O" % 3 =4%3/
M" 2\$1. +/" \$8 Git -> #, O' 2%" ' / 3%G/C 1%6#S8 - " ' = O# Git.

@6#2" #3%" ' / O#, O' 2%" ' (#S01%3#- + #9" # "%CS' 3 - #++' \$/, =, / O1/, 2\$%34/" % *\$% 5. " - &' (.

U. : G' C 20#2#6 Ñ O1#2\$# . - %?%; Git, : \$# 38 32/=, % A#\$' \$/ O#, O' 283%; - #++' \$8, \$/= ' ' #S01%3- ' . F\$# + #9" # 2, /4%; , . 2\$%" #3' 3 " /2- #4; - # O/1/+/" " 8A - # " 5' = . 1%&' ' :

```
% git config --add user.signingKey LONG-KEY-ID
% git config --add commit.gpgSign true
% git config --add tag.gpgSign true
% git config --add push.gpgSign if-asked
```

!

Z\$#68 ' ?6/9%\$; 3#?+ #9" 8A - # " 54' - \$#3, . 6/, ' \$/2; , : \$# 38 . - %?%4'
, 4' " " 8C ' , /" \$' 5' - %\$#1 - 4<: % , 4(Git.) 8 + #9/\$/ O#4. : ' \$; , 4' " " 8C'
' , /" \$' 5' - %\$#1 2 O# + #7; < - #+%", 8: gpg --list-secret-keys --keyid-format
LONG.

!

E4(' 20#4; ?#3%" ' (- # " - 1/\$" 8A O#, - 4<: /C, 6/? 1%?1/G/" ' (GnuPG
O#, - 4<: /C 3 O/13' : " 8C - 4<: , , #6%3; \$/ ! - - 4<: .. B%O1' +/1, , 4(
G' 51#3%" ' (2 O#, - 4<: #+ DEADBEEF ' 20#4; ? . CS/ DEADBEEF!.

5.2.6.1. <, \$%+, #- 9\$&9*' +E

>#, O' 2; -#++' \$% +#9" # 01#3/1' \$; , 380#4"' 3 -#+% , . git verify-commit <./0 1%&&,) * > ' 4' git log --show-signature.

>#, O' 2' \$/=#3 +#9" # 01#3/1' \$; 2 0#++#7; < git verify-tag <,&2)' 3* > ' 4' git tag -v <,&2)' 3* >.

5.2.7. A' \$8+//'\$' (* 9\$, (\$%

E/1/3# 0#1\$#3 1%6#\$%/\$ %" %4#=' : " 8+ #61%?#+. B%?3%"' (3/\$3/C #4' : %<\$2(, ' 1/0#?' \$#1' ' 1%20#4#9/" 8 3, 1.= ' A +/2\$%A.

) /6-' " \$/15/C2 cgit , 4(1%6#\$8 3 61%. ?/1/ , #2\$. 0/" 0# % , 1/2. <https://cgit.FreeBSD.org/ports/> . J%6#: ' C 1/0#?' \$#1' C Git "%A# , ' \$2(0# % , 1/2. <https://git.FreeBSD.org/ports.git> ' ssh://anongit@git.FreeBSD.org/ports.git (' 4' anongit@git.FreeBSD.org:ports.git).

N%- 9/ , #2\$. 0" # ?/1-%4# "% GitHub, 2+.) "/G" ' / ?/1-%4% , 4(#6?#1%.) /\$-% latest "%?83%/\$2(main.) /\$- ' quarterly' +/" . <\$2(yyyy0n, =, /'yyyy' Ñ =#, , % 'n' Ñ - 3%1\$%4.

5.2.7.1. I \$,) - (O '\$8H+/*E #S)) * (\$%

) 1/0#?' \$#1' ' 0#1\$#3 , #2\$. 0/" 0/1/A3%\$: ' -, -#S#18C 0#++#=#/\$ #5#1+4(\$; 2##67/"' (-#++' \$#3 3 [.hooks/prepare-commit-message](#). Q=# +#9" # 3-4<: ' \$; , 380#4"' 3 -#+% , . git config --add core.hooksPath .hooks.

@2" #3" %(' , / (?%- 4<: %/\$2(3 \$#+, : \$# 2##67/"' / -#++' \$% , #49" # 68\$; #5#1+4/" # 24/, . < 7' + #61%?#+:

category/port: Summary.

Description of why the changes where made (45627(' (, ' , 8%9' &: 5;<, 7=' <*(; , >&' ((, 2).

PR: 12345

#

>/13%(2\$1#-% Ñ *\$# \$/+% -#++' \$%, 3 " /C .-%?83%/\$2(, -%- #C 0#1\$ 684 ' ?+/" D" , ' -1%\$- #/ #O' 2%"' / -#++' \$%. @"% , #49" % 2#, /19%\$; 50 2' +3#4#3 ' 4' +/" ; G/.

>. 2\$(2\$1#-% , #49" % #\$, /4(\$; /=# #S #2\$%4; " #C : %2\$' 2##67/"' (# -#++' \$/.

@2\$%4; "% (: %2\$; 2##67/"' (# -#++' \$/ , #49" % 68\$; 0/1/" /2/" % "% =1%" ' &/ 72 2' +3#4#3.

Q7/ #, " % 0. 2\$(2\$1#-% , #49" % 68\$; , #6%34/" % , /24' /2\$; -%- ' /-4' 6# 0#4(+/\$%, % " 8A, : \$#68 ' A +#9" # 684# 4/=- # #4' : ' \$; #S 2##67/"' (# -#++' \$/.

5.2.8. J9, -%1+/*+ 1\$#- 1: /O) * *7) +/+/*5) *

FS#\$ 1%?, /4 0#23(7/" #S24/9' 3%" ' < 4#-%4; " 8A ' ?+/" /"' C. Q24' . 3%2 " /\$ 4#-%4; " 8A ' ?+/" /"' C, 38 +#9/\$/ 01#0. 2S' \$; *\$#\$ 1%?, /4.

@, ' " 3%9" 8C +##/" \$, 4(32/A: 32/ ' ?+/" /"' (#2S%<\$2(4#-%4; " 8+' , 0#-% #' ' " / 6. , . \$ #S01%34/" 8 (push).) #S4' : ' / #S Subversion, Git ' 20#4; ?. /\$ 1%201/, /4D" " . < +#, /4; . E4(0#4; ?#3%\$ /4/C 3 6#4; G' " 2S3/ 24. : %/3 1%?" ' &% " /3/4' -%. @, "%- #, /24' . 3%2 /2\$; 4#-%4; " 8/ ' ?+/" /"' (, 38 +#9/\$/ ' 20#4; ?#3%\$; \$S\$ 9/ ' " 2\$1. +/" \$, 4(. 01%34/" ' (' +', : \$# ' , 4(0#4. : /"' (' ?+/" /"' C ' ? FreeBSD.) 2/ ' ?+/" /"' (, -#\$#18/ 38 " / #S01%3' 4' , (34(<\$2(4#-%4; " 8+' ' +#=. \$ 68\$; 4/=-# ' ?+/" /"' 8 (*\$# , /4%/\$ git rebase, #62. 9, %/+8C " ' 9/).

5.2.8.1. 6S>, -/+/*+ 1\$#- 1: /O> *7) +/+/*E

L#+8C 01#2S#C 20#2#6 2#A1%" ' \$; 4#-%4; " 8/ ' ?+/" /"' ((#2#6/" " # " /?"%: ' \$/4; " 8/) Ñ ' 20#4; ?#3%\$; git stash.) 01#2\$/CG/+ 24. : %/ 38 ' 20#4; ?. /\$ / git stash, : \$68 ?%0' 2%\$; ' ?+/" /"' ((: \$# 0#+/7%/\$ ' A 3 2S/- stash). T#4; G' " 2S3# 4<, /C ' 20#4; ?. <\$ *\$# , 4(2#A1%" /"' (' ?+/" /"' C 0/1/, #6" #34/" ' /+ , /1/3%, -%- #0' 2%" # 38G/. P%\$/+ #' ' ' 20#4; ?. <\$ git stash apply, : \$68 0#3S#1" # 01' +/" ' \$; ' ?+/" /"' (- , /1/3.. Stash 01/, 2S%34(/\$ 2#6#C 2S/- ' ?+/" /"' C, -#\$#18C +#9" # 01#2+#\$1/\$; 2 0##+7; < git stash list. >#, 1#6" #2S' 01' 3/, /" 8 3 man-2\$1%" ' &/ git-stash (<https://git-scm.com/docs/git-stash>).

FS#\$ +/\$#, 0#, A#, ' \$, -#=#, % . 3%2 /2\$; " /6#4; G' / ' ?+/" /"' (3 , /1/3/. Q24' . 3%2 : \$#-\$# 6#4// 24#9" #/, 3/1#(\$# #, 4. : G/ 6. , /\$ 2#?, %\$; 4#-%4; ". < 3/\$-. ' 380#4" (\$; 0/1/6%' 1#3%" ' / L#A1%" /"' / ' ?+/" /"' C \$%- 9/ ' " \$/=1' 1#3%" # 3 -#+" , . git pull: 01#2S# #, #6%3; \$/ --autostash 3 -#+" , " . < 2\$1#-..

5.2.8.2. 6S>, -/+/*+ 1\$#- 1: /SE %+(#*

L 0##+7; < Git =#1%?, # 01#7/ 0#, , /19' 3%\$; 4#-%4; ". < 3/\$-., : /+ 3 Subversion.) Subversion " /#6A#, ' +# 380#4" (\$; -#++' \$ 24' (" (' 1%?1/G%\$; -#" 54' -\$8. FS# 380#4" ' +#, " # +#9/\$ 01' 3/2S' - ?%0. \$%" " #C ' 2\$#1' ' ' ?+/" /"' C, -#\$#1. < 6. , /\$ 24#9" # 0/1/, %\$; 3 38G/2\$#(7' C 1/0#?' \$#1' C, /24' *\$# 0#\$1/6. /\$2(, ' 4' 24#9" # 3#201#' ?3/2S' 01' " /#6A#, ' +2S'. Git \$%- 9/ 0#?3#4(/\$ 380#4" (\$; -#++' \$ 24' (" (, " # 2 \$/+ ' 9/ 01#64/+%+' . FS# #, ' " ' ?20#2#6#3. 01%34/" ' (3/\$- #C, " # "%' +/" // =' 6- ' C.

) , #0#4" /"' / - 24' (" <, Git 0#, , /19' 3%/\$ -#" &/0& < Ç0/1/6%' 1#3%" ' (È (rebase), -#\$#1%(0#?3#4(/\$ ' ?6/9%\$; *\$' A 01#64/+. I #+" , % git rebase 3#201#' ?3#, ' \$ 32/ -#++' \$ 8 3/\$- ' 3 -#" &/ 1#, ' \$/4; 2-#C 3/\$-'. O8 1%22+#\$1' + "%' 6#4// 1%201#2\$1%" D" " 8/ 2&/" %1' ' , 3#?" ' -%< 7' / 01' /D' 20#4; ?#3%" ' ' .

5.2.8.2.1. 6S7&- (: %+(#"

>1/, 0#4#9' +, 38 A#\$' \$/ 3"/2S' ' ?+/" /"' / 3 -#+" , . ls FreeBSD, : \$68 #" % " ' -#=#, % " / ' 20#4; ?#3%4% &3/\$#3#/ 38, /4/" ' / L. 7/2\$3. /\$ + " #9/2\$3# 01' : " , 4(*\$#=#, " # 3 , %" " #+ 01' +/1/ +8 6. , /+ ' 20#4; ?#3%\$; *\$# 3 -%: /2S3/ 6%?#3#=# 2&/" %1' (I #+" , % ls 3 FreeBSD 0/1' #, ' : /2- ' ' ?+/" (/S2(, ' 3#+ " . 9" # 6. , /\$ %, %0S' 1#3%\$; 2(- *\$' + ' ?+/" /"' (+. I 2: %2\$; <, 2 0##+7; < git rebase *\$# #68: " # 01# 2A#, ' \$ %3S#+\$' : /2- ' .

```

% cd src
% git checkout main
% git checkout -b no-color-ls
% cd bin/lis
% vi ls.c      # hack the changes in
% git diff     # check the changes
diff --git a/bin/lis/lis.c b/bin/lis/lis.c
index 7378268867ef..cfc3f4342531 100644
--- a/bin/lis/lis.c
+++ b/bin/lis/lis.c
@@ -66,6 +66,7 @@ __FBSDID("$FreeBSD$");
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
+#undef COLORLS
#include <termcap.h>
#include <signal.h>
% # these look good, make the commit...
% git commit lis.c

```

```

I#+++ $#$- 1#/$ 1/, %- $#1, : $#68 #0' 2%$; 380#4" /" " 8/ ' ?+/" /" ' (. >#24/ 33#, % #0' 2%" ' ( .
3%2 6. ,/$ 2#62$3/" "%( 1$#- 1: /-5 3/$- % 3 Git-1/0#?' $#1' ' . L#6/1' $/ ' ' .2$%" #3' $/
' ?+/" /" ' (, %- #68: " #, 24/, . ( .-%?" ' (+ 3 1. -#3#, 2$3/. Git #4' : %/$2( # $ , 1. =' A 2' 2$/+
-#" $1#4( 3/12' C $/+, : $# " . 9" # (3" # .-%?83%$; , -%- ' / 5%C48 -#+++ ' $' $; . [ 01/, 0#: ' $%<
, /4%$; *$# 3 - #+% " , "#C 2$1#- / -#+++ $%, " # $%- 9/ +#9" # ' 20#4; ?#3%$; git add, -%- #0' 2%" #
3 6#4// 0#, 1#6" 8A 1. - #3#, 2$3%A.

```

5.2.8.2.2. C, +) 5 \$8/\$%* (:

```

I#=#, % 01' A#, ' $ 31/+( 3" /, 1' $; " #3. < 3/12' <, 01#&/22 0#: $' $%- #C 9/, -%- ' 6/? 3/$#- .) 8
380#4" (/ $/ #6" #34/" ' /, -%- #0' 2%" # 38G/, " # 0/1/, #6" #34/" ' /+ " . 9" # 380#4" ' $; #, " .
, #0#4" ' $/4; " . < -#+" , . ' #, " . 0#24/. B' 9/ 01/, 0#4%=%/$2(, : $# 38 "%: ' "%/$/ 2
"/ ' ?+/" D" "#=# , /1/3%. )%9" # "%: ' "%$; #0/1%&' ' 0/1/6%' 1#3%" ' ( 2 : ' 2$#=# , /1/3% (Git
$1/6. /$ *$#=#).

```

```

% git checkout main
% git pull --ff-only
% git rebase -i main no-color-ls

```

```

F$# $#$- 1#/$ 1/, %- $#1, 3 -#$#1#+ 6. , . $ 0/1/: ' 24/" 8 32/ -#+++ '$8. ) ,%" " #+ 01' +/1/ " /
' ?+/" (C$/ /=# 2#, /19' +#/. @68: " # *$# , /4%/$2( 01' #6" #34/" ' ' 6%?#3#C 3/12' ' (A#$(
$%- 9/ +#9" # ' 20#4; ?#3%$; - #+" , . Git rebase , 4( . 01#34/" ' ( -#+++ '$%+' 3 3/$- /).

```

```

>#24/ ?%3/1G/" ' ( 38G/. -%?" " 8A , /C2$3' C "/#6A#, ' + # 0/1/" /2$' -#+++ '$8 , 4( lis.c 2#
2$%1#C 3/12' ' FreeBSD " % " #3. <.

```

```

M" #=#, % 3#?" ' -%<$ -#" 54' - $8 24' (" ' ( . F$# " #1+%4; " #. B/ 0%" ' - . C$/ . ) +/2$# *$#=#

```

1/G%CS/ ' A \$%- 9/, -%- ' 4<68/ , 1.= ' / -#" 54' - \$8 24' ("' (. Z\$#68 .01#2\$' \$; , (#0' G.
4' G; 1%201#2\$1%" D" ". < 01#64/+., -#\$#1%(+ #9/\$ 3#?"' - ". \$; . L284- % " % 0#4" #/
1. - #3#, 2\$3# 01' 3/, /" % 3 - #" &/ *\$#=# 1%?, /4%.

E#0. 2\$' +, ' ?+/" /"' (3-4<: %<\$ 0/1/A#, "% terminfo 3 38G/2\$#(7/+ -#, /, % \$%- 9/
' ?+/" /"' / "%?3%"' (#0&' ' .>1' #6" #34/"' ' 38 + #9/\$. 3' , /\$; 24/, . < 7 //:

```
Auto-merging bin/lis/lis.c
CONFLICT (content): Merge conflict in bin/lis/lis.c
error: could not apply 646e0f9cda11... no color ls
Resolve all conflicts manually, mark them as resolved with
"git add/rm <conflicted_files>", then run "git rebase --continue".
You can instead skip this commit: run "git rebase --skip".
To abort and get back to the state before "git rebase", run "git rebase --abort".
Could not apply 646e0f9cda11... no color ls
```

: \$# 38=4(, ' \$ 0. =%< 7/.

Q24' # \$- 18\$; 1/, %- \$#1, 38 . 3' , ' \$/ \$' 0' : "#/ 1%?1/G/"' / -#" 54' - \$% 2 \$1DA2\$#1#" "' +
24' ("' /+, 2 -#\$#18+ 38 + #=4' 2\$%4- ' 3%\$; 2(3 , 1.= ' A 2' 2\$/+%A .01%34/"' (' 2A#, " 8+
- #, #+ (#2\$%4; " %(: %2\$; lis.c #0. 7/" %):

```
Ê<<<<<<< HEAD
Ê#i fdef COLORLS_NEW
Ê#i nclude <terminfo.h>
Ê=====
Ê#undef COLORLS
Ê#i fdef COLORLS
Ê#i nclude <termcap.h>
Ê>>>>>>> 646e0f9cda11... no color ls
```

B#38C - #, ' , D\$ 0/138+, % 3%G - #, - 3\$#18+.

>1%3' 4; " #/ 1/G/"' / ?, /2; Ñ 01#2\$# , #6%3' \$; #undef COLORLS_NEW 0/1/, #i fdef, % ?%\$/+
., %4' \$; 2\$%18/ ' ?+/" /"' (:

```
#undef COLORLS_NEW
#i fdef COLORLS_NEW
#i nclude <terminfo.h>
```

' 2#A1%"' \$; 5%C4.

J/6%?' 1#3%"' / 684# 01/13%" #, 0#*\$#+. 3%+ "/#6A#, ' + # ?%3/1G' \$; /=#:

```
% git add lis.c
% git rebase --continue
```

```
: $# .-%?83%/$ Git, : $# 5%C4 l.s.c ' 201%34/" ' + #9" # 01#, #49' $; #0/1%&' <
O/1/6%' 1#3%"' (. >#2-#4; -. 3#?"' - -#" 54' - $, 2' 2$/+% # $- 1#/$ 1/, %- $#1 , 4( #6" #34/"' (
2##67/"' ( - #++' $% (/24' *$# " /#6A#, ' + #). Q24' 2##67/"' / - #++' $% O#-01/9" /+ .
- #11/- $" #, 01#2$# ?%- 1#C$/ 1/, %- $#1.
```

```
Q24' 38 %2$1(4' 3 01#&/22/ O/1/6%' 1#3%"' (, "/ O%"' -. C$/ . I #+%", % git rebase --abort
3/1" D$ 3%2 - ' 2A#, " #+. 2#2$#(" < . @, "%-# 3%9" # "%: ' "%$; 2 "/' ?+/" D" "#=# , /1/3%.
>1' +/: "%" /: . O#+( ". $%( 38G/ - #+%", % git reflog 6. , /$ O#4/" % 3 *$#C 2' $. %&' ' , $%- -%#
- #%" 2#, /19' $ 20' 2#- 32/A (01#+/9. $#: " 8A) - #++' $#3, - # $#18/ 38 + #9/$/ 01#2+ # $1/$; ,
' ?.: ' $; ' 4' 3861%$; : /1/? cherry-pick.
```

```
E4( 6#4// O#, 1#6" #=# #?" %- #+4/"' ( 2 *$#C $/+ #C, 2+ . , #3#4; " # #6G' 1" #/ 1. - #3#, 2$3# O#
%, 1/2. : https://www.freecodecamp.org/news/the-ultimate-guide-to-git-merge-and-git-rebase/. F$#$
1/2. 12 6. , /$ O#4/"' , 4( 1/G/"' ( 01#64/+, - # $#18/ 3#?"' - %< $ " /: %2$#, " # 24' G- #+
20/&' 5' : " 8 , 4( , %" "#=# 1. - #3#, 2$3%.
```

5.2.8.3. <+, + #134+/*+ /- &, "=" 3 %+(#" FreeBSD

```
Q24' 38 A#$' $/ O/1/C$' 2 3/$- ' stable/12 "% 3/$- . current ' . 3%2 /2$; O#4" 8C - 4#"
1/O#?' $#1' (, 6. , /$ , #2$%$#: " # 380#4" ' $; 24/, . < 7. < - #+%", . . :
```

```
% git checkout main
% # build and install here...
```

```
@, "%- #, /24' . 3%2 /2$; 4#-%4; "%( 3/$-%, /2$; "/2- #4; - # 3%9" 8A ?#+/: "%" ' C. ) # - O/138A,
O/1/6%' 1#3%"' / O/1/O' 283%/$' 2$#1' <, O#*$#+. 3%+, 2- #1// 32/=#, ?%A#: /$2( 2#A1%" ' $; /D
- %- ' + - 4' 6# #61%?#+. ) # - 3$#18A, O/1/- 4<: /" ' / + /9, . 3/$- %+' : %2$# 38?83%/$ 6#4; G/
- #" 54' - $#3. Q24' 01/, O#4#9' $; , : $# 01' 3/, D" " 8C 38G/ 01' + /1 # $" #2' 42( - 3/$- /
stable/12, $#, 4( O/1/A#, "% % 3/$- . main ( 68 1/- #+/" , #3%4 24/, . < 7//:
```

```
% git checkout no-color-ls
% git checkout -b no-color-ls-stable-12 # create another name for this branch
% git rebase -i stable/12 no-color-ls --onto main
```

```
Z$# , /4%/$ 38G/#0' 2%" " #/: ' ?34/- %/$2( 3/$-% no-color-ls. P%$/+ , 4( " /D 2#?, %D$2( " #3#/#
' + ( (no-color-ls-stable-12) "% 24. : %C, /24' O#$1/6. /$2( 3/1" . $; 2( - " /C. >#24/ *$#=#
380#4" (/ $2( O/1/6%' 1#3%"' / "% 3/$- . main. F$# O#?3#4' $ "%C$' 32/ - #++' $8 3 $/- . 7 /C
3/$- / no-color-ls (304# $; , # $#: - ' /D #3/$34/"' ( # $ stable/12) ' ?%$/+ 3#201# ' ?3/2$' ' A "%
3/$- / main, 2#?, %3 $%+ " #3. < 3/$- . no-color-ls (O#*$#+. ( ' O#01#2' 4 3%2 2#?, %$; 1/?/13" #/
' + ( ).
```

5.3. <, \$@+&" , O MFC (Merge From Current)

5.3.1. 2, - (#\$+ ' \$&+, D- /*+

```
J#6#: ' C 01#&/22 MFC + #9" # #6#67' $; - % - git cherry-pick -x 04<2 git commit --amend , 4(
```

```
-#11/- $' 1#3- ' 2##67/' ' ( -#+++' $%. E4( "/2- #4; - ' A -#+++' $#3 ' 20#4; ?. C$/ git rebase -i,
: $#68 #6W/, ' " ' $; ' A 3+/2$/ ' #S1/, %- $' 1#3%; 2##67/' ' / -#+++' $%.
```

5.3.2. A&* /\$4/OE #S)) * (MFC

```
% git checkout stable/X
% git cherry-pick -x $HASH --edit
```

E4(-#+++' \$#3 MFC, "%01' +/1, ' +0#1% \$ 3/", #1%, 3%+ 0#\$1/6. /\$2(.-%?%; #, "#=# 1#, ' \$/4(, 4(&/4/C 386#1#: "#=# 01' +/" /" ' ((cherry-pick). @68: "# *\$# 6. , /\$ Ç0/138C 1#, ' \$/4; È 3/\$- ' , ' ? -#\$#1#C 38 01' +/" (/\$/ ' ?+/" /" ' (, \$# /2\$; :

```
% git checkout stable/X
% git cherry-pick -x $HASH -m 1 --edit
```

Q24' : \$#\$# 0#C, /\$ " / \$%- , 3%+ 0#\$1/6. /\$2(4' 6# 01/13%; 386#1#: "#/ 01' +/" /" ' / 2 0#+#7; < git cherry-pick --abort, 4' 6# ' 201%3' \$; 01#64/+. ' 380#4"' \$; git cherry-pick --continue.

>#24/ ?%3/1G/' ' (386#1#: "#=# 01' +/" /" ' (380#4"' \$/ #S01%3-. 2 0#+#7; < git push. Q24' 3#?' - " /\$ #G' 6-% ' ?-?% 01#' =18G% 3 =#" -/ -#+++' \$#3, ' 20#4; ?. C\$/ git pull --rebase ' 0#3\$#1' \$/ 0#08\$-. #S01%3- ' .

5.3.3. MFC %%+(#" RELENG

MFC 3 3/\$- ' , \$1/6. < 7' / #, #61/' ' (, \$1/6. < \$ " /+ "#=# 6#4; G/ 3" ' +%" ' (. >1#&/22 #, ' "%- #3 -% - , 4(#68: "#=# 24' (" ' (, \$%- ' , 4(01(+## -#+++' \$% 3 ' 2- 4<: ' \$/4; "#C 2' \$. %&' ' .

```
¥ L" %: %4% 380#4"' $/ 24' ( " ' / ' 4' 01(+## -#+++' $ 3 2##3/$2$3. < 7. < 3/$- . stable/X,
01/9, /: /+ 24' 3%; 3 3/$- . rel eng/X. Y.
```

```
¥ M20#4; ?. C$/ A*G ' ? 3/$- ' stable/X , 4( MFC 3 3/$- . rel eng/X. Y.
```

```
¥ @2$%34(C$/ #6/ 2$1#- ' "cherry picked from" 3 2##67/' ' ' -#+++' $%.
```

```
¥ @6(?%$4; " # , #6%3; $/ 2$1#- . Approved by: 01' 1%6#$/ 3 1/, %- $#1/.
```

```
% git checkout rel eng/13.0
% git cherry-pick -x $HASH --edit
```

Q24' 38 ?%684' , #6%3' \$; 2\$1#-. Approved by:, 38 +#9/\$/ 380#4"' \$; git commit --amend, : \$#68 #S1/, %- \$' 1#3%; 2##67/' ' / -#+++' \$% 0/1/, #S01%3- #C ' ?+/" /" ' (.

5.3.4. B /\$D+' (%+//OE #S)) * (MFC

```
% git checkout -b tmp-branch stable/X
% for h in $HASH_LIST; do git cherry-pick -x $h; done
```

```
% git rebase -i stable/X
# %)&' ), )? 1*=@; - 1%&&, ) 8%7<' 8'+A%3% 1*1 'squash'
# B+, ('%5.%=, &%7), %5(%A,)? 7%5C' (, ' 1%&&,* , 9)%5; %)+*>, )? A7' '3% /<'&' (); .
# 452>*)' <?(% 7%. +*(, )? 7)+%1, "cherry picked from".
% git push freebsd HEAD:stable/X
```

Q24' #S01%3-% "/ ., %4%2; ' ?-% 01#' =18G% 3 =#" - / - #++' \$ #3, 380#4"' \$/ 0/1/6%' 1#3%" ' /
' 0#3\$#1' \$/ 0#08\$- . :

```
% git checkout stable/X
% git pull
% git checkout tmp-branch
% git rebase stable/X
% git push freebsd HEAD:stable/X
```

>#24/ ?%3/1G/" ' (MFC 38 + #9/\$/ ., %4' \$; 31/+/" " . < 3/\$- . :

```
% git checkout stable/X
% git branch -d tmp-branch
```

5.3.5. MFC Ñ *) 9\$, (\$(%+/&\$, -

M+0#1\$8 # \$ 3/" , #1#3 Ñ *\$# /, ' " 2S3/" "#/ 3 , /1/3/, : \$# 2#?, %/\$ - #++' \$ 24' (" ' (3 3/\$- /
main. I #++' \$8 24' (" ' (386#1#: " 8+ 0/1/" #2#+ (cherry-pick) 3 stable/XX 01/, 2\$%34(<\$
, #0#4"' \$/4; " . < 24#9" #2\$; , 0#2- #4; - . . - #++' \$% 24' (" ' (, 3% 1#, ' \$/4(. I%- 01%3' 4#, 3%+
0#" % , #6' \$2(1%?" ' &% 2 0/138+ 1#, ' \$/4/+ , \$%- -%- *\$# 1%?" ' &% 2 main (A#\$ (+#= . \$ 68\$; '
' 2-4<: /" ' ().

```
% git cherry-pick -x -m 1 $HASH
```

#68: " # *\$# \$#, : \$# 3%+ " . 9" #. F\$# . - %9/\$ 386#1#: " #+. 0/1/" #2. 01' +/" ' \$; 01%3' 4; " 8C
diff.

T83%<\$, "%, /<2; , 1/, -' / 24. : %' , - # =, % 3#?+ #9" #, : \$# 3/\$- % main 684% #6W/, ' " /" % 3
#61%\$" #+ 0#1(, - / 2- 1' 0\$#+ 01/#61%?#3%" ' (. Q24' *\$# 01#' ?#C, /\$ (% + 8 0#- % \$%- ' A 24. : %/3
" / #6" %1. 9' 4'), 3%+ 24/, . /\$ ' ?+/" ' \$; . - %?" " #/ 38G/ " % -m 2, : \$ #68 3861%\$;
01%3' 4; " #=# 1#, ' \$/4(. > 1#2\$# 380#4"' \$/:

```
% git cherry-pick --abort
% git cherry-pick -x -m 2 $HASH
```

, 4(*\$#=#. @O&' (--abort 380#4"' \$ #: ' 2\$- . 0#24/ " / ., %: " #C 0/13#C 0#08\$- ' .

5.3.6. <+, +&+1#- MFC

Q24' 38 , /4%/\$/ MFC, ' 32D ' , D\$. 9%2"# " /01%3' 4; "#, ' 38 A#\$' \$/ "%: %\$; 2" %: %4%, \$# 2%+8C 01#2\$#C 20#2#6 Ñ ' 20#4; ?#3\$; git reset --hard, -%- 0#- %?%" # "' 9/:

```
% git reset --hard freebsd/stable/12
```

A#\$(/24' . 3%2 /2\$; "/- #18/ 1/3' ?' ' , -#18/ 38 A#\$' \$/ 2#A1%" ' \$; , % , 1.= ' / Ñ " /\$, ' 20#4; ?#3%" ' / git rebase -i 01/, 0#: \$' \$/4; " //.

5.3.7. ?+#\$(\$, O+ ' \$\$8, -D+/* 5 \$ MFC

>1' 3"/2/" ' ' ' 2A#, " 8A -#++' \$#3 3 2\$%6' 4; " 8/ ' 1/4' ?" 8/ 3/\$- ' +8 01/24/, ./+ 24/, . < 7' / &/4' :

¥ Z/\$- # #6#?"%: ' \$; 01(+8/ -#++' \$8, #4' : %(' A # \$ -#++' \$#3, 3" #2(7' A ' ?+/" /"' (' ? , 1.=#C 3/\$- ' .

¥ M?6/= %\$; 3" /2/" ' (' ?3/2\$" 8A "%1. G/" ' C 3 2\$%6' 4; " 8/ 3/\$- ' ' 3/\$- ' 380. 2-% 1/4' ?#3 (releug).

¥ >#?3#4' \$; 1%?1%6# \$: ' -%+ #01/, /4(\$; , -%- ' / ' ?+/" /"' (684' ' 4' " / 684' 0/1/" /2/" 8 ' ? #, "#C 3/\$- ' 3, 1.= <.

L O##7; < Subversion +8 ' 20#4; ?#3#4' 24/, . < 7' / 01%- \$' - ' , 4(, #2\$' 9/" ' (*\$' A &/4/C:

¥ M20#4; ?#3%" ' / \$/=#3 MFC ' MFS , 4(0##+/\$- ' -#++' \$#3, -#18/ 2, /4%4' 24' (" / ' ?+/" /"' (' ? , 1.=#C 3/\$- ' .

¥ @6W/, ' " /"' / (squash) ' 201%34(< 7' A (fixup) -#++' \$#3 2 #2" #3" 8+ -#++' \$##+ 01' 24' (" ' ' ' ?+/" /"' (.

¥ P%0' 2; ' " 5#1+%&' ' # 24' (" (A , 4(-#11/- \$" #C 1%6#\$8 svn mergeinfo --show-revs.

L O##7; < Git "%+ 0#\$1/6. /\$2(' 20#4; ?#3\$; , 1.= ' / 2\$1%\$/=' ' , 4(, #2\$' 9/" ' (\$/A 9/ &/4/C. F\$#\$, #- . +/" \$ 01' ?3%" #01/, /4' \$; 4. : G' / 01%- \$' - ' , 4(-#++' \$#3 24' (" (' 2A#, "#=# -#, % 2' 20#4; ?#3%" ' /+ Git, -#18/ , #2\$' =%< \$ *\$' A &/4/C.) &/4##+ +8 2\$1/+ ' +2(' 20#4; ?#3\$; 32\$1#/" " 8/ 3#?+#9" #2\$' Git , 4(, #2\$' 9/" ' (*\$' A &/4/C, % " / 01' +/" (\$; 01%- \$' - ' , #2" #3%" " 8/ "%+#, /4' Subversion.

@67// ?%+/: %"' /: 3 23(?' 2 \$/A"' : /2- ' + ' 1%?4' : ' (+ ' 3 Git, +8 " / 6. , /+ ' 20#4; ?#3\$; "- #++' \$8 24' (" (" Git (2#?, %" " 8/ : /1/? git merge) 3 2\$%6' 4; " 8A 3/\$- %A ' 4' 3/\$- %A releug.) +/2\$# *\$#=#, -#=#, % 3 , #- . +/" \$/ . 0##+ ' "%< \$2("- #++' \$8 24' (" (" , ' +/\$2(3 3' , . -#++' \$, ' ?" %: %4; " # 2, /4%" " 8C 3 main, -#18C 1/04' &' 1. /\$2(' 4' "0/1/" #2' \$2(" 3 2\$%6' 4; " . < 3/\$- . , ' 4' -#++' \$' ? 2\$%6' 4; " #C 3/\$- ' , -#18C 1/04' &' 1. /\$2(3 3/\$- . releug 2 0##7; < 3%1' %&' ' -#+% , 8 git cherry-pick.

5.3.8. <\$*' # 9\$&>\$&5H* >>KL +E &15 MFC

Git 01/, #2\$%34(/\$ 32\$1#/" " . < 0#, , /19- . *\$#=# : /1/? -#+% , 8 git cherry ' git log --cherry. FS' -#+% , 8 21%3" ' 3%< \$ ' 2A#, " 8/ 1%?4' : ' (-#++' \$#3 (" # " / , 1.= ' / +/\$%, %" " 8/, \$%- ' /

-%- 2##67/"' (9.1"%4%), : \$#68 #01/, /4' \$; , ' , /" \$' : " 8 4' , 3% -#++' \$%. FS# A#1#G# 1%6#S\$/ \$, -#=#, % -%9, 8C -#++' \$ ' ? main 0/1/" #2' \$2(-%- #S, /4; " 8C -#++' \$ 3 2\$%6' 4; ". < 3/\$- ., " # 0/1/2\$%D\$ 1%6#S\$%; , /24' " /2- #4; -# -#++' \$ #3 ' ? main #6W/, ' " (<\$2(3 #, ' " -#++' \$ 3 2\$%6' 4; " #C 3/\$- / . >1#/- \$ %- \$' 3" # ' 20#4; ? . /\$ git cherry-pick -x 2 2#A1%" /" ' /+ 32/A 2\$1#- , 4(#6A#, % *\$' A \$1. , " #2\$/C ' 1%?1%6\$83%/\$ %3S#+%\$ ' ?' 1#3%" " 8/ ' " 2\$1. +/" \$8 , 4(' 20#4; ?#3%" ' (*\$=# 0#, A#, %.

5.3.9. 6(- /&- , (O ' \$\$8H+/*E #S)) * (\$%

5.3.9.1. <\$) +(#- MFC

>1#/- \$ 01' " (4 24/, . < 7. < 01%- \$' - . , 4(O#+/\$- ' MFC:

¥ M20#4; ? . CS/ 54%= -x 2 -#+" , #C git cherry-pick. FS# , #6%34(/\$ 2\$1#- . 3 2##67/" ' / -#++' \$%, -#\$#1(3-4<: %/\$ A*G #1' = " %4; " #=# -#++' \$ % 01' 24' (" ' ' . >#2- #4; - . *\$# , #6%34(/\$2(" /O#21/, 2\$3/" " # Git, -#++' \$\$/1%+ " / " . 9" # 31. : " . < 1/, %- \$' 1#3%; 9. 1"%4 -#++' \$ #3 01' 24' (" ' ' .

>1' 24' (" ' ' " /2- #4; - ' A -#++' \$ #3 2#A1%" (CS/ 32/ 2\$1#- ' "cherry picked from".

5.3.9.2. A8, +7- (:) +(- &- //O+?

@, " #C ' ? #64%2\$/C, -#\$#1(" / 684% : D\$- # ?%, #- . +/" \$' 1#3%" % 3 Subversion (' , %9/ 3 CVS), (34(/\$2(5#1+%\$' 1#3%" ' / +/\$%, %" " 8A 3 2##67/" ' (A 9. 1"%4% , 4(-#++' \$ #3 MFC. E#49" 8 4' #"' 3-4<: %\$; +/\$%, %" " 8/ ' ? ' 2A#, " #=# -#++' \$ % 6/? ' ?+/" /" ' C ' 4' , #49" 8 68\$; ' ?+/" /" 8 , 4(# \$1%9/" ' (' ' 5#1+%&' ' # 2%+##+ -#++' \$ / MFC?

M2\$#1' : /2- ' 01%- \$' -% 1%?4' : %4%2; , A#\$(" /- # \$ #18/ 1%?4' : ' (?%3' 2(\$ # \$ #64%2\$' . B#01' +/1, MFC, # \$ " #2(7' /2(- PR, #68: " # 3-4<: %< \$ 0#4/ PR 3 MFC, : \$ #68 -#++' \$ 8 MFC 3-4<: %4' 2; 3 % . , ' \$- \$1/- /1 2' 2\$/+ 8 # \$24/9' 3%" ' (#G' 6#- .) , 1. = ' A #64%2\$(A 2' \$. %&' (+/" // (2" % . B#01' +/1, Phabricator 0#- ?%83%/\$ 1%?" ' &. 0#24/, " /=# -#++' \$%, 0#+/ : /" " #=# , 4(#6?#1%, 0#*\$#+. 3-4<: /" ' / URL-%, 1/2#3 Phabricator ?%+/" (/ \$ #2" #3" #C -#++' \$ " % ?%3/1G/" " 8/ -#++' \$8. LO' 2#- 1/&/" ?/" \$ #3 \$%- 9/ " / (2/" . Q24' 1/&/" ?/" \$ #, #61' 4 ' ?+/" /" ' / , 4(main, #?" %: %/\$ 4' *\$#, : \$ # # " #, #61' 4 -#++' \$ MFC?) /1" # 4' *\$# \$ #4; -# , 4(' , /" \$' : " #=# -# , % ' 4' 4' G; 2 " /?" %: ' \$/4; " #C , #1%6#\$- #C? @: /3' , " #, *\$# " /3/1" # , 4(6#4// +%2G\$%6" 8A , #1%6#S#- . E%9/ , 4(' , /" \$' : " #=# -# , %: : \$ #, /24' -#++' \$ " / -# " 54' - \$. /\$, " # 3" #2' \$ ' ?+/" /" ' / ABI? J/&/" ?/" \$ += #, #61' \$; -#++' \$, 4(main ' ?-?% "%1. G/" ' (ABI, " # + #9/\$ " / #, #61' \$; 24' (" ' / \$ #=# 9/ -#++' \$ % 3 " / ' ?+/" " #+ 3' , / . >1' , /\$2(O#4%=%\$; 2(" % 2#62\$3/" " #/ " % 4. : G// 2. 9, /" ' / , # \$/A 0#1, 0#- % " / 6. . . \$ 2#-4%2#3%" 8 : /\$- ' / 1. -#3#, (7' / 01' " &' 08.

E4(MFC, 1/= . 4' 1. /+ 8A re@, , #6%34(<\$2(" #38/ 0#4(+/\$%, %" " 8A, \$%- ' / -%- \$/= Approved by , 4(#, #61/" " 8A -#++' \$ #3. FS' " #38/ +/\$%, %" " 8/ , #49" 8 68\$; , #6%34/" 8 : /1/? git commit --amend ' 4' "% %4#=' : " 8/ 21/, 2\$3% 0#24/ \$ #=#, -%- ' 2A#, " 8C -#++' \$ 6. , /\$ 01#3/1/" ' #, #61/" . O8 \$%- 9/ + #9/+ ?%A#\$/ \$; ?%1/?/13' 1#3%; " /- # \$ #18/ 0#4(+/\$%, %" " 8A 3 -#++' \$ %A MFC, \$%- ' / -%- URL-%, 1/2% Phabricator, , 4(' 20#4; ?#3%" ' (re@ 3 6. . . 7/+.

L#A1%" /" ' / 2. 7/2\$3. < 7' A +/\$%, %" " 8A #6/20/: ' 3%/ \$ #: /" ; 01#2\$#C 1%6#: ' C 01#&/22. J%?1%6#S: ' - ' ' 20#4; ? . < \$ git cherry-pick -x 6/? " /#6A#, ' + #2\$' 1/, %- \$' 1#3%; 2##67/" ' /

9. 1" %4%.

Q24' 9/ +8 1/G' + ' ?+/" (\$; +/\$%, %" " 8/ 3 MFC, 1%?1%6#\$: ' -%+ 01' , /\$2((3" # 1/, %- \$' 1#3%\$; 2##67/" ' (9. 1" %4% 2 0#+#7; < git cherry-pick --edit ' 4' git commit --amend. @, " %- # 0# 21%3" /" ' < 2 svn, 0# - 1%C" /C +/1/, 2. 7/2\$3. < 7// 2##67/" ' / # 5' -2%&' ' +#9/\$ 68\$; 01/, 3%1' \$/4; " # ?%0#4" /" #, % 0#4(+/\$%, %" " 8A +#9" # , #6%34(\$; ' 4' ., %4(\$; 6/? "/#6A#, ' +#2\$' 0#3\$#1" #=# 33#, % 32/=# 2##67/" ' (# 5' -2%&' ' .

L. \$; 3 \$#+, : \$# 1%?1%6#\$: ' -%+, 3/1#(\$" #, 0#\$1/6. /\$2(\$7%\$/4; " # =#\$#3' \$; 23# ' 2##67/" ' (# - #++' \$%A , 4(MFC, -#\$#18/ " / (34(< \$2(\$1' 3' %4; " 8+' .

5.4. M) 9\$, (%+/&\$, \$% ' Git

) *\$#+ 1%?, /4/ 0#, 1#6" # #0' 283%/\$2(01#&/, . 1% ' +0#1\$% 3/" , #1% 2 ' 20#4; ?#3%" ' /+ Git.

5.4.1. 6\$=1-L +/*+ \$ /- *) +/\$%- /* * %+(\$#

) 2/ 3/\$- ' ' \$/= ' 3/" , #1#3 "%: ' " %< \$2(2 vendor/. FS' 3/\$- ' ' \$/= ' 3' , " 8 0# . +#4: %" ' < .

!

FS% =4%3% 24/, ./ \$ 2#=4%G/" ' < , : \$# freebsd Ñ *\$# ' +(' 2\$#: "' -% , 4(#5' &' %4; " #=# 1/0#?' \$#1' (Git FreeBSD. Q24' 38 ' 20#4; ?./ \$/ , 1. =#/ 2#=4%G/" ' /, ?%+/" ' \$/ freebsd "% ' 20#4; ?./ +# / 3%+' ' +(3 01' 3/, D" " 8A "' 9/ 01' +/1%A.

O8 1%22+#\$1' + 01' +/1 #6" #34/" ' (mtree NetBSD, -#\$#18C "%A#, ' \$2(3 "%G/+ , /1/3/.)/\$-% 3/" , #1%, 4(" /=# Ñ vendor/NetBSD/mtree.

5.4.2. A8/\$%1+/*+ ' (-, \$=\$ *) 9\$, (- \$ (%+/&\$, -

E/1/3; (3/" , #1#3 #68: " # 2#, /19%\$ 4' G; 0#, + "#9/2\$3# 2\$#1#" "/=# 01#=1%++ " #=# #6/20/: /" ' (, 0#, A#, (7/=# , 4(FreeBSD. FS' , /1/3; (, -%- 01%3' 4#, #: /" ; +%48 0# 21%3" /" ' < 2 , /1/3#+ FreeBSD. N%- ' + #61%?##+, 1%6#: ' / , /1/3; (Git , #3#4; " # -#+0%- \$" 8 ' 682\$18, : \$# , /4/\$ ' A 01/, 0#: \$' \$/4; " 8+ +/\$#, #+ ' 20#4; ?#3%" ' (. K6/, ' \$/2; , : \$# 3861%" " 8C 3%+' -%\$%4#=(./mtree) 3 "%2\$#(7// 31/(" / 2. 7/2\$3. /\$.

```
% git worktree add ../mtree vendor/NetBSD/mtree
```

5.4.3. A8/\$%1+/*+ * ' >\$&/O> #S&\$% % %+(#+ %+/&\$, -

>#, =#\$#3; \$/ 0#4" #/, : ' 2\$#/ , /1/3# ' 2A#, " 8A -#, #3 3/" , #1%. M+0#1\$' 1. CS/ 32D, " # , /4%CS/ 24' (" ' / \$#4; -# \$#+. , : \$# "/#6A#, ' +#.

FS#\$ 01' +/1 01/, 0#4%=%/\$, : \$# ' 2A#, " 8C -#, NetBSD 0#4. : /" ' ? ' A ?/1-%4% "% GitHub 3 -%\$%4#=# /-git/NetBSD. K: \$' \$/, : \$# Ç38G/2\$#(7' C 1/0#?' \$#1' CÈ +=, #6%3' \$; ' 4' ., %4' \$; 5%C48, 0#*\$#+. +8 A#\$' + .6/, ' \$; 2(, : \$# ., %4/" ' (\$%- 9/ 1%201#2\$1%" (< \$2(. >%- /\$ net/rsync #68: " # . 2\$%" #34/" , 0#*\$#+. (6. . . ' 20#4; ?#3%; /=#.

```

% cd ../mtree
% rsync -va --del --exclude=".git" ~/git/NetBSD/usr.sbin/mtree/ .
% git add -A
% git status
...
% git diff --staged
...
% git commit -m "Vendor import of NetBSD's mtree at 2020-12-11"
[vendor/NetBSD/mtree 8e7aa25fcf1] Vendor import of NetBSD's mtree at 2020-12-11
Ê7 files changed, 114 insertions(+), 82 deletions(-)
% git tag -a vendor/NetBSD/mtree/20201211

```

```

I 1%C" / 3%9" # .6/, ' $; 2(, : $# ' +O#1$' 1./+8C ' 2A#, " 8C -#, O#4.: /" ' ? "%, D9" #=#
' 2$#: "' -%. O" #=' / O1#/- $8 2 #-$ 18$8+ ' 2A#, " 8+ -#, #+ ' 20#4; ?. <$ -1' O$#=1%5' : /2- ' /
O#, O' 2' , 4( O#, O' 283%" ( ' ?+/" /" ' C -#, %, $/#3 git ' /' 4' tar-%1A' 3#3 2' 2A#, " 8+ -#, #+.
) 2/=%, O1#3/1(C$/ *$' O#, O' 2' ' ' 20#4; ?. C$/ +/A%" ' ?+8 ' ?#4(&' ' , $%- ' / -%- -4/$- ' ,
chroot, 3 2#: /$%" ' ' 2 38, /4/" " #C " /O1' 3' 4/= ' 1#3%" " #C .: D$" #C ?%O' 2; < O#4; ?#3%$ /4(,
#$4' : " #C $ $ #C, -#$#1. < 38 ' 20#4; ?. /$/ 1/= . 4(1" # (O#, 1#6" // 2+. 3 1%?, /4/ Ç@6" #34/" ' /
, /1/3% ' 2A#, " #=# -#, % FreeBSDÈ " ' 9/), O#-% 38 " / 6. , /$/ . 3/1/" 8, : $# ' +O#1$' 1./+8C
' 2A#, " 8C -#, 38=4(, ' $ 6/?#O%2" 8+. @ $24/9' 3%" / 1%?1%6#$- ' 3 38G/2$#(7/+
1/O#?' $#1' ' ' O/1' #, ' : /2- ' C O1#2+#$1' ?+/" /" ' C -#, % 3 " D+ +#=#. $ ?%": ' $/4; " # O#+#; ;
3 O#38G/" ' ' -%: /2$3% -#, % ' O1' " /2$' O#4; ?. 32/+ .: %2$" ' -%+. N%- 9/ 1/- #+/" , ./ $2(
' ?.: %$; 1/? . 4; %$8 git diff O/1/, ' +O#1$#+ ' A 3 #64%2$; 3/" , #1%.

```

```

) 2/=%, % 38O#4" (C$/ -#+% , 8 git diff ' git status ' 3"' +%$/4; " # ' ?.: %C$/ 1/? . 4; %$8. )
24. : %/ 2#+ " /" ' C O#4/?" # 38O#4" ' $; git annotate "% 3/$- / 3/" , #1% ' 4' 3 38G/2$#(7/+ git-
1/O#?' $#1' ' , : $#68 . 3' , /$; , - $# ' O#: /+. 3" /2' ?+/" /" ' / .

```

```

) O1' +/1/ 38G/ +8 ' 20#4; ?#3%4' -m , 4( ' 44<2$1%&' ' , " # 3%+ 24/ , ./ $ 2#2$%3' $;
-#11/- $" #/ 2##67/" ' / 3 1/, %- $#1/ ( ' 20#4; ?. ( G%64#" 2##67/" ' ( # 5' -2%&' ' ).

```

```

N%- 9/ 3%9" # 2#?, %$; %" " # $' 1#3%" " 8C $/= 2 O#+#7; < git tag -a, ' "%: / # $O1%3-% 6. , /$
#$- 4#" /" %. N#4; -# %" " # $' 1#3%" " 8/ $/= ' 1%?1/G/" 8 , 4( # $O1%3- . ! " " # $' 1#3%" " 8C $/=
, %D$ 3%+ 3#?+#9" #2$; 33/2$' 2##67/" ' / -#++' $%. K-%9' $/ 3/12' <, -#$#1. < 38
' +O#1$' 1. /$, 3+/2$/ 2 4<68+' 3%9" 8+' " #38+' 5. " -&' (+ ' ' 4' ' 201%34/" ' (+ ' 3 *$#C
3/12' ' .

```

5.4.4. A8/\$%1+/*+ #S9** FreeBSD

```

B% *$#+ *$%O/ 38 +#9/$/ # $O1%3' $; ' +O#1$ 3 vendor 3 "%G 1/O#?' $#1' C.

```

```

% git push --follow-tags freebsd vendor/NetBSD/mtree

```

```

--follow-tags .-?#83%/$ git push $%- 9/ # $O1%34($; $/= ' , 23(?%" " 8/ 2 4#-%4; " #
?%5' -2' 1#3%" " #C 1/3' ?' /C.

```

5.4.5. A8/\$%1+/*+ &+, +% - *' >\$&/O> #\$\$% FreeBSD

N/O/1; 3%+ ". 9" # #6" #3' \$; mtree 3 FreeBSD. M2A#, " 8/ -#, 8 "%A#, (\$2(3 contrib/mtree, \$%-
-%- *\$# 01#=1%++ "#/ #6/20:/ "' /' ? 3"/G" ' A' 2\$#: "' - #3.

) 1/(# \$ 31/+/" ' "%+ + #9/\$ 0#\$1/6#3%; 2(3" #2' \$; ' ?+/" /"' (3 01/, #2\$%34/" " 8C
(contrib) -#, , : \$#68 4. : G/ 2##\$3/\$2\$3#3%; 0#\$1/6" #2\$(+ FreeBSD. ># 3#?+#9" #2\$',
0#9%4. C2\$, 2\$%1%CS/2; 0/1/, %3%; 4#-%4; " 8/ ' ?+/" /"' (#61%" # 3 38G/2\$(7' /
01#/- \$8 Ñ *\$# 0#+#=#/\$ ' + 4. : G/ 0#, , /19' 3%; FreeBSD, % \$%- 9/ *- #' #+' \$ 3%G/ 31/(
01' 1%?1/G/" ' ' -#" 54' - \$#3 3 6. , . 7/+ 01' ' +0#1\$/ #6" #34/" ' C.

```
% cd ../src
% git subtree merge -P contrib/mtree vendor/NetBSD/mtree
```

FS# 2#?, %2\$ -#++' \$ 24' (" (0#, , /1/3% contrib/mtree 2 4#-%4; "#C 3/\$- #C vendor/NetBSD/mtree.
M?: : ' \$/ 1%?"' &. (diff) +/9, . 1/? . 4; \$%\$##+ 24' (" (' 2#, /19' +8+ 38G/2\$(7/C 3/\$- ' .
Q24' 24' (" / 2#- 1#\$' 4# "%G' 4#-%4; " 8/ ' ?+/" /"' (, # 6#4// \$1' 3' %4; " 8A 1%?4' : ' C,
\$%- ' A -%- ' ?+/" /"' (0. 2\$8A 2\$1#- ' 4' #2\$. 0#3, 0#01#6. CS/ ' 201%3' \$; 4#-%4; " 8/
' ?+/" /"' (, : \$#68 . +/" ; G' \$; 1%?"' &. 2 38G/2\$(7/C 3/12' /C, ' 4' 0#08\$%CS/2; 3' /2\$'
#2\$%3G' /2(' ?+/" /"' (#61%" # 3 38G/2\$(7' C 01#/- \$. Q24' 3#?"' - 4' -#" 54' - \$8, 3%+
0#\$1/6. /\$2(. 2\$1%"' \$; ' A 0/1/, -#++' \$##.) -4<: ' \$/ 0#, 1#6" #2\$' #6 #6W/, ' " (/+8A
' ?+/" /"' (A 3 2##67/" ' / -#++' \$% 24' (" (.

B/- # \$ #1# / # \$ - 18\$# / 01#=1%++ "#/ #6/20:/ "' / 3-4<: %/\$ 2- 1' 0\$ configure, - # \$ #18C
=/" /1' 1. /\$ 5% C48, ' 20#4; ? . /+8/ , 4(#01/, /4/" ' (01#&/22% 26#1- ' -#, %; #68: " # *\$'
2=/" /1' 1#3%" " 8/ 5% C48, \$%- / -%- config.h, , #49" 8 #6" #34(\$; 2(-%- : %2\$; 01#&/22%
' +0#1\$%. >1' 380#4/" ' ' *\$#=# 32/=, % 0#+ " ' \$/, : \$# *\$' 2- 1' 0\$8 (34(< \$2(' 20#4" (/+8+
-#, #+, 1%6#\$%< 7' + 0#, . : D\$" 8+' , % " 8+' \$/- . 7/= # 0#4; ?#3%\$/4(. FS# \$ 01#&/22 32/=, %
, #49/" ?%0. 2-%\$; 2(3' ?#4' 1#3%" "#C 21/, /, 3' , /%4/ 3' . \$1' - 4/\$- ' , " /' +/< 7/C 2/\$/3#=#
, #2\$. 0%, ' 2 " /01' 3' 4/= 1#3%" "#C . : D\$" #C ?%0' 2; <; ' 4' , -%- + ' " ' +. +, 2 38, /4/" "#C
. : D\$" #C ?%0' 2; <, # \$4' : "#C # \$ \$C, - # \$ #1. < 38 #68: " # ' 20#4; ? . /\$ / , 4(0#32/, " /3" 8A
?%, %: ' 4' , 4(# \$01%3- ' ' ?+/" /"' C 3 1/0#?' \$ #1' C ' 2A#, "#=# -#, % FreeBSD. FS#
+ ' " ' + ' ?' 1. /\$ 1' 2- 2\$#4- " #3/" ' (2 #G' 6-%+' , - # \$ #18/ + # =. \$ 01' 3/2\$' - 0#\$/1/ , % " 8A
' 4' , 3 A. , G' A 24. : % (A, - 380#4/" ' < ?4#" %+/1/" "# 3"/, 1D" "#=# -#, % . M20#4; ?#3%" ' /
' ?#4' 1#3%" "#C - 4/\$- ' \$%- 9/ 01/, # \$31%7%/\$ #6" %1. 9/" ' / 2- 1' 0\$%+' configure 4#-%4; " #
. 2\$%" #34/" " 8A 0%- /\$#3 01#=1%++ "#=# #6/20:/ "' (, : \$# + #9/\$ 01' 3/2\$' - " /#9' , % " 8+
1/? . 4; \$%\$%+.

>1' \$/2\$' 1#3%" ' ' 3%G' A' ?+/" /"' C ?%0. 2-%CS/ ' A 2" %: %4% 3 chroot ' 4' 3 - 4/\$- /, ' 4' , %9/
3" . \$1' 3' 1\$. %4; "#C +%G' " 8, #2#6/" "# , 4(+#, ' 5' - %&' C (, 1% ' 4' 6' 64' #\$/- . FS# \$ 0#, A#,
0#+#=#/\$ 01/, # \$31%\$' \$; " /64%=#01' (\$" #/ 3?' + #, /C2\$3' / 2 3%G/C 1%6#: /C 21/, #C. FS#
+ #9/\$ 68\$; #2#6/" "# 0#4/?" # , 4(' ?+/" /"' C 3 6' 64' #\$/- %A, - # \$ #18/ ' 20#4; ? . < \$ + " # = /
- # + 0#" /" \$8 6%?#3#C 2' 2\$/+8 21/, ' 01#: /=#.

5.4.6. <+, +8- 7*, \$%- /*+ %- L * > * 7) +/+/* E \$(/\$' * (+1: /\$ 9\$' 1+&/+E %+, ' * * *' >\$&/ \$ = \$ &+, +% - FreeBSD

>#2- #4; - . \$/-. 7%(0#4' \$' - % 1/- #+/" , . /\$ ' ?6/= %\$; 24' (" ' C (merge), \$#, /24' 38G/2\$(7%(

3/\$-% FreeBSD main 01#, 3' ". 4%2; 30/1D, , # \$=#, -%- . 3%2 O#(3' \$2(3#?+#9" #2\$; #S01%3' \$; ' ?+/" /" ' (, 3%+ 01' , D\$2(O/1/, /483%\$; 24' (" ' /.

@68: " 8C git rebase ' 4' git pull --rebase "/ .+//\$ O/1/+//7%\$; -#+++' \$ 24' (" ' (#- # \$)) * (' 1*5/*5, O#*\$#+. 3+/2\$# *\$#=# 3%+ 01' , D\$2(3#22#?, %\$; -#+++' \$.

L4/, . < 7' / G%=' 24/, ./ \$ 380#4' ' \$; , : \$#68 4/=-# 3#22#?, %\$; -#+++' \$ 24' (" ' (, -%- /24' 68 git rebase --merge-commits 21%6#S%4 01%3' 4; " #:

¥ >/1/C, ' \$/ 3 -#1/" ; 1/O#?' \$#1' (

¥ L#?, %CS/ O#6#: ". < 3/\$3; XXX 2' S&+, D*) O) , /1/3% 2# 24' (" ' /+.

¥ @6" #3' \$/ *\$. O#6#: ". < 3/\$-. XXX , 4(24' (" ' (' %-\$.%4' ?%&' ' 2 #2" #3" #C 3/\$- #C FreeBSD main.

\) A, G/+ 24.: %/ 3%+ 32D 1%3" # 01' , D\$2(1%?1/G%\$; -#" 54' -\$8 24' (" ' (, /24' #"' 684' , "# *\$# , #49" # 68\$; -1%C" / 1/, -#.

\ J%?1/G' \$/ -#" 54' -\$8 ' , /24' "/#6A#, ' +#, #6W/, ' "' \$/ (collapse) "/2- #4; -# -#+++' \$#3 3 #, ' " (6/? -#" 54' -\$#3 #6W/, ' "/" /" / \$1/6. /\$2()

¥ ' ?34/- ' \$/ (checkout) 3/\$- . main

¥ 2#?, %CS/ 3/\$- . YYY (O#?3#4(/ \$ O1#7 / #S-%\$' \$; 2(, /24' : \$#-\$# O#C, /\$ " / \$%-)

¥ >#3\$#1' \$/ 24' (" ' / O#, , /1/3%

¥) +/2\$# 1%?1/G/" ' (-#" 54' -\$#3 #S 24' (" ' (O#, , /1/3%, ' ?34/- ' \$/ (checkout) 2#, /19' +#/ XXX O#3/1A " /=#.

\ P%3/1G%< 7%(. 3%9" %, -%- ' "%A#9, /" ' / "% 3/1A" /+ . 1#3" / 1/O#?' \$#1' (.

\) +/2\$# O/1/- 4<: /" ' (3/\$#- "% XXX, # " "%-4%, 83%/\$ 2#, /19' +#/ XXX O#3/1A 1/O#?' \$#1' (

¥ L, /4%CS/ -#+++' \$ O#4.: /" "#+. 1/? . 4; %\$\$. 2 O1/, 8, . 7' + 2##67/" ' /+ -#+++' \$% (O1' +/1 O1/, O#4%=%/\$, : \$# 3 3/\$- / XXX 684% \$#4; -# #, "% #O/1%&' (24' (" ').

¥ K6/, ' \$/2; , : \$# 3/\$- ' #, ' "%- #38/.

¥ L, /4%CS/ 4<68/ "/#6A#, ' +8/ O1#3/1-' , 3-4<: %(O1' 34/: /" ' / , 1. = ' A 4<, /C , 4(O1#3/1-' , /24' 38 2: ' \$%/ \$/, : \$# *\$# "/#6A#, ' +#.

¥ P%O' G' \$/ (push) *\$#\$ -#+++' \$. Q24' 38 Ç2" #3% O1# ' =1%4' 3 =#" -/È, O1#2\$# O#3\$#1' \$/ *\$' G%=' (2+. 1/&/O\$ " ' 9/)

¥ K, %4' \$/ 3/\$- ' O#24/ \$#=#, -%- -#+++' \$ O#0%, D\$ 3 38G/2\$#(7' C 1/O#?' \$#1' C. @" ' #, " #1%?#38/.

I #+%" , 8, -#\$#18/ +#9" # ' 20#4; ?#3%\$; , 24/, . (O1' 3/, D" "#+. 38G/ O1' +/1. 2mtree, 6, . \$ 38=4(, /\$; 24/, . < 7' + #61%?#++ (2' +3#4 # "%: ' "%/\$ -#+++' /" \$%1' C, O#+#=#< 7' C 23(?%\$; -#+% , 8 2 #0' 2%" ' (+ ' 38G/):

```
% cd ../src          # CD to top of tree
% git checkout -b XXX      # create new throw-away XXX branch for merge
% git fetch freebsd      # Get changes from upstream from upstream
% git merge freebsd/main  # Merge the changes and resolve conflicts
```

```
% git checkout -b YYY freebsd/main # Create new throw-away YYY branch for redo
% git subtree merge -P contrib/mtree vendor/NetBSD/mtree # Redo subtree merge
% git checkout XXX . # XXX branch has the conflict resolution
% git commit -c XXX-1 # -c reuses the commit message from commit before rebase
% git diff XXX YYY # Should be empty
% git show YYY # Should only have changes you want, and be a merge commit
from vendor branch
```

```
>1' +/: %"' /: /24' : $#-$# 0#C, /$ "/ $%- 2 -#++' $#+, 38 +#9/$/ 261#2' $; 3/$-. YYY,
0#3$#1" # 380#4"' 3 -#+" , . checkout, -#$#1%( 2#?, %4%/D, 2 54%=#+ -B, : $#68 "%: %$; ?" #3#:
```

```
% git checkout -B YYY freebsd/main # D%>=*)? (%A:E A+'&' ((:E A')1: YYY, '7<, (*9*)?
>*(%A% 5:=' ) 8+%C'
```

5.4.7. A(9, -%#- (push) *7) +/+/*E

```
I #=, % 38 2: ' $%/$/,: $# . 3%2 /2$; "%6#1' ?+/" /"' C, ' #' ' A#1#G' /, 38 +#9/$/ #S01%3' $; ' A
3 5#1- "% GitHub ' 4' GitLab , 4( 01#2+#S1% ' 1/&/" ?' 1#3%"' ( , 1.= ' +'. @, "% ' ? A#1#G' A
#2#6/" " #2$/C Git ?%- 4<: %/$2( 3 $#+, : $# # " 0#?3#4(/$ 0. 64' -#3%$; : /1" #38/ 3/12' ' 3%G/C
1%6#$8 , 4( 01#3/1-' , 1.= ' +'. H#$( Phabricator A#1#G , 4( 01#3/1-' 2#, /19%"' (,
0. 64' -%&' ( #6" #34/" " #C 3/$- ' 3/" , #1% ' -#++' $#3 24' (" ( 0#?3#4(/$, 1.= ' + 01#3/1' $;
, /$%4' , -#$#18/ 3 -#" /: " #+ ' $#=/ 0#(3($2( 3 1/0#?' $#1' ' .
```

```
>#24/ 01#3/1-' , -#=#, % 38 . 3/1/" 8, : $# *$# A#1#G// ' ?+/" /"' /, 38 +#9/$/ #S01%3' $; (push)
/= # 3 1/0#?' $#1' C FreeBSD:
```

```
% git push freebsd YYY:main # put the commit on upstream's 'main' branch
% git branch -D XXX # Throw away the throw-a-way branches.
% git branch -D YYY
```

```
>1' +/: %"' /: [ ' 20#4; ?#3#4 XXX ' YYY, : $#68 684# #: /3' , "#, : $# *$# . 9%2" 8/ ' +/"%, ' #' '
"/ , #49" 8 0#-' , %$; 3%G. +%G' " .. Q24' 38 ' 20#4; ?./$/ $%- ' / ' +/"%, 4( , 1.= #C 1%6#$8,
3%+ " . 9" # 6. , /$ 3861%$; , 1.= ' /' +/"% ' 4' 1' 2- " . $; 0#$/1($; , 1.= < 1%6#$.. ) *$' A
' +/"%A "/$ " ' : /=# 3#4G/6" #=#. ) 38G/2$#(7' C 1/0#?' $#1' C 3%+ " / 1%?1/G%$ ' A
#S01%3' $; , "#, $/+ " / +/"//, #61%$' $/ 3" ' +% " / "% $#: " 8/ -#+" , 8 38G/. B/- #S#18/
-#+" , 8 ' 20#4; ?.<$ 2' " $%-2' 2, -#$#18C 4' G; " /?"%: ' $/4; " # #S4' : %/$2( #S $' 0' : " #=#
' 20#4; ?#3%"' (, ' *$# 1%?4' : ' / 3 0#3/, /"' ' -1' $' : /2- ' 3%9" # , 4( 1%6#$8 , % " #=#
1/&/O$%.
```

5.4.8. 2- # 9+, +&+1- (: %+H*, + 1* K(\$ /+\$8>\$&*) \$

```
Q24' 38 0#08$%4' 2; 380#4"' $; #S01%3- . ' ? 01/, 8, . 7/= # 1%?, /4% ' #' % ?%3/1G' 4%2;
"/ . , %: /C, $# 3%+ 24/, . /$ 380#4"' $; 24/, . < 7' / , /C2$3' ( , 4( Ç0#3$#1" #=# 380#4" /"' (È
#0/1%&' C. F$% 0#24/, #3%$/4; " #2$; 2#A1%" (/ $ -#++' $ 2 2##67/"' /+ # -#++' $/ 32/=, % " %
0#?' &' ' XXX~1, 4( . 01#7/"' ( -#++' $%.
```

```

% git checkout -B XXX YYY # recreate that throw-away-branch XXX and switch to it
% git merge freebsd/main # Merge the changes and resolve conflicts
% git checkout -B YYY freebsd/main # Recreate new throw-away YYY branch for redo
% git subtree merge -P contrib/mtree vendor/NetBSD/mtree # Redo subtree merge
% git checkout XXX . # XXX branch has the conflict resolution
% git commit -c XXX-1 # -c reuses the commit message from commit before rebase

```

P%\$/+ 01#3/1; \$/, -%- #0' 2%" # 38G/, ' #01%3; \$/ (push), -%- #0' 2%" # 38G/, -#=#, % 6. , /\$=#\$#3#.

5.5. 6\$7&- /* + /\$%\$E %+ (#* %+/&\$, -

L. 7/2\$3. /\$ "/2-#4; -# 20#2#6#3 2#?, %" ' ("#3#C 3/\$- ' 3/", #1%. J/-#+/" , ./+8C 20#2#6 Ñ 2#?, %\$; " #38C 1/0#?' \$#1' C ' ?%\$/+ 2, /4%\$; /=# 24' (" ' / 2 FreeBSD. B%01' +/1, 01# ' ?3#, ' \$2(' +0#1\$ glorbni tz 3/12' ' 3.1415 3 , /1/3# FreeBSD. E4(01#2\$#\$8 +8 " / 6. , /+ #61/?%\$; *\$#\$ 1/4' ?. F\$# 01#2\$\$(0#4; ?#3%\$/4; 2-%(-#+%" , % , -#\$#1%(0/1/3#, ' \$.2\$1#C2\$3# nitz 3 1%?4' : " 8/ +%=' :/2- ' / 2#2\$#(" ' (glorb, ' #" % , #2\$#\$#: " # +%4%, \$%- : \$# #61/?- % " / 2*- #" #+' \$ + " #=#.

5.5.1. 6\$7&- E(+ , +9\$7* (\$, * E

```

% cd /some/where
% mkdir glorbni tz
% cd glorbni tz
% git init
% git checkout -b vendor/glorbni tz

```

B% *\$#+ *\$%0/ . 3%2 /2\$; " #38C 1/0#?' \$#1' C, 3 -#\$#1#+ 32/ " #38/ -#++' \$8 6. , . \$ "%01%34(\$; 2(3 3/\$- . vendor/glorbni tz.

@08\$" 8/ 0#4; ?#3%\$/4' Git \$%- 9/ +#=#. \$ 2, /4%\$; *\$# "/0#21/, 2\$3/" "# 3 23#/C -#0' ' FreeBSD, ' 20#4; ?. (git checkout --orphan vendor/glorbni tz, /24' ' + \$%- . , #6" //.

5.5.2. 6#\$9*, "E(+ '+8+ *' >\$&/ * #*

>#2-#4; -. *\$# " #3%(' +0#1\$' 1#3%" "%(-#0' (, 38 +#9/\$/ 01#2\$# 2-#0' 1#3%\$; 5%C48 ' 2A#, " #=# -#, % -#+%" , #C cp, 4' 6# ' 20#4; ?#3%\$; tar ' 4' , %9/ rsync, -%- 0#- %?" # 38G/. M +8 , #6%3' + 32D, 01/, 0#4%=%(#2. \$2\$3' / 5%C4#3 2 \$#: -#C 3 " %: %4/ ' +/" ' .

```

% cp -r ~/glorbni tz/* .
% git add *

```

B% *\$#+ *\$%0/ . 3%2 , #49" % 68\$; : ' 2\$%(-#0' (glorbni tz, =#\$#3%(- -#++' \$..

```
% git commit -m "Import GlibNitz frobnosticator revision 3.1415"
```

```
I%- ' 38G/, ( ' 20#4; ?#3%4 -m , 4( 01#2$#$8, "# 3%+, 3/1#($"# #, 24/, ./ $ 2#?, %$; 2##67/" ' /  
-#+++' $%, -#$#1#/#6W(2" (/ $, : $# $%- #/ Glib ' O#: /+ . , 4( /=# O#4. : /" ' ( ' 20#4; ?./ $2( Nitz.  
B/ 32/ *$# ?" %< $, O#*$#+. . , 4( 3%G/=# 1/%4; "#=# -#+++' $% 3%+ 24/, ./ $ 1. -#3#, 2$3#3%$; 2(  
1%?, /4##+ 2##67/" ' / -#+++' $%, % " / ' + ' $' 1#3%$; -1%$- ' C 2$' 4; , ' 20#4; ?#3%" " 8C?, /2; .
```

5.5.3. ; +9+, : *) 9\$, (*, "E(+ += \$ % /- L , +9\$7* (\$, * E

N/O/1; "/#6A#, ' +# ' +O#1\$' 1#3%\$; 3/\$- . 3 "%G 1/O#?' \$#1' C.

```
% cd /path/to/freebsd/repo/src  
% git remote add glibnitz /some/where/glibnitz  
% git fetch glibnitz vendor/glibnitz
```

```
@61%$' $/ 3" ' +%" ' /, : $# 3/$- % vendor/glibnitz "%A#, ' $2( 3 1/O#?' $#1' ' . B% *$#+ *$%O/  
/some/where/glibnitz + #9" # . , %4' $; , /24' A#$' $/. FS# 684# 4' G; 01##+/9. $#: " 8+ G%=##  
, 4( , #2$' 9/" ' ( &/4' .
```

5.5.4. 6&+1-E(+ (+ = * \$(9, -%: (+ (push)

```
E#4; "/CG' / G%=' 3# +" #=#+ "%%4#=' : " 8 01#&/22. #6" #34/" ' ( 3/$- ' 3/" , #1%, ?%  
' 2- 4< : /" ' /+ 2#+#=# G%=% #6" #34/" ' ( 3/$- ' 3/" , #1%.
```

```
% git worktree add ../glibnitz vendor/glibnitz  
% cd ../glibnitz  
% git tag --annotate vendor/glibnitz/3.1415  
# F5' =, )' 7?, 9)% 1%&&, ) .%+%0, -, 7 8%&&C?E "git show"  
% git push --follow-tags freebsd vendor/glibnitz
```

>#, ÇA#1#G' +È +8 O#, 1%?. +/3%/+:

1.) 2/ "/#6A#, ' +8/ 5%C48 01' 2. \$2\$3. < \$
2. B' #, ' " ' ? " /O1%3' 4; " 8A 5%C4#3 " / O1' 2. \$2\$3. /\$
3.) /\$- % 3/" , #1% . - %?83%/\$ "% : \$#-\$# 1%?. + " #/
4. N/= 38=4(, ' \$ A#1#G# ' ' +// \$ % " "#\$%&' <
5. L##67/" ' / -#+++' \$% , 4(\$/= % 2#, /19' \$ - 1%\$- . < 23#, - . # " #3#33/, /" ' (A 2 +##+/" \$%
O1/, 8, . 7/= # \$/= %

5.5.5. C, +) 5 /- #\$/+@ ' &+1- (: ' 1*5/* + K(\$=\$ % 8- 7\$%\$+ &+, +% \$

```
% cd ../src  
% git subtree add -P contrib/glibnitz vendor/glibnitz  
# F5' =, )' 7?, 9)% 1%&&, ) .%+%0, -, 7 8%&&C?E "git show"
```

```
% git commit --amend # one last sanity check on commit message
% git push freebsd
```

P, /2; ÇA#1#G' CÈ #?" %: %/\$:

1.) 2/ 01%3' 4; " 8/ 5%C48 ' " ' #, "#=# " /01%3' 4; "#=# 684' #6W/, ' " /" 8 24' (" ' /+ 3 contrib/glorbnitz.
2.) , /1/3/ " /\$, 1. =' A ' ?+/" /" ' C.
3. L##67/" ' (-#++' \$#3 , #49" 8 38=4(, /\$; A#1#G#. @" ' , #49" 8 2#, /19%; 23#, - . ' ?+/" /" ' C 2 +##/" \$% 0#24/, "/=# 24' (" ' (2 #2" #3" #C 3/\$- #C FreeBSD main ' 4<68/ 01/, #2\$/1/9/" ' (.
4. RELNOTES ' UPDATING , #49" 8 68\$; #6" #34/" 8, /24' /2\$; : \$-\$# 3%9" #/, "%01' +/1, ?%+/\$" 8/ 0#4; ?#3%\$/4(+ ' ?+/" /" ' (, 3%9" 8/ %20/- \$8 #6" #34/" ' (' \$, .

!

```
F$# /7D " / 0#, -4<: ' 4# glorbni tz - 26#1-/. LO#2#6 2, /4%$; *$# ?%3' 2' $ # $
-#" - 1/$" #=# ' +0#1$' 1. /+##=# 01#=#1%++" #=# #6/20/: /" ' ( ' 38A#, ' $ ?%
1%+- ' , %" " #=# 1. -#3#, 2$3%.
```

5.5.5.1. 6\$>, - /55 - #(" - 1: /\$' (:

```
M$%- , 31/+( ' , D$. >1' G4# 31/+( #6" #3' $; , /1/3# , # 0#24/, " ' A ' ?+/" /" ' C ' ?
38G/2$$(7/= # 1/0#?' $#1' (. >1' 0/1/A#, / "% 3/$- . main (01' checkout) . 6/, ' $/2; , : $# . 3%2
"/$ " /?%- #++' : /" " 8A' ?+/" /" ' C. B%+" #=# 01#7 / ?%- #++' $' $; ' A 3 # $, /4; ". < 3/$- . ( ' 4'
' 20#4; ?#3%$; git stash) 0/1/, 380#4' /" ' /+ 24/, . < 7' A , /C2$3' C.
```

```
Q24' 38 01' 38- 4' - git pull , +8 "%2$#($/4; "# 1/- #+/" , . /+ ' 20#4; ?#3%$; #0&' < --ff-only
' , #0#4" ' $/4; "# . 2$%" #3' $; /D 3 -%: /2$3/ #0&' ' 0# . +#4: %" ' <.) -%: /2$3/ %4; $/1" %$' 38,
git pull --rebase 0#4/?/" , /24' . 3%2 /2$; ' ?+/" /" ' (, 01#' " , /-2' 1#3%" " 8/ (stage) 3 3/$- /
main.
```

```
% git config --global pull.ff only
```

```
) #?+#9" #, 3%+ 0#1/6. /$2( #0. 2$' $; --global, /24' 38 A#$' $/, : $#68 *$% " %2$1#C-%
01' +/" (4%2; $#4; -# - *$#+. 1/0#?' $#1' <.
```

```
% cd freebsd-src
% git checkout main
% git pull (--ff-only|--rebase)
```

```
L. 7/2$3. /$ 1%201#2$1%" D" "%( 4#3. G-%: -#+%", % git pull 0#08$%/$2( 380#4" ' $; 24' (" ' /,
: $# ' " #=#, % 2#?, %D$ - #++' $ 24' (" ' (, - # $#1#=# 1%" // " / 2. 7/2$3#3%4#.) #22$%" #34/" ' / 0#24/
*$#=# + #9/$ 68$; ?%$1. , " ' $/4; " #.
```

J/- #+/" , . /\$2(\$%- 9/ ' 20#4; ?#3%\$; 1%2G' 1/" " . < 5#1+..

```
% cd freebsd-src
% git checkout main
% git fetch freebsd
% git merge --ff-only freebsd/main
```

FS' -#+%", 8 261%283%<\$ 3%G/ , /1/3# - 3/\$- / main, % ?%\$/+ #6" #34(<\$ /=# ' ? ' 2A#, "#=# ' 2\$#: "' - %, #-\$., % , /1/3# 684# 0/13#" %: %4; "# 0#4. : /" # (pull).)%9" # 0/1/- 4<: ' \$; 2("% main 0/1/, 380#4" /" ' /+ *\$#=#, : \$#68 #6/20/: ' \$; 01#, 3' 9/" ' / 30/1D, . N/0/1; 01' G4# 31/+ (01#, 3' ". \$; ' ?+/" /" ' (30/1D, :

```
% git rebase -i main working
```

FS# 38?#3/\$ ' " \$/1%- \$' 3" 8C *- 1%" , 4(' ?+/" /" ' ("%2\$1#/- 0# . +#4: %"' < . >#- % 01#2\$# 38C, ' \$/ ' ? 1/, %- \$#1%.) 2D , #49" # 01' +/" ' \$; 2(%3\$#+%\$' : /2- ' . Q24' " /\$, \$# 3#+ 0# \$1/6. /\$2(1%?1/G' \$; 1%?4' : ' (. E#- . +/" \$%&' ([GitHub](#) + #9/\$ 0#+#; ; 3#+ 3 *\$#+ 01#&/22/.

5.5.5.2. C, +) 5 \$ (9, -%* (: (push) *7) +/+/* 5 %%, > (upstream)

L" %: %4% . 6/, ' \$/2;, : \$# URL , 4(#01%3- ' (push) 01%3' 4; "# "%2\$1#/" , 4(38G/2\$#(7 /=# 1/0#?' \$#1' (.

```
% git remote set-url --push freebsd ssh://git@gitrepo.freebsd.org/src.git
```

P%\$/+ . 6/, ' \$/2;, : \$# ' + (0#4; ?#3\$/\$4(' %, 1/2 *4/- \$1#" "#C 0#: \$8 "%2\$1#/" 8 01%3' 4; "#. N1/6. /\$2(, : \$#68 #"' \$#: "# 2##3/\$2\$3#3%4' ?%0' 2' passwd 3 - 4%2\$/1/ FreeBSD.

M20#4; ?#3%" ' /

```
freefall% gen-gitconfig.sh
```

"% freefall.freebsd.org (01' .24#3' ' , : \$# /usr/local/bin "%A#, ' \$2(3 PATH), : \$#68 0#4. : ' \$; =#\$#38C G%64#" - #' 5' =. 1%&' ' , - # \$#18C + #9" # ' 20#4; ?#3%; "%01(+. <.

L4/, . < 7% (-#+%", % , /4%/\$ 24' (" ' / 3/\$- ' working 3 #2" #3" . < 3/\$- . main 38G/2\$#(7 /=# 1/0#?' \$#1' (.) %9" #, : \$#68 38 0#, =#\$#3' 4' 23# ' ' ?+/" /" ' (' +/" "# \$%- , -% - A#\$' \$/ 3' , /\$; ' A 3' 2A#, "# + 1/0#?' \$#1' ' FreeBSD, 0/1/, 380#4" /" ' /+ *\$#C #0/1%&' ' . E%" " 8C 2' " \$%- 2' 2 #01%34(/\$ (push) 3/\$- . working 3 main, 0/1/+ /7% (3/\$- . main 30/1D, .) 8 2+ #9/\$/ 2, /4%\$; *\$# \$#4; - # 3 \$#+ 24. : %/, /24' 1/? . 4; \$%\$#+ 6. , /\$ 4' "/C" #/ ' ?+/" /" ' / , 4(main (\$./ 6/? 24' (" ' C).

```
% git push freebsd working:main
```

Q24' 3%G% #01%3- % (push) # \$- 4#" /" % ' ?-% 01# ' =18G% 3 =# - / - #++ ' \$#3, 0/1/6%' 1. C\$/ 3%G. 3/\$- . 0/1/, 0#3\$#1" #C 0#08\$- #C:

```
% git checkout working
% git fetch freebsd
% git rebase freebsd/main
% git push freebsd working:main
```

5.5.5.3. C, +) 5 \$(9, -%*((: (push) *7) +/+/*5 %%+, > (- 1: (+, /- (*%/OE %- , *- /())

```
B/- #18+ . , #6" // , /4%; 24' (" ' / 23#' A ' ?+/" /"' C 3 4#-%4; " . < 3/$- . main 0/1/,
#01%3- #C 3 . , %4D" " 8C 1/0#?' $1' C. I 1#+/ $#=#, git arc stage 0/1/+ /7%/$ ' ?+/" /"' ( ' ?
3/$- ' 3 4#-%4; " . < main, -#=#, % $1/6. /$2( 380#4" ' $; $4; -# :%2$; ' ?+/" /"' C ' ? 3/$- ' .
M" 2$1. - &' ' 2A#9' 2 01/, 8, . 7' + 1%?, /4#+:
```

```
% git checkout main
% git merge --ff-only `working`
% git push freebsd
```

Q24' 38 01#'=1%4' =#" -., 0#01#6. C\$/ 2" #3%2

```
% git pull --rebase
% git push freebsd
```

```
F$' -#+%" , 8 0#4. : %$(fetch) 0#24/, "' / ' ?+/" /"' ( ' ? freebsd/main, % ?%$/+ 0/1/6%' 1. < $
(rebase) 4#-%4; " 8/ ' ?+/" /"' ( main 0#3/1A "' A, : $# ' $1/6. /$2(, -#=#, % 38 01#'=1%4' =#" - .
-#++' $#3. >1' +/: %"' /: -#++' $8 24' (" ( 3/$- ' 3/" , #1#3 " / 6. , /$ 1%6#$%; 2 *$#C
$/A"' -#C.
```

5.5.5.4. <\$*' # , +%*7** Subversion

```
)%+ " . 9" # . 6/, ' $; 2(, : $# 38 0#4. : ' 4' (fetch) 01' +/: %"' ( (0#, 1#6" #2$' 2+ #1' $/ 3
1%?, /4/ Q9/, " /3" #/ ' 20#4; ?#3%" /). I%- $4; -# 38 *$# 2, /4%/$/, 01' +/: %"' ( 6. , . $
#$#61%9%; 2( 3 -#+%" , / git log 24/, . < 7' + #61%?#+:
```

```
% git log
```

Q24' . 3%2 /2\$; -#" - 1/\$" (3/12' (, 38 + #9/\$/ ' 20#4; ?#3%; *\$. -#" 2\$1. - &' <:

```
% git log --grep revision=XXXX
```

```
: $#68 "%C$' -#" - 1/$" . < 1/3' ?' <. S /2$"% , &%$/1' : " #/ : ' 24# 0#24/ 'commit' Ñ *$# A*G,
-#$#18C + #9" # ' 20#4; ?#3%; , 4( 2284- ' " %*$#$ -#++' $.
```

5.6. F- ' (\$ 7- &- %- +) O+ %\$9, \$' O \$ Git

) *\$#+ 1%?, /4/ 01/, 2\$%34/" 8 -#" - 1/\$" 8/ #3/\$8 "% 3#01#28, -#\$#18/ :%2\$# 3#?"' - %< \$.
 O#4; ?#3%\$4/C ' 1%?1%6#\$: ' -#3.

!

```
O8 ' 20#4; ?. /+ #67/01' " ($#/ 2#-4%G/" ' /, 2#-4%2" # -#$#1#+. ' 2$#: "' -#+
, 4( 1/0#?' $#1' ( FreeBSD (34(/$2( 'freebsd', % " / 2$%", %1$" 8C 'origin', : $#68
O#?3#4' $; 4<, (+ ' 20#4; ?#3%$; /=# , 4( 2#62$3/" "#C 1%?1%6#$- ' '
+ ' "' + ' ?' 1#3%$; 24. : %C" 8/ #01%3- ' (push) 3 "/01%3' 4; " 8C 1/0#?' $#1' C.
```

5.6.1. < \$1: 7\$%- (+1*

5.6.1.1. 2- # \$(' 1+D*%- (: -current * -stable, *) +5 (\$1: #\$ \$&/" #9*3 , +9\$7* (\$, *5?

C: H\$\$(+/2\$# "% , ' 2- / " / (34(/\$2(6#4; G#C 01#64/+ #C, *55/- \$' 3" // ' 20#4; ?#3%\$; \$#4; -#
 #, ". -#0' < 1/0#?' \$#1' (. >1' ?/1-%4' 1#3%" "' SVN (+= ' ?34/- %\$; "/2-#4; -# , /1/3; /3' ?
 #, "#=# ' \$#=# 9/ 1/0#?' \$#1' (. I%- + " / 2, /4%\$; *\$# 2 O#+#7; < Git?

A:) 8 + #9/\$/ ' 20#4; ?#3%\$; 1%6#: ' / , /1/3; (Git. L. 7/2\$3. /\$ " /2-#4; -# 20#2#6#3 2, /4%\$;
 *\$#, "# 2#+ 8C 01#2\$#C Ñ ' 20#4; ?#3%\$; - 4#" , 4(#24/9' 3%"' (-current ' 1%6#: // , /1/3#
 , 4(#24/9' 3%"' (2\$%6' 4; " 8A 380. 2-#3. H\$\$(' 20#4; ?#3%"' / Ç=#4#=# (bare) 1/0#?' \$#1' (È
 01/, 4%=%4#2; -%- 20#2#6 201%3' \$; 2(2 *\$' +, *\$# 6#4// 24#9" # ' ?, /2; , #- . +/" \$' 1#3%\$; 2("/
 6. , /\$.

L" %: %4% " /#6A#, ' + # - 4#" ' 1#3%\$; 1/0#?' \$#1' C FreeBSD, ?, /2; O#-%?" # - 4#" ' 1#3%" ' / 3
 freebsd-current , 4(' ?6/9%"' (O. \$%"' &8. \$URL Ñ *\$# 4<6#C ?/1-%4; " 8C 2/13/1, -#\$#18C
 1%6#\$%/ \$, 4(3%2 " %' 4. : G' + #61%?#+:

```
% git clone -o freebsd --config remote.freebsd.fetch='+refs/notes/*:refs/notes/*' $URL
freebsd-current
```

O#24/ \$#=#, -%- # " 6. , /\$ - 4#" ' 1#3%", 38 + #9/\$/ 01#2\$# 2#?, %\$; 1%6#: // , /1/3# ' ? " /=#:

```
% cd freebsd-current
% git worktree add ../freebsd-stable-12 stable/12
```

*\$# ' ?34/: D\$ stable/12 3 -%\$%4#=# 2 ' +/" /+ freebsd-stable-12, -#\$#18C "%A#, ' \$2("% #, "#+
 . 1#3" / 2 -%\$%4#=#+ freebsd-current. >#24/ 2#?, "%" (# " #6" #34(/\$2(#: /"; O#A#9' + #61%?#+,
 -%- 38 + #4' 68 #9' , %\$; :

```
% cd freebsd-current
% git checkout main
% git pull --ff-only
# changes from upstream now local and current tree updated
% cd ../freebsd-stable-12
% git merge --ff-only freebsd/stable/12
```

```
# now your stable/12 is up to date too
```

```
[ 1/- #+/" , . < ' 20#4; ?#3%; --ff-only, $%- -%- *$# 6/?#0%2" // ' 0#?3#4(/$ ' ?6/9%;  
24. : %C" #=# 0#0%, %" ' ( 3 '- #G+%1 24' (" ' (, -#=#, % 3 3%G/+ , /1/3/ 0#(34(<$2(  
, #0#4' '$/4; " 8/ ' ?+/" /" ' (, 38" . 9, %< 7' / 380#4" ($; 24#9" #/ 24' (" ' / 3+ /2$# 01#2$#=#.
```

```
) $ A#1#G( 2$%; (, 3 - # $1#C 1%22+%$1' 3%/ $2( *$# $ 3#01#2 6#4// 0#, 1#6" #.
```

5.6.2. ! - 7, - 8\$(4*#*

```
5.6.2.1. AE! N 7- # $ ) ) * ( * 1 % main % ) + ' ( $ &, "= $E %+ (#*.
```

```
C:) 1/( # $ 31/+/" ' ( #G' 6%<2; ' 0# #G' 6- / , /4%< -#++' $ 3 3/$- . main. Z$# + " / , /4%; ?
```

```
A:) #-0/138A, " / 0%" ' -. C$/.
```

```
) #-3$#18A, " / # $01%34(C$/ (push) ' ?+/" /" ' ( . B% 2%+## , /4/, + #9" # ' 201%3' $; 0#: $' 32D,  
/24' ' ?+/" /" ' ( " / 684' # $01%34/" 8. ) 2/ # $3/$8 3 *$#+ 1%?, /4/ 01/, 0#4%=%<$, : $#  
# $01%3- ' " / 01# ' ?#G4#.
```

```
L4/, . < 7' C # $3/$ 01/, 0#4%=%/$, : $# 38 ?%- #++' $' 4' 3 main ' A#$' $/ 2#?, %$; 3/$- . 2  
"%?3%" ' /+ issue:
```

```
% git checkout -b issue # Create the 'issue' branch  
% git checkout -B main freebsd/main # Reset main to upstream  
% git checkout issue # Back to where you were
```

```
5.6.2.2. AE! N 7- # $ ) ) * ( * 1 4($-($ /+ % (" %+(#!
```

```
C: [ 1%6#$%4 "%, 5. "- &' /C 3 3/$- / wilma, "# 24. : %C" # 2, /4%4 - #++' $ ' ?+/" /" ' < ,  
#$" #2(7/+ . 2( - 3/$- / fred, 3 'wilma'. Z$# + " / , /4%; ?
```

```
A: @ $3/$ %" %4#=' : /" 01/, 8, . 7/+ . , "# 2 ' 20#4; ?#3%" ' /+ 386#1#: "#=# 01' +/" /" ' /+  
- #++' $#3 (cherry-pick). >1/, 0#4%=%/$2(, : $# 3 3/$- / wilma ' +// $2( 32/=# #, ' " - #++' $,  
#, "%- # 0#, A#, + #9" # #6#67' $; ' , 4( 6#4// 24#9" 8A 2' $. %&' C. N%- 9/ 01/, 0#4%=%/$2(, : $#  
*$# 0#24/, "' C - #++' $ 3 3/$- / wilma (#$2<, % ' 20#4; ?#3%" ' / wilma 3 - #+%", / git cherry-  
pick), " # ' *$# + #9" # #6#67' $; .
```

```
# We're on branch wilma  
% git checkout fred # move to fred branch  
% git cherry-pick wilma # copy the misplaced commit  
% git checkout wilma # go back to wilma branch  
% git reset --hard HEAD^ # move what wilma refers to back 1 commit
```

```
Q24' *$# " / 0#24/, "' C - #++' $, 38 + #9/$/ 386#1#: "# 01' +/" ' $; (cherry-pick) *$# #, "#  
' ?+/" /" ' / ' ? wilma - fred, ?%$/+ ' 20#4; ?#3%; git rebase -i, : $#68 . , %4' $; ' ?+/" /" ' / ' ?  
wilma.
```

```
# G; (*.%=&72 (* A')1' wilma
% git checkout fred          # 8'+'-), (* A'): fred
% git cherry-pick HASH_OF_CHANGE # 71%8,+%A*)? %0,5%9(% +*>&'CH((; - 1%&&,)
% git rebase -i main wilma   # :=*,<,) ? 71%8,+%A*(('% ,>&' (' (,'
```

C: B# :\$#, /24' (A#: . 2,/4%\$; -#++' \$ "/2-#4; -' + ' ?+/" /"' (+ 3 main, "# #2\$%3' \$; #2\$%4; " 8/ 3 wilma 0# -%- #C-\$# 01' : ' " /?

A: N#\$ 9/ +/\$#, , #0' 2%" " 8C 38G/, \$%- 9/ 1%6#\$%/\$, /24' 38 A#\$' \$/ Ç01' ?/+4' \$; È : %2\$' 3/\$- ', "%, -#\$#1#C 1%6#\$%/\$, 3 main , # \$#=#, -%- 32(3/\$-% 6., /\$ =#\$#3% (2-%9/+, 38 ?%+/\$' 4' "/23(?%" ". < #0/: %\$-. ' 4' ' 201%3' 4' 24. : %C". < #G' 6-.).) 8 + #9/\$/ 386#1#: "# 01' +/" ' \$; (cherry-pick) *\$' ' ?+/" /"' (3 main, % ?%\$/+ #S01%3' \$; ' A 3 1#, ' \$/4; 2- ' C 1/0#?' \$#1' C. >#24/ \$#=#, -%- 38 *\$# 2, /4%/\$, #: ' 2\$-% "/ + #9/\$ 68\$; 01#7/: 01#2\$# 380#4"' \$/ git rebase -i. Git ?%+/\$' \$, : \$# 38 *\$# 2, /4%4', ' %3\$#+%\$' : /2- ' 01#0. 2\$' \$ #67' / ' ?+/" /"' ((, %9/ /24' 3%+ 01' G4#2; ' ?+/" ' \$; 2##67/" ' / -#++' \$%' 4' 24/=-% 0#, -#11/- \$' 1#3%\$; -#++' \$). B/\$ "/#6A#, ' + #2\$' 0/1/- 4< : %\$; 2(#61%\$" # "% wilma, : \$#68 /D 0#01%3' \$; : 01#2\$# , /4%CS/ rebase!

C: [A#: . 38, /4' \$; "/- # \$#18/ ' ?+/" /"' (' ? 3/\$- ' wilma 3 3/\$- . fred

A: T#4// #67' C #3/\$ 6., /\$ \$%- ' + 9/, -%- ' 01/, 8., . 7' C.) 8 , #49" 8 38=1. ?' \$; (checkout)/2#?, %\$; 3/\$- . fred, 386#1#: "# 01' +/" ' \$; (cherry-pick) ". 9" 8/ ' ?+/" /"' (' ? 3/\$- ' wilma 0# #, "#+., % ?%\$/+ 0/1/6%?' 1#3%\$; (rebase) wilma, : \$#68 ., %4' \$; \$/ ' ?+/" /"' (, -#\$#18/ 38 386#1#: "# 01' +/" ' 4'. git rebase -i main wilma 0/1/" /2D\$ 3%2 3 1/, %- \$#1, =, / ". 9" # ., %4' \$; 2\$1#- ' pick, 2##\$3/\$2\$3. < 7' / -#++' \$%+, -#\$#18/ 38 2- #0' 1#3%4' 3 fred. Q24' 32D 01#C, D\$ A#1#G# ' "/ 6., /\$ - # " 54' - \$#3, 38 ?%- #: ' 4'. Q24' "/ \$, 3%+ ". 9" # 6., /\$ 1%?1/G%\$; -# " 54' - \$8 0# +/1/ ' A 0#(34/" ' (.

E1. =#C 20#2#6 2, /4%\$; *\$# Ñ 38=1. ?' \$; wilma, % ?%\$/+ 2#?, %\$; 3/\$- . fred, . - %?83% < 7. < "% \$. 9/ \$#: -. 3, /1/3/. P%\$/+ 38 + #9/\$/ 380#4"' \$; git rebase -i , 4(#6/' A *\$' A 3/\$#-, 386' 1%(' ?+/" /"' (, -#\$#18/ 38 A#\$' \$/ 3' , /\$; 3 fred ' 4' wilma, #2\$%34((2\$1#- ' 2 pick ' ., %4((#2\$%4; " 8/ 3 1/, %- \$#1/. B/- # \$#18/ 01/, 0#: ' \$%< \$ 2#?, %\$; \$/=3/\$- . 2 "%?3%" ' /+ pre-split 0/1/, "%: %4#+, "% 24. : %C /24' : \$#-\$# 0#C, /\$ "/ \$%- 01' 1%?, /4/" ' ' .) 8 + #9/\$/ # \$+/" ' \$; *\$# 24/, . < 7/C 0#24/, #3%\$4; " #2\$; < :

```
% git checkout pre-split    # Go back
% git branch -D fred        # delete the fred branch
% git checkout -B wilma     # reset the wilma branch
% git branch -d pre-split   # Pretend it didn't happen
```

>#24/, "' C G%= "/#6(?%\$4/" . Q24' 38 2#6' 1%/\$/2; 0#3\$#1' \$; 0#08\$-. 1%?, /4/" ' (, /=# + #9" # 01#0. 2\$' \$; .

C: B# (, /4%4 32D 0# +/1/ 01#: \$/" ' (' " / . 3' , /4 3%G 2#3/\$ 3 - # " &/ 2#?, %\$; 3/\$- ., ' \$/0/1; fred ' wilma 0#4" #2\$; < ' 20#1: /" 8. I %- + " / "%CS' , : /+ wilma 684% , # \$#=#, -%- ("%: %4. ["/ ?" %<, 2- #4; - # 1%? (32D 0/1/2\$%34(4.

A: B/ 32D O#\$/1(" #.) 8 + #9/\$/ 1%?#61%\$; 2(2 *\$' +, /24' O1#G4# " / 24' G- #+ + " #=# 31/+/' ' 4' " / 684# 2, /4% " # 24' G- #+ + " #=# - #++' \$#3 (2#\$" ').

M\$%- , (2#?, %4 3/\$- . wilma ' ?%- #+++' \$' 4 3 " /D O%1. ' ?+/" /"' C, ?%\$/+ 1/G' 4 1%?, /4' \$; /D "% fred ' wilma. B' : /=# 2\$1%" "#=# O1' *\$#+ " / O1#?#G4#, " # O1/, O#4#9' +, : \$# O1#?#G4#. LO#2#6 O#2+ #S1/\$; , : \$# 38 2, /4%4' , Ñ *\$# ' 20#4; ?#3%\$; git reflog:

```
% git reflog
6ff9c25 (HEAD -> wilma) HEAD@{0}: rebase -i (finish): returning to refs/heads/wilma
6ff9c25 (HEAD -> wilma) HEAD@{1}: rebase -i (start): checkout main
869cbd3 HEAD@{2}: rebase -i (start): checkout wilma
a6a5094 (fred) HEAD@{3}: rebase -i (finish): returning to refs/heads/fred
a6a5094 (fred) HEAD@{4}: rebase -i (pick): Encourage contributions
1ccd109 (frebsd/main, main) HEAD@{5}: rebase -i (start): checkout main
869cbd3 HEAD@{6}: rebase -i (start): checkout fred
869cbd3 HEAD@{7}: checkout: moving from wilma to fred
869cbd3 HEAD@{8}: commit: Encourage contributions
...
%
```

P, /2; +8 3' , ' + ' ?+/" /"' (, - #S#18/ (3" /2.) 8 + #9/\$/ ' 20#4; ?#3%\$; *\$#, : \$#68 O#" (\$; , =, / : \$#-\$# O#G4# " / \$%- . [4' G; . -%9. " % " /2- #4; - # + #+/" \$#3. > /138C ' ? "' A Ñ HEAD@{X} (34(/\$2('- #+++' \$#O#, #6" #C' 2. 7 " #2\$; <, O#*\$#+. 38 + #9/\$/ ' 20#4; ?#3%\$; *\$# 3 -%: /2\$3/ %1=. +/" \$% - #+%", 8. H#\$ (/24' *\$% - #+%", % 3" #2' \$: \$#-4' 6# 3 1/O#?' \$#1' C, " #+ /1% X ' ?+/" (< \$2(.) 8 \$%- 9/ + #9/\$/ ' 20#4; ?#3%\$; A*G (O/138C 2\$#46/&).

E%4//, 'Encourage contributions' 684 O#24/, "' + - #+++' \$#+, - #S#18C (2, /4%4 3 wilma O/1/, \$/+ , -% - 1/G' 4 1%?, /4' \$; 32D.) 8 \$%- 9/ + #9/\$/ 3' , /\$; , : \$# \$# \$ 9/ A*G O1' 2. 2\$S3. /\$, - #=#, % (2#?, %4 3/\$- . fred , 4(*\$#=#. ["%: %4 2 O/1/6%' 1#3%" ' (fred, ' 38 3' , ' \$/ "' %: %4#, - %9, 8C G#=' '?%3/1G/' ' / *\$#=# O1#&/22%. H#\$ ("%+ *\$# ? , /2; " / " . 9" #, 38 + #9/\$/ \$#: " # O#" (\$; , : \$# O1#?#G4#. I 2: %2\$; <, : \$#68 ' 201%3' \$; *\$#, 38 + #9/\$/ 380#4" ' \$; G#=' ' ? O1/, 8, . 7 /=# #S3/\$%, " # 2 A*G/+ 869cbd3 3+ /2\$# pre-split. H#\$ (*\$# - %9/\$2(" /+ " #=# + " #=#24#3" 8+, *\$# 4/=- # %O#++ " ' \$; , O#2- #4; -. 38 , /4%/\$/ #, " # , /C2\$3' / ?% 1%?.) 8 \$%- 9/ + #9/\$/ O#24/, #3%\$/4; " # O1' +/" ' \$; - #+%", 8 #, " . ?%, 1. =#C:

```
% git checkout -B wilma 869cbd3
% git branch -D fred
```

' 38 =#\$#38 O#O1#6#3%\$; 2" #3%. I #+%", % checkout -B 2 A*G/+ #6W/, ' " (/ \$ ' ?34:/ /"' / (checkout) ' 2#?, %"' / 3/\$- ' , 4(" /=#. M20#4; ?#3%" ' / -B 3+ /2\$# -b O1' " . , ' \$/4; " # O/1/+ /7%/\$. 9/ 2. 7 /2\$3. < 7. < 3/\$- . .) 4< 6#+ 24. : %/ *\$# 1%6#%/\$, : \$# ' O1/- 1%2" # (' . 9%2" #) 3 Git. @, " % ' ? O1' : ' " , O# - #S#1#C (2- 4#/" /' ' 20#4; ?#3%\$; git checkout -B xxxx . /O 3+ /2\$# ' ?34:/ /"' ((checkout) A*G%, % ?%\$/+ 2#?, %"' (/ O/1/+ /7/" ' (3/\$- ' , Ñ *\$# : ' 2\$# : \$#68 ' ?6/9%\$; 24/=- % \$1/3#9" #=# 2##67/" ' (#6 #\$, /4D" " #+ HEAD:

```
% git checkout 869cbd3
M faq.md
```

Note: checking out '869cbd3'.

You are in 'detached HEAD' state. You can look around, make experimental changes and commit them, and you can discard any commits you make in this state without impacting any branches by performing another checkout.

If you want to create a new branch to retain commits you create, you may do so (now or later) by using `-b` with the checkout command again. Example:

```
git checkout -b <new-branch-name>
```

```
HEAD is now at 869cbd3 Encourage contributions
```

```
% git checkout -B wilma
```

```
*$# 01#' ?3#, ' $ $$$ 9/ *55/- $, " # +"/ 01' A#, ' $2( : ' $$$; =#1%?, # 6#4; G/, % # $1. 64/" " 8/
=#4#38 (01' + 0/1/3.: detached HEAD Ñ # $1. 64/" "% (= #4#3%) Ñ " / $$$ #61%?, - # $18C +"/
" 1%3' $2( 2#?/1&%$; .
```

```
5.6.2.3. AE! N %O9$1/* 1 git pull , * K($ ' $7&- 1$ # $ ) * ( ' 1*5/*5, 4($) /+ &+1- (: ?
```

```
C: [ , /C2$3#3%4 "% %3$#0' 4#$/ ' 2, /4%4 git pull , 4( 23#/=# , /1/3% 1%?1%6# $- ' , : $ # 2#?, %4#
-#++' $ 24' ( "' ( 3 main. I %- +"/ 3#22$%" #3' $; 2(?
```

```
A: F$# + #9/$ 01#' ?#C$' , -#=#, % 38 380#4" (/ $/ ' ?34/: /" ' / (checkout) 2 3861%" " #C 3/$- #C
1%?1%6# $- ' .
```

```
O" #=' / 1%?1%6# $: ' - ' ' 20#4; ? . < $ git pull --rebase, : $ #68 ' ?6/9%$; *$#C 2' $. %&' ' .
```

```
L1%?. 0#24/ 0#4. : /" ' ( ' 24' ( "' ( (pull) . 3%2 3 1%6#: . < -#0' < 6. , /$ ' ?34/: /" " #38C
-#++' $ 24' ( "' ( . Git 0#, , /19' 3%/$ 2' " $%- 2' 2 HEAD^# , 4( #01/, /4/" ' ( 1#, ' $/4/C -#++' $%
24' ( "' ( :
```

```
git log --oneline HEAD^1 # Look at the first parent's commits
git log --oneline HEAD^2 # Look at the second parent's commits
```

```
M? *$' A 9. 1"%4#3 38 + #9/$/ 4/=- # 01/, /4' $; , -% -#C -#++' $ (34(/$2( 3%G/C 1%?1%6# $- #C.
P%$/+ 38 01#2$# 261%283%/$/ 23#< 3/$- . - 2##$3/$2$3. < 7/+ . HEAD^#:
```

```
git reset --hard HEAD^1
```

```
I 1#+/ $#=#, -#+" , % git pull --rebase "% *$#+ *$%0/ 0/1/6%' 1. /$ 3%G' ' ?+/" /" ' ( ' ? 3/$- '
'main' "% 0#24/, "<< 3/12' < 'frebsd/main'.
```

```
C: B# +"/ $%- 9/ " . 9" #' 201%3' $; + #< 3/$- . main. I %- +"/ *$# 2, /4%$; ?
```

```
A: Git # $24/9' 3%/$ 3/$- ' . , %4D" " #=# 1/0#?' $ #1' ( 3 01#2$1%" 2$3/ ' +D" frebsd/. Z$#68
' 201%3' $; 3%G. 3/$- . main, 01#2$# ?%2$%3; $/ /D. - %?83%$; " % . , %4D" " . < 3/$- . main:
```

```
git branch -f main freebsd/main
```

```
)/$3' 3 Git "/ ' +/<$ "':/=# +=':/2- #=#: #" ' 32/=# 4' G; +/$- ' "% =1%5/, -#$#18/  
%3$#+%$':/2- ' 0/1/+ /7%<$2( 30/1D, 01' 2#?,%" ' ' -#+++' $#3. N%- :$# 38G/#0' 2%" "#/  
1%6#$%/$, 0#$#+. :$# 38 01#2$# 0/1/+ /7%/$/ +/$-.. M?-?% *$#=# "/$ " ' -%- ' A +/$%, %" " 8A #  
3/$-/, -#$#18/ ". 9" # 684# 68 2#A1%" ($; .
```

```
5.6.2.4. 6) +L *%- / *+ * '$9$' (-%1+/*+ %+( $#
```

```
C: MS%- , . +/" ( /2$; , 3/ 3/$- ' worker ' async, -#$#18/ ( A#: . #6W/, ' "' $; 3 #, ". 3/$- . 0#,  
"%?3%" ' /+ feature 2 2#A1%" /" ' /+ -#+++' $#3 3 #6/' A.
```

```
A: FS# ?%, %: %, 4( 386#1#: "#=# 01' +/" /" ' ( (cherry-pick).
```

```
% git checkout worker  
% git checkout -b feature # create a new branch  
% git cherry-pick main..async # bring in the changes
```

```
N/O/1; . 3%2 /2$; "#3%( 3/$-% 0#, "%?3%" ' /+ feature. FS% 3/$-% #6W/, ' " (/ $ -#+++' $8 ' ?  
#6/' A 3/$#- .) 8 +#9/$/ , %4// 1%6#$%$; 2 "/C 2 0#++#7; < git rebase.
```

```
C: K +/" ( /2$; 3/$-% 0#, "%?3%" ' /+ driver, ' ( A#: . 1%?, /4' $; /D "% kernel ' userland, : $#68  
1%?3' 3$%; ' A # $, /4; " # ' -#+++' $' $; -%9, . < 3/$- . 0# +/1/ /D=#$#3" #2$' .
```

```
A: FS# $1/6. /$ "/6#4; G#C 0#, =#$#3' $/4; "#C 1%6#$8, "# git rebase 380#4" ' $ ?, /2;  
#2" #3" . < : %2$; 1%6#$8.
```

```
% git checkout driver # Checkout the driver  
% git checkout -b kernel # Create kernel branch  
% git checkout -b userland # Create userland branch
```

```
N/O/1; . 3%2 /2$; , 3/ ' , /" $' : " 8/ 3/$- ' . P" %: ' $, 01' G4# 31/+( 1%?, /4' $; -#+++' $8. O8  
01/, 0#4#9' +, : $# 2" %: %4% 32/ -#+++' $8 3 3/$- / driver 0#0%, . $ 4' 6# 3 3/$- . kernel, 4' 6# 3  
3/$- . userland, " # " / 3 #6/ #, " #31/+/" " #.
```

```
% git rebase -i main kernel
```

```
' 01#2$# 3- 4<: ' $/ ' ?+/" /" ' (, -#$#18/ 38 A#$' $/ (2$1#- #C 'p' ' 4' 'pick), ' . , %4' $/  
-#+++' $8, -#$#18/ " / ". 9" 8 (*$# ?3. : ' $ 0. =%< 7/, " # 3 A. , G/+ 24. : %/ 38 32/=, % + #9/$/ 32D  
#$61#2' $; ' " %: %$; ?%" #3# 2 3/$- ' driver, /24' 38 $#4; -# /D " / 0/1/+ /2$' 4' ).
```

```
% git rebase -i main userland
```

```
' 2, /4%C$/ $# 9/ 2%+ #/, : $# 38 2, /4%4' 2 3/$- #C `kernel` .
```

C: @\$4' : "#! [380#4"' 4 . -%?" " 8/ 38G/ G%=' ' ?%684 2, /4%\$; - #+++' \$ 3 3/\$- / kernel . I %
+ " / 3#22\$%" #3' \$; 2(?

A:) 8 + #9/\$/ ' 20#4; ?#3%\$; 3/\$- . driver, : \$#68 " %CS' A*G - #+++' \$%, - # \$#18C # \$2. \$2\$3. /\$, ' 386#1#: " # 01' + / "' \$; /=# (cherry-pick).

```
% git checkout kernel  
% git log driver  
% git cherry-pick $HASH
```

C: H#1#G#. K + /" (\$%-%(9/ 2' \$. %&' (, -%- ' 38G/, " # + #' - #+++' \$8 32/ 0/1/+ /G%" 8. O" /
". 9" #, : \$#68 : %2\$' #, " #=# - #+++' \$% 0#0%4' 3 #, ". 3/\$-., % #2\$%4; " 8/ Ñ 3, 1. =. <. B% 2%+ #+
, /4/, . + /" (' A " /2- #4; - #.) %G + /\$#, 0/1/6%?' 1#3%" ' (2 386#1#+ - %9/\$2(24#9" 8+.

A:) *\$#C 2' \$. %&' ' 3%+ 4. : G/ #61%6#\$%\$; ' 2A#, ". < 3/\$-., : \$#68 #\$, /4' \$; - #+++' \$8, %
?%\$/+ ' 20#4; ?#3%\$; 38G/. - %?" " 8C + /\$#, , 4(1%?, /4/" ' (3/\$- '.

MS%- , 01/, 0#4#9' +, : \$# /2\$; 32/= # #, ' " - #+++' \$ 2 : ' 2\$8+ , /1/3#+.) 8 + #9/\$/
' 20#4; ?#3%\$; 4' 6# git rebase 2# 2\$1#- #C edit, 4' 6# *\$# 2 - #+++' \$#+ " % #2\$1' /.) 4<6#+
24. : %/ G%=' #, ' " %- #38. >/13#/, : \$# "%+ ". 9" # 2, /4%\$; , Ñ *\$# # \$- %\$' \$; 2(" % #, ' " - #+++' \$
"%?%, , #2\$%3' 3 ' ?+ /" /" ' (" /?%- #+++' : /" " 8+ ' 3, /1/3/:

```
% git reset HEAD^
```

>1' + /: %" ' /: BQ, 0#3\$#1(<, BQ , #6%34(C\$/ ? , /2; --hard, \$%- -% - *\$# \$%- 9/ . , %4' \$ ' ?+ /" /" ' (' ? 3%G/= # , /1/3%.

N/O/1; , /24' 3%+ 0#3/?D\$, ' ?+ /" /" ' (, - # \$#18/ " . 9" # 1%?, /4' \$; , 0#4" #2\$; < . - 4%, 83%< \$2(0# =1%" ' &%+ 5%C4#3.) *\$#+ 24. : %/ 38 + #9/\$/ 01#2\$# 380#4" ' \$; #68: " 8C git add , 4(5%C4#3 3 - %9, #C =1. 00/, % ?%\$/+ 2, /4%\$; git commit. >1' + /: %" ' /: 01' *\$#+ 38 0#\$/1(/\$/ 2##67/" ' / - #+++' \$% 01' 380#4" /" ' ' 261#2%, 0#*\$#+. /24' # " # 3%+ 0# - %- #C-\$# 01' : ' " / " . 9" #, 24/, . /\$ 2#A1%" ' \$; - #0' < (A#\$ (git log \$HASH + #9/\$ /=# 3#22\$%" #3' \$;).

Q24' 3%+ " / 0#3/?4#, 3%+ 01' , D\$2(1%?, /4(\$; 5%C48. E4(*\$#=# 2. 7/2\$3. /\$ /7D #, ' " ' 2\$1. + /" \$, - # \$#18C + #9" # 01' + /" (\$; 0# #, " #+. 5%C4. ?% 1%?.

```
git add -i foo/bar.c
```

6. , /\$ 0#24/, #3%\$/4; " # 01#A#, ' \$; : /1/? 1%?4' : ' (, 01/, 4%=(3%+ 3- 4<: ' \$; ' 4' ' 2- 4<: ' \$; - %9, 8C 51%=+ /" \$. >#24/ ?%3/1G/" ' (, 380#4"' \$/ git commit, ' #2\$%3G' /2(' ?+ /" /" ' (# - %9. \$2(3 3%G/+ , /1/3/.) 8 \$%- 9/ + #9/\$/ ?%0. 2- %\$; *\$. - #+%" , . " /2- #4; - # 1%?, , %9/ , 4(" /2- #4; - ' A 5%C4#3 (A#\$ ((2: ' \$%< . , #6" // 1%6#\$%\$; 2 #, " ' + 5%C4#+ ?% 1%? ' ' 20#4; ?#3%\$; git rebase -i , 4(#6W/, ' " /" ' (23(?% " 8A - #+++' \$#3).

5.6.2.5. <, *' \$+&* /+ / *+ # \$, =- / *7- @** FreeBSD /- GitHub.

C: I %- 01' 2#/, ' " ' \$; 2(- #1=%" ' ?%&' ' FreeBSD "% GitHub?

A: >#, 1#6"#2\$' 2+#\$1' \$/ "% 2\$1%" ' &/ "%G/C 3' -' [GitHub](#).) - 1%\$&/, 01' 2#/, ' "' \$; 2(+#= \$ 32/ -#+++' \$\$/18 FreeBSD. U' &%, " / (34(< 7' /2(-#+++' \$\$/1%+', -#\$#18/ ?%01%G' 3%< \$ 01' 2#/, ' " /" ' /, 6. . \$ 1%22+%"\$1' 3%\$; 2(3' " , ' 3' , . %4; "#+ 0#1(, - /.

5.6.3. 21\$/*, \$%- /*+ * 7+, #- 1*, \$%- /*+

C: [A#: . 2#?, %\$; 0#4" . < ?/1-%4; " . < -#0' < 1/0#?' \$#1' (Git, -%- +"/ *\$# 2, /4%\$; ?

A: Q24' 3%+ ". 9" # \$#4; -# ?/1-%4' 1#3%" ' /, \$#

```
% git clone --mirror $URL
```

21%6#\$%/\$. @, "%- #, . *\$#=# /2\$; , 3% " /, #2\$%\$- %, /24' 38 A#\$' \$/ ' 20#4; ?#3%\$; *\$#, 4(: /=#-\$# - 1#+/ ?/1-%4%, -#\$#1#/ 38 6. , /\$ / 0/1/- 4#" ' 1#3%\$; .

)#-0/138A, *\$# '#48C 1/0#?' \$#1' C', -#\$#18C 2#, /19' \$ 6%?. , %" " 8A 1/0#?' \$#1' (, " # " / '+//\$ ' ?34/: /" "#=# 1%6#: /=# , /1/3%. F\$# #4' : " # 0#, A#, ' \$, 4(?/1-%4' 1#3%" ' (, " # . 9%2" # , 4(0#32/, "/3" #C 1%6#\$8. L. 7/2\$3. /\$ " /2- #4; -# 20#2#6#3 #6#C\$' *\$# 2 0#+#7; < [git](#) [worktree](#):

```
% git clone --mirror https://git.freebsd.org/ports.git ports.git
% cd ports.git
% git worktree add ../ports main
% git worktree add ../quarterly branches/2020Q4
% cd ../ports
```

B# /24' 38 " / ' 20#4; ? . /\$ / 23#C ?/1-%4; " 8C 1/0#?' \$#1' C , 4(, %4; " /CG/=# 4#- %4; " #=# - 4#" ' 1#3%" ' (, \$# *\$# " /0#, A#, (7' C 386#1.

)\$#1#C " /, #2\$%\$#- ?%- 4<: %/\$2(3 \$#+, : \$# Git #68: " # 0/1/?%0' 283%/\$ 2284-' ' ? 38G/2\$#(7/=# 1/0#?' \$#1' ((" %?3%" ' (3/\$#-, \$/= ' \$, .) , : \$#68 3%G' 4#- %4; " 8/ 2284-' +#=4' ' ?+/" (\$; 2(" /?%3' 2' +# # \$ 38G/2\$#(7/=# 1/0#?' \$#1' (. F\$# #?" %: %/\$, : \$# 38 0#\$/1(/\$ / ' ?+/" /" ' (, /24' 6. , /\$ / -#+++' \$' \$; 3 23#C 1/0#?' \$#1' C - . , %4' 6#, - 1#+/ 3/\$#- 01' 3%\$" 8A 01#/- \$#3.

C: N%- : \$# 9/ (+#= . 2, /4%\$; 3+/2\$# *\$#=#?

A: B., 38 +#9/\$/ 0#+/2\$' \$; 32/ 2284-' (refs) 38G/2\$#(7/=# 1/0#?' \$#1' (3 01' 3%\$" #/ 01#2\$1%" 2\$3# ' +D" 3%G/=# 4#- %4; " #=# 1/0#?' \$#1' (. Git - 4#" ' 1. /\$ 32D : /1/? 'refspec', ' refspec 0# . +#4: %" ' < 38=4(, ' \$ \$%- :

```
Ê fetch = +refs/heads/*:refs/remotes/freebsd/*
```

: \$#=#3#1' \$ 01#2\$# 0#4. : ' \$; (fetch) 2284-' 3/\$#- .

@, "%- # 3 1/0#?' \$#1' ' FreeBSD /2\$; ' 1(, 1. = ' A *4/+/" \$#3. Z\$#68 . 3' , /\$; ' A, 38 +#9/\$/ , #6%3' \$; (3" 8/ 20/&' 5' -%&' ' 2284#- , 4(-%9, #=# 01#2\$1%" 2\$3% ' +D" 2284#- ' 4'

O#4.: ' \$; 32D.Z\$#68 "%2\$1#' \$; 3%G 1/O#?' \$#1' C, 4(*\$#=#:

```
git config --add remote.freebsd.fetch '+refs/*:refs/freebsd/*'
```

: \$# O#+/2\$' \$ 32D ' ? 38G/2\$#(7/=# 1/O#?' \$#1' (3 O1#2\$1%" 2\$3# ' +D" refs/freebsd/ 3%G/=# 4#-%4; "#=# 1/O#?' \$#1' (. @61%\$' \$/ 3" ' +%'' /, : \$# *\$# \$%- 9/ ?%A3%\$83%/\$ 32/ "/2-# 3/1\$' 1#3%" " 8/ 3/\$- ' 3/" , #1#3, % -#4' : /2\$3# 23(?% " 8A 2 " ' + ' 2284#- , #3#4; " # 3/4' -#.

)%+ O#\$1/6. /\$2(2284\$%; 2("% *\$' 2284- ' 2' A O#4" 8+ ' ' +/"%+' , O#2- #4; - . #"' " / 3A#, (\$ 3 #68: " 8/ O1#2\$1%" 2\$3% ' +D" Git.

```
git log refs/freebsd/vendor/zlib/1.2.10
```

6. , /\$ O1#2+%\$1' 3\$%; 9. 1" %4 3/\$- ' 3/" , #1% , 4(zlib, "%: ' "%(2 3/12' ' 1.2.10.

5.7. 6\$(, "&/ * 4+' (%\$ ' &, "=*) *

@, "' + ' ? -4<: /38A +##/" \$#3 -%: /2\$3/" "#C 1%?1%6#\$- ' O1#=1%++ "#=# #6/20/: /"' (3 \$%- #+ - 1. O" #+ O1#/- \$/, -%- FreeBSD, (34(/\$2(3#?+#9" #2\$; 2#\$1., "' : %\$; 2 , 1. = ' + ' . : %2\$"' -%+' , # # \$O1%3- ' 23# ' A ' ?+/" /"' C 3 , /1/3# ' 2A#, "#=# -#, %. J/O#?' \$#1' ' Git O1#/- \$% FreeBSD O#- % " / O#?3#4(< \$ # \$O1%34(\$; O#4; ?#3\$/\$; 2- ' / 3/\$- ' 3 1/O#?' \$#1' C, O#*\$#+. /24' 38 A#\$' \$/ O#, /4' \$; 2(23# ' + ' ' ?+/" /"' (+ ' 2 , 1. = ' + ' , 3%+ "/#6A#, ' + # ' 20#4; ?#3\$; , 1. =#C +/A%" ' ?+, "%O1' +/1, 1/O#?' \$#1' C, 1%?+/7D" " 8C 3 GitLab ' 4' GitHub, , 4(#6+/"% ' ?+/" /"' (+ ' 3 3/\$- /, 2#?, "% " #C O#4; ?#3\$/\$/+.

L4/, . < 7' / ' " 2\$1. - &' ' O#- ?%83%< \$, -%- 2#?, %\$; O#4; ?#3\$/\$; 2- . < 3/\$- . "% #2" #3/ 3/\$- ' FreeBSD main ' # \$O1%3' \$; /D 3 GitHub.

>1/9, / : /+ "%: %\$; , . 6/, ' \$/2; , : \$# 3%G 4#- %4; " 8C 1/O#?' \$#1' C Git %- \$. %4/" ' ' +//\$ O1%3' 4; " # "%2\$1#/" " 8/ ' 2\$#: "' - ' , -%- O#- %?" # 3 1%?, /4/ 38G/.

```
% git remote -v
freebsd https://git.freebsd.org/src.git (fetch)
freebsd ssh://git@gitrepo.freebsd.org/src.git (push)
```

>/138+ G#=#+ (34(/\$2(2#?, %"' / 5#1-% FreeBSD "% GitHub, 24/, . (*\$' + ' "2\$1. - &' (+ . B%?"%: /"' /+ 5#1-% , #49/" 68\$; 3%G 2#62\$3/" " 8C, 4' : " 8C %- -. "\$ "% GitHub (3 + #D+ 24. : %/ gvnn3).

N/O/1; , #6%3; \$/ . , %4/" " 8C 1/O#?' \$#1' C 3 3%G/C 4#- %4; " #C 2' 2\$+/+, -#\$#18C . - ?%83%/\$ "% 3%G 5#1-:

```
% git remote add gitHub git@gitHub.com:gvnn3/freebsd-src.git
% git remote -v
gitHub git@gitHub.com:gvnn3/freebsd-src.git (fetch)
```

```
git hub git@github.com:gvnn3/freebsd-src.git (push)
freebsd https://github.com/freebsd/freebsd-src.git (fetch)
freebsd ssh://git@trepo.freebsd.org/src.git (push)
```

```
) *$#+ 1/0#?' $#1' ' 38 + #9/$/ 2#?, %$; 3/$- . -%- 0#-%?" # 38G/.
```

```
% git checkout -b gnn-pr2001-fix
```

```
) "#2' $/ 4<68/' ?+/" /"' ( 3 23#/C 3/$-/. L#6' 1%CS/, $/2$' 1. CS/, ' -%- $#4; - # 6., /$/=#$#38
- 2#3+/2$" #C 1%6#$/ 2 , 1.= ' +', "%2$%" /$ 31/+( #S01%3' $; 23# ' ?+/" /"' ( 3 3/$-.,
1%?+/7D" ". < 3 GitHub. >1/9, / : /+ #S01%3' $; ' ?+/" /"' (, 3%+ ". 9" # 6., /$ .2$%" #3' $;
2##$3/$2$3. < 7. < 38G/2$#(7. < 3/$- . (upstream), # : D+ Git 2##67' $ 01' 0/13#C 0#08$-/
#S01%3-' 3 3%G ., %4D" " 8C 1/0#?' $#1' C github:
```

```
% git push github
fatal: The current branch gnn-pr2001-fix has no upstream branch.
To push the current branch and set the remote as upstream, use

Ê git push --set-upstream github gnn-pr2001-fix
```

```
Q24' .2$%" #3' $; 0%1%+/$18 #S01%3-' (push) $%- , -%- 2#3/$. /$ git, $# *$# 0#?3#4(/$ /C
. 20/G" # 380#4"' $; 2(:
```

```
% git push --set-upstream github gnn-feature
Enumerating objects: 20486, done.
Counting objects: 100% (20486/20486), done.
Delta compression using up to 8 threads
Compressing objects: 100% (12202/12202), done.
Writing objects: 100% (20180/20180), 56.25 MiB | 13.15 MiB/s, done.
Total 20180 (delta 11316), reused 12972 (delta 7770), pack-reused 0
remote: Resolving deltas: 100% (11316/11316), completed with 247 local objects.
remote:
remote: Create a pull request for 'gnn-feature' on GitHub by visiting:
remote: https://github.com/gvnn3/freebsd-src/pull/new/gnn-feature
remote:
To github.com:gvnn3/freebsd-src.git
Ê* [new branch] gnn-feature -> gnn-feature
Branch 'gnn-feature' set up to track remote branch 'gnn-feature' from 'github'.
```

```
>#24/, . < 7' /' ?+/" /"' ( 3 $#C 9/ 3/$- / 6. . $ 0# . + #4: %"' < #S01%34($; 2( - #11/- $" #:
```

```
% git push
Enumerating objects: 4, done.
Counting objects: 100% (4/4), done.
Delta compression using up to 8 threads
Compressing objects: 100% (2/2), done.
```

```
Writing objects: 100% (3/3), 314 bytes | 1024 bytes/s, done.
Total 3 (delta 1), reused 1 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (1/1), completed with 1 local object.
To github.com:gvnn3/freebsd-src.git
   9e5243d7b659..cf6aeb8d7dda gnn-feature -> gnn-feature
```

B% *\$#+ *\$%0/ 3%G% 1%6#\$% "%A#, ' \$2(3 3%G/C 3/\$- / "% GitHub, ' 38 + #9/\$/ 0#, /4' \$; 2(2284- #C 2, 1. = ' + ' . : %2\$" ' -%+ ' .

5.8. A8, - 8\$(#- 7- 9, \$' \$% /- 9, * /5(* + * 7) +/+/* E (pull request) /- github

) *\$#+ 1%?, /4/ #0' 2%" #, -% - ' "\$/=1' 1#3%; ?%01#2 "% 01' " (\$' / ' ?+/" /"' C (pull request) ' ? GitHub, #S01%34/" " 8C "% ?/1-%4% FreeBSD 3 Git "% GitHub. H#\$("% ,%" " 8C +##+/" \$ *\$# " / #5' &' %4; " 8C 20#2#6 #S01%3- ' ' 201%34/" ' C, ' "#=, % \$%- ' + #61%?##+ 01' A#, (\$ A#1#G' / 01%3- ' , ' 01#7/ 32/= # 01#2\$# 0/1/" /2\$' ' A 3 , /1/3# -##+ ' \$\$/1% ' #\$\$, % #S01%3' \$; (push) 3 , /1/3# FreeBSD. ! "%4#=: " 8/ G%= ' + #9" # ' 20#4; ?#3%; , 4(0#4. : %\$; ' 24' 3%; (pull) 3/\$- ' ' ? , 1. = ' A 1/0#?' \$#1' /3 ' ' A ' 20#4; ?#3%; ' A. >1' -##+ ' \$/ ?%01#2#3 "% 01' " (\$' / ' ?+/" /"' C # \$, 1. = ' A 24/, ./ \$ 01#(34(\$; #2#6. < #2\$#1#9" #2\$; , : \$#68 01#3/1' \$; 32/ ' ?+/" /"' (' .6/, ' \$; 2(, : \$# # " ' 3 \$#: " #2\$' 2##\$3/\$2\$3. < \$?%(34/" " 8+.

>1/9, / : /+ "%: %\$; , .6/, ' \$/2; , : \$# 4#-%4; " 8C 1/0#?' \$#1' C Git %- \$. %4/" ' ' +// \$ 01%3' 4; " # "%2\$1#/" " 8/ ' 2\$#: " ' - ' , -% - 0#-%?" # 3 1%?, /4/ 38G/. I 1#+/ \$#=#, .6/, ' \$/2; , : \$# . 3%2 /2\$; 24/, . < 7' /' 2\$#: " ' - ' :

```
% git remote -v
freebsd https://git.freebsd.org/src.git (fetch)
freebsd ssh://git@gitrepo.freebsd.org/src.git (push)
github https://github.com/freebsd/freebsd-src (fetch)
github https://github.com/freebsd/freebsd-src (fetch)
```

Z%2\$# ?%01#28 "% 01' " (\$' / ' ?+/" /"' C 01#2\$8: *\$# ?%01#28, 2#, /19%7' / 32/= # #, ' " -##+ ' \$.) *\$#+ 24. : %/ + #9" # ' 20#4; ?#3%; . 01#7D" " 8C 0#, A#, , A#\$(0#, A#, ' ? 01/, 8, . 7/= # 1%?, /4% \$%- 9/ 6. , /\$ 1%6#\$%; . P, /2; 2#?, %D\$2(3/\$- %, ' ?+/" /"' (386#1#: "# 01' +/" (< \$2(, 2##67/" /' / -##+ ' \$% - #11/- \$' 1. /\$2(' 01#3/1(/\$2("% %, /- 3%\$ " #2\$; 0/1/, #S01%3- #C.) *\$#+ 01' +/1/ ' 20#4; ? . /\$2(3/\$- % staging, " # # "% + #9/\$' + /\$; 4< 6#/' + (. FS\$ \$/A" ' - % 1%6#\$%/ \$, 4(4< 6#=# - #4' : /2\$3% - ##+ ' \$#3 3 ?%01#2/ "% 01' " (\$' / ' ?+/" /"' C, #2#6/" " # - #, % ' ?+/" /"' (: ' 2\$# 01' +/" (< \$2(- , /1/3. FreeBSD. @, "% - #, - #, % - ##+ ' \$#3 "/2- #4; - #, #2#6/" " # - #, % \$1/6. < \$2("/?"%: ' \$/4; " 8/ - #11/- \$' 1#3- ' , git rebase -i 1%6#\$%/ \$ 4. : G/, : /+ git cherry-pick.) - 1%\$&/, *\$' - ##+ ", 8 2#?, %< \$ 3/\$- . ; 386#1#: "# 01' +/" (< \$ ' ?+/" /"' (' ? ?%01#2% "% 01' " (\$' / ' ?+/" /"' C; \$/2\$' 1. < \$ ' A; - #11/- \$' 1. < \$ 2##67/" /' (- ##+ ' \$#3; ' 380#4" (< \$ 24' (" / 0/1/+ # \$- #C (fast-forward) #61%\$ " # 3 main. B#+/1 PR " ' 9/ #6#?"%: /" -% - \$PR. >1' - #11/- \$' 1#3- / 2##67/" /' (, #6%3; \$/ Pull Request: https://github.com/freebsd-src/pull/\$PR.) 2/ ?%01#28 "% 01' " (\$' / ' ?+/" /"' C, ?%5' - 2' 1#3% " 8/ 3 1/0#?' \$#1' ' FreeBSD, , #49" 8 68\$; 01#3/1/" 8 -% - + ' " ' + . #, " ' + : /4#3/- ##+ . FS# " / #6(?%\$/4; " # , #49/" 68\$; \$#\$, - \$# ' A 5' - 2' 1. /\$, " # 3 *\$#+ 24. : %/ \$#\$, - \$#

5' -2' 1. /\$, , #49/" , #3/1(\$; -#+0/\$/" \$" #2\$' , 1. =' A 1/&/" ?/" \$#3 3 01#3/1- / -#++' \$%. I#++' \$\$/18, -#\$#18/ 01#3#, (\$ 1/&/" ?' 1#3%"' / -#, % . ?%01#2#3 "% 01' " (' / ' ?+/" /"' C 0/1/, ' A #S01%3- #C 3 1/0#?' \$#1' C, , #49" 8 , #6%3' \$; 2\$1#-. **Reviewed by:** - -#++' \$., 0#\$#+. : \$# 3 *\$#+ 24. : %/ *\$# " / 0#, 1%?. +/3%/\$2(. E#6%3; \$/ 32/A, -\$# 01#2+%\$1' 3%/\$ ' #, #61(/\$ -#++' \$ "% github, \$%-9/ 3 **Reviewed by:** . I%- 32/=, %, 24/, ./ \$ 0#?%6#\$' \$; 2(# \$#+, : \$#68 ' ?+/" /"' / , /4%4# \$#, : \$# 01/, 0#4%=%/\$2(, ' : \$#68 3 " D+ " / 684# 31/, # " #2" #=# - #, %.

I 1#+/ \$#=#, 0#9%4. C2\$, . 6/, ' \$/2;, : \$# ' + (%3\$#1% ?%01#2% "% 01' " (' / ' ?+/" /"' C " / (34(/\$2("% #"' + " 8+.) /6-' "\$/15/C2 1/, %- '\$ 1#3%"' (Github =/" /1' 1. /\$ ' +/" % 3' , %:

Author: gi thub-user <38923459+gi thub-user@users.noreply.gi thub.com>

! 3\$#1. 24/, ./ \$ #S01%3' \$; 3/94' 3. < 01#2; 6. 01/, #2\$%3' \$; 6#4// 0#, A#, (7// ' + (' /' 4' %, 1/2 *4/- \$1#" "#C 0#: \$8. L4/, ./ \$ 01#(34(\$; #2#6. < #2\$#1#9" #2\$;, : \$#68 " / , #0. 2\$' \$; #G' 6#- 2\$' 4(' 4' 3"/, 1/"' (31/, # " #2" #=# - #, %.

```
% git fetch gi thub pull /$PR/head: staging
% git rebase -i main staging # to move the staging branch forward, adjust commit
message here
<do testing here, as needed>
% git checkout main
% git pull --ff-only # to get the latest if time has passed
% git checkout main
% git merge --ff-only staging
<test again if needed>
% git push freebsd --push-option=confirm-author
```

E4(24#9" 8A ?%01#2#3 "% 01' " (' / ' ?+/" /"' C 2 " /2- #4; -' +' -#++' \$%+', 2#, /19%7' + ' -#" 54' - \$8, 24/, . C\$/ 01' 3/, D" "#C "' 9/ 2A/+/.

1. ' ?34/-' \$/ ?%01#2 "% 01' " (' / ' ?+/" /"' C **git checkout gi thub/pull /XXX**
2. 2#?, %C\$/ 3/\$-. , 4(0/1/6%?' 1#3%"' (**git checkout -b staging**
3. 0/1/6%?' 1. C\$/ 3/\$-. **staging** "% 0#24/, "<< 3/12' < main 2 0##7; < **git rebase -i main staging**
4. 1%?1/G' \$/ -#" 54' - \$8' 01#3/, ' \$/ 32/ " /#6A#, ' +8/ \$/2\$' 1#3%"' (
5. 0/1/+ #S%C\$/ (fast-forward) 3/\$-. **staging 3 main**, -%- #0' 2%" # 38G/
6. 2, /4%C\$/ 5' "%4; ". < 01#3/1-. ' ?+/" /"' C, : \$#68 . 6/, ' \$; 2(, : \$# 32D 3 0#1(, - /
7. #S01%3; \$/ 3 1/0#?' \$#1' C Git FreeBSD.

F\$# \$%-9/ 6. , /\$ 1%6#\$%\$; 01' 3"/2/"' ' 3/\$#-, 1%?1%6#\$%" " 8A 3 , 1. =## + /2\$/ , 3 4#-%4; " #/ , /1/3# , 4(-#++' \$%.

>#24/ ?%3/1G/" ' (1%6#S\$ 2 ?%01#2##+ "% 01' " (' / ' ?+/" /"' C (pull request), ?%- 1#C\$/ /=# 2
0##+7; < 3/6-' " \$/15/C2% GitHub. L\$# ' \$ #S+/' \$ \$; , : \$# /24' 3%G ' 2\$#: "' - gi thub ' 20#4; ? . /\$
https://, /, ' 2\$3/" " 8+ G%=#+, , 4(-#\$#1#=# 0#S1/6. /\$2(.: D\$%"(?%0' 2; GitHub, 6. , /\$
?%- 18\$' / ?%01#2% "% 01' " (' / ' ?+/" /"' C.

6. M' (\$, * 5 ' * ' (+) O #\$/ (, \$15 %+, ' * E

>1#/- \$ 0/1/GD4 "% git.

J/O#?' \$#1' C ' 2A#, " 8A - #, #3 FreeBSD 0/1/GD4 2 CVS "% Subversion 31 +%(2008 =#, %. >/138C
"%2\$#(7' C -#++' \$ SVN Ñ r179447. J/O#?' \$#1' C ' 2A#, " 8A - #, #3 0/1/GD4 2 Subversion "% Git
23 , /- %61(2020 =#, %. >#24/, "' C "%2\$#(7' C -#++' \$ svn Ñ r368820. H/G 0/13#=# "%2\$#(7 /=#
-#++' \$% git Ñ 5ef5f51d2bef80b0ede9b10ad5b0e9440b60518c.

J/O#?' \$#1' C doc/www FreeBSD 0/1/GD4 2 CVS "% Subversion 19 +%(2012 =#, %. >/138C
"%2\$#(7' C -#++' \$ SVN Ñ r38821. J/O#?' \$#1' C , #. - +/" \$%&' ' 0/1/GD4 2 Subversion "% Git 8
, /- %61(2020 =#, %. >#24/, "' C -#++' \$ SVN Ñ r54737. >/138C "%2\$#(7' C A*G -#++' \$% git Ñ
3be01a475855e7511ad755b2defd2e0da5d58bbe.

J/O#?' \$#1' C ports FreeBSD 0/1/G/4 2 CVS "% Subversion 14 ' < 4(2012 =#, %. >/138C
"%2\$#(7' C -#++' \$ SVN Ñ r300894. J/O#?' \$#1' C ports 0/1/G/4 2 Subversion "% Git 6 %01/4(
2021 =#, %. >#24/, "' C -#++' \$ SVN Ñ r569609. >/138C "%2\$#(7' C A*G -#++' \$% git Ñ
ed8d3eda309dd863fb66e04bccaa513eee255cbf.

7. ? - ' (, \$E#- , ' \$=1-L +/* 5 * (, - &* @* *

) - %: /2\$3/ " #3#=# 1%?1%6#\$: ' - % "/#6A#, ' + # 380#4"' \$; 1(, /C2\$3' C. >/138C "%6#1 G%=#3
#\$" #2' \$2(' 2-4<: ' \$/4; " # - -#++' \$\$/1%+. FS' G%=' , #49" 8 68\$; 380#4/" 8
"%2\$#3"' - #+ , 4(\$/A, - \$# " / (34(/\$2(-#++' \$\$/1#+.

7.1. 015 /\$%O> # \$)) * ((+, \$%

N/, - #+. 01/, #2\$%34/" 8 01%3% "% - #++' \$ 3 1/O#?' \$#1' ' FreeBSD, , #49" 8 380#4"' \$;
24/, . < 7' / G%=' .

¥ >#4. : ' \$/ #, #61/" ' / "%2\$%3"' - % 0/1/, 3" /2/" ' /+ - %9, #=# ' ? *\$' A ' ?+/" /"' C!

¥) 2/ - #++' \$8 3 src 2" %: %4% 0#0%, %< \$ 3 FreeBSD-CURRENT, 01/9, / : /+ 68\$; 24' \$8+' 3
FreeBSD-STABLE.) /\$- % FreeBSD-STABLE , #49" % 2#A1%" (\$; 2#3+/2\$' + #2\$; ABI ' API 2
01/, 8, . 7' + ' 3/12' (+ ' *\$#C 3/\$-'. B/ , /4%CS/ 24' (" ' / ' ?+/" /"' C, "%1. G%< 7' A *\$.
2#3+/2\$' + #2\$; .

P - = * &15 /\$%O> # \$)) * ((+, \$%

1. E#6%3' \$; %3\$#1%

doc/shared/authors.adoc - E#6%3' \$; ' " 5#1+%&' < #6 %3\$#1/. >#24/, . < 7' / G%='
?%3' 2(\$ # \$ *\$#C " " 5#1+%&' , ' 01#0. 2- *\$#=# G%=% 01' 3/, DS - 26#< 26#1- ' doc/. FS#

#\$"#2' \$/4; "# 01#2\$(?%, %: %, "# #%" #2\$%D\$2(A#1#G' + 0/138+ '208\$%"' /+ "%38- #3 1%6#\$\$ 2 2' 2\$/+#C -#" \$1#4(3/12' C.

2. @6" #3' \$; 20' 2#- 1%?1%6#\$: ' -#3' .: %2\$" ' -#3

doc/shared/contrib-committers.adoc - E#6%3; \$/ ?%O' 2; , -#\$#1%(?%\$/+ 0#(3' \$2(3 1%?, /4/ "J%?1%6#\$: ' -' "LO' 2-%-#" \$1' 6; <\$#1#3.P%O' 2' 2#1\$' 1.<\$2(O# 5%+' 4' ' .

doc/shared/contrib-additional.adoc - <1*&(OE ?%O' 2;. P%O' 2' #2#1\$' 1#3%" 8 O# ' +/" ' ' .

3. E#6%3' \$; 2\$%; < 3 B#3#2\$'

doc/website/data/en/news/news.toml - E#6%3; \$/ ?%O' 2;. B#C, ' \$/ , 1.= ' / ?%O' 2' , #6W(34(< 7' / # " #38A -#++' \$\$/1%A, ' 24/, .CS/ 5#1+%. . M20#4; ?. CS/ , %\$. ' ? O' 2; +% #6 . \$3/19, /" ' ' -#++' \$\$/12-' A O1%3.

4. E#6%3' \$; PGP-- 4< :

Dag-Erling Smørgrav <des@FreeBSD.org> "%O' 2%4 2&/" %1' C #6#4#: -' (doc/documentation/tools/addkey.sh) , 4(.O1#7/" ' ' (*\$#=# O1#&/22%. E4(O#4.: /" ' ' (, #O#4" ' \$/4; "#C ' " 5#1+%&' ' #61%\$' \$/2; - 5%C4. README.

M20#4; ?. CS/ doc/documentation/tools/checkkey.sh , 4(O1#3/1-' , : \$# -4<: ' 2##\$3/\$2\$3. <\$ -%- +' "' +. + + ' "' +%4; " 8+ 2\$%" , %1\$%+ 4. : G' A O1%- \$' - .

>#24/ , #6%34/" ' ' (' O1#3/1-' -4<: % , #6%3; \$/ #6% #6" #34/" " 8A 5%C4% 3 2' 2\$/+ . -#" \$1#4(3/12' C ' ?%\$/+ ?%5' -2' 1.CS/ (commit) ' A. P%O' 2' 3 *\$#+ 5%C4/ #2#1\$' 1#3%" 8 O# 5%+' 4' ' .

!

@: /"; 3%9" # ' +/\$; %- \$. %4; " 8C PGP/GnuPG -4<: 3 1/O#?' \$#1' ' . I 4<: + #9/\$ O# \$1/6#3%\$; 2(, 4(O#, \$3/19, /" ' ' (4' : "#2\$' -#++' \$\$/1%. B%O1' +/1, I=&, (, 7)+*)%+; FreeBSD.org <admins@FreeBSD.org> ' 20#4; ?. <\$ /=# , 4(3#22\$%" #34/" ' ' (.: DS" #C ?%O' 2' . >#4" 8C "%6#1 -4<: /C O#4; ?#3%\$/4/C FreeBSD.org , #2\$. O/" , 4(2-%: ' 3%" ' (O# 2284- / https://docs.FreeBSD.org/pgpkeys/pgpkeys.txt.

5. @6" #3' \$; ' " 5#1+%&' < # "%2\$%3" ' -/' O#, #O/: " #+

src/share/misc/committers-<repository>.dot - E#6%3' \$; ?%O' 2; 3 1%?, /4 \$/-. 7' A -#++' \$\$/1#3, =, / repository - *\$# doc, ports ' 4' src, 3 ?%3' 2' +#2\$' # \$ O1/, #2\$%34/" " 8A O1%3 -#++' \$%.

E#6%3; \$/ ?%O' 2; , 4(-%9, #=# , #O#4" ' \$/4; "#=# # \$" #G/" ' ("%2\$%3" ' -/O#, #O/: " 8C 3 " ' 9" /+ 1%?, /4/.

6. @6" #3' \$; 5%C4 mailmap 3 git

src./mailmap, doc./mailmap ' ports./mailmap - E#6%3; \$/ ?%O' 2; , 4(-#++' \$#3, 2#?, %" " 8A 3%+' , # O#4. : /" ' ' (2\$%. 2% -#++' \$\$/1% FreeBSD.

>1' 3(?- % - 3%G/+. %, 1/2. FreeBSD O#?3#4(/\$ "%+ O1#7/ #S\$24/9' 3%\$; 3' /G" ' A -#++' \$\$/1#3, -#\$#18/ +#=#. \$ 68\$; =#\$#38 O#4.: ' \$; O1%3% -#++' \$\$/1%.) 8 \$%- 9/ +#9/\$/ ' 20#4; ?#3%\$; *\$# , 4(' 201%34/" ' (2\$%18A ' +/" , #O/: %\$#- 3 ' +/" %A ' S., . 3 2\$%" , %1\$" #+ 383#, / [git log](#).

7. L="/ /1' 1#3%\$; O%1#4; Kerberos

L+. [Kerberos](#) ' [LDAP 3/6-O%1#4](#); , 4(- 4%2\$/1% [FreeBSD](#) , 4(=/" /1%&' ' ' 4' "%2\$1#C- ' .: D\$" #C ?%O' 2' Kerberos , 4(' 20#4; ?#3%" ' (2 , 1. = ' + ' 2/13' 2%+ ' [FreeBSD](#), \$%- ' + ' -%- 6%?% , %" " 8A #S\$24/9' 3%" ' (#G' 6#- (38 O#4.: %/\$/ .: D\$" . < ?%O' 2; , 4(#S\$24/9' 3%" ' (#G' 6#- -%- :%2\$; *\$#=# G%=%).

8. B/#6(?%\$/4; " #:) - 4<: ' \$; .: D\$" . < ?%O' 2;)' -'

K: D\$" %(?%O' 2; [FreeBSD Wiki](#) Ñ .: D\$" %(?%O' 2; "% 3' - ' O#?3#4(/\$, /4' \$; 2(O1#/- \$%+ ' ' ' , /(+ ' . N/ , . -#=# /7D " /\$.: D\$" #C ?%O' 2' , +#=#. \$ 24/ , #3%\$; ' " 2\$1. - &' (+ "% 2\$1%" ' &/ [Wiki/About](#) , :\$#68 /D O#4.: ' \$; . L3(9' \$/2; 2 [wiki-admin@FreeBSD.org](#) , /24' 3%+ " . 9" % O##7; 2 3%G/C .: D\$" #C ?%O' 2; < "%) ' - ' .

9. B/#6(?%\$/4; " #: @6" #3' \$; ' " 5#1+%&' < 3) ' -'

M" 5#1+%&' (3 3' - ' Ñ O#4.: ' 3 , #2\$. O - 3' - ' , " /- #S\$18/ , #6%34(< \$?%O' 2' "% 2\$1%" ' &8 I %- +8 2< , % O#O%4' , [IRC-O2/3](#) , #"' +8, L#6%- ' [FreeBSD](#) ' /' 4' I #G- ' [FreeBSD](#).

10. B/#6(?%\$/4; " #: @6" #3' \$; O#1\$8 2 4' : " #C ' " 5#1+%&' /C

ports/astro/xearth/files/freebsd.committers.markers
src/usr.bin/calendar/calendars/calendar.freebsd Ñ B/- #S\$18/ 4< , ' , #6%34(< \$ 3 *\$' 5%C48 ?%O' 2' # 2/6/ , : \$#68 .- %?%\$; 23#D +/2\$#O#4#9/" ' / ' 4' , %\$. 23#/# = , " (1#9, /" ' (.

11. B/#6(?%\$/4; " #: >1/, #S\$1%7/" ' / O#3\$#1" 8A 1%2284#-

># , O' 2: ' - ' I #++' \$8 3# 32/ 3/\$- ' 1/O#?' \$#1' (, #- . +/" \$%&' ' , I #++' \$8 3# 32/ 3/\$- ' 1/O#?' \$#1' (O#1\$#3 ' 4' I #++' \$8 3# 32/ 3/\$- ' 1/O#?' \$#1' (' 2A#, " #=# - #, %, 3#?+ #9" #, ?%A#\$(\$ #SO' 2%\$; 2(, : \$#68 ' ?6/9%\$; O#4.: /" ' (, . 64' - %\$#3 2##67/" ' C # -#++' \$%A ' #S\$3/\$#3 "% " ' A.

7.2. O15 %' +>

- >1/, 2\$%3; \$/2; , 1. = ' + 1%?1%6#\$: ' -%+ , ' "%: / " ' - \$# " / 6. , /\$ ' +/\$; O1/, 2\$%34/" ' (, - \$# 38 ' "% , : /+ 1%6#\$%/\$/. >1/, 2\$%34/" ' / " / , #49" # 68\$; ' 2: /1083%< 7/C 6' #=#15' /C Ñ O1#2\$# " %O' G' \$/ %6?%&' ' 4' , 3% # \$#+ , - \$# 38 , : /+ O4%" ' 1. /\$ / ?%" ' +%\$; 2(-%- 1%?1%6#\$: ' - 3 [FreeBSD](#), ' - \$# 6. , /\$ 3%G' + "%2\$%3" ' -#+. @S\$O1%3; \$/ *\$# O# *4/- \$1#" " #C O#: \$/ "% LO' 2#- 1%2284- ' 1%?1%6#\$: ' -#3 [FreeBSD](#), ' 38 "%: " D\$/ 23#C O. \$; !
-) #C, ' \$/ "% [freefall.FreeBSD.org](#) ' 2#?, %C\$/ 5%C4 /var/forward/O#4; ?#3%\$/4; (=, /

"#&E=#, *O7&E Ñ *\$# 3%G/ ' +(O#4; ?#3%/4(), 2#, /19%7' C %, 1/2 *4/- \$1#" "#C O#: \$8, " % -#\$#18C , #49" 8 O/1/"%01%34(\$; 2(O' 2; +% , %, 1/2#3%" " 8/ " % , *; 7(: 2" "#&E=#, *O7&2@FreeBSD.org. F\$# 3-4<: %/\$ 32/ 2##67/"' (# -#++' \$%A, % \$%- 9/ 4<6. < , 1. =. < O#: \$. , %, 1/2#3%" ". < LO' 2#- 1%2284-' -#++' \$\$/1#3 FreeBSD ' LO' 2#- 1%2284-' 1%?1%6#\$: ' -#3 FreeBSD. @: /" ; 6#4; G' / O#: \$#38/ (7' -' , -#\$#18/ ?%" (4' O#2\$#(" #/ +/2\$# " % **freefall** , +=. \$ 68\$; . 2/: /" 8 6/? O1/ , . O1/9, /" ' (, /24' O#\$1/6. /\$2(#23#6#, ' \$; +/2\$#, O#*\$#+. O/1/"%01%34(C\$/ ' 4' 2#A1%" (C\$/ ' A 3 , 1. =#+ +/2\$/.



Q24' 3%G% 2' 2\$/+% *4/- \$1#" "#C O#: \$8 ' 20#4; ?./ \$ SPF 2# 2\$1#=' + ' O1%3' 4%+' , 3#+ 24/ , ./ \$' 2- 4<: ' \$; **mx2.FreeBSD.org** ' ? O1#3/1#- SPF.

M?-?% 382#- #C "%=1. ?-' , -#\$#1. < #61%6#\$-% 20%+% 2#?, %/\$ " % &/" \$1%4; " 8A O#: \$#38A 2/13/1%A, #61%6%\$83%< 7' A O#: \$#38/ 1%2284-' , 51#" \$/" , -2/13/1 380#4" (/ \$ 6%?#38/ O1#3/1-' ' + #9/\$ #61%283%\$; " /- #38/ 2##67/"' (" % ' A #2" #3/ .) "%2\$#(7// 31/+ (/ , ' " 2\$3/" "#C %- \$' 3" #C O1#3/1- #C (34(/\$2("%4' : ' / -#11/- \$" #C DNS-' " 5#1+%&' ' , 4(O#, - 4<: %< 7/=#2(A#2\$%, " # *\$# + #9/\$ ' ?+/" ' \$; 2(. B/- #38/ O#4; ?#3%/4' 23(?83%< \$ *\$' O1#3/1-' 2 4#9" 8+ #61%283%" ' /+ 4/= ' \$' + " #C O#: \$8. E4(#3- 4<: /" ' (, %" " 8A O1#3/1#- , 4(3%G/C O#: \$8 2#?, %C\$/ 5%C4 2' +/" /+ ~/.spam_lover " % **freefall.FreeBSD.org**.



N/, - \$# (34(< \$2(1%?1%6#\$: ' -%+' , " # " / -#++' \$\$/1%+' , " / 6. . . \$ O#, O' 2%" 8 " % 1%2284-' -#++' \$\$/1#3 ' 4' 1%?1%6#\$: ' -#3. ># , O' 2-' #O1/ , /4(< \$2(O1%3%+' , #2\$. O%.

7.2.1. ?-' (, \$E#- &\$' ("9- SMTP

E4(\$/A, - \$# 9/4%/\$ #01%34(\$; *4/- \$1#" " 8/ O' 2; +% : /1/? ' " 51%2\$1. - \$. 1. FreeBSD.org, 24/ , . C\$/ O1' 3/, D" " 8+ " ' 9/ ' " 2\$1. - &' (+:

1. B%O1%3; \$/ 3%G O#: \$#38C - 4' /" \$ " % **smtp.FreeBSD.org**: 587.
2.) - 4<: ' \$; STARTTLS.
3. K6/, ' \$/2; , : \$# 3%G %, 1/2 **From**: . 2\$%" #34/" -% - !"#%&' ()*+,)!"- \$*' @FreeBSD.org.
4. E4(% . \$/" \$' 5' -%&' ' + #9" # ' 20#4; ?#3%\$; 3%G/ ' + (O#4; ?#3%/4(' O%1#4; FreeBSD Kerberos (2+. **Kerberos** ' LDAP 3/6-O%1#4; , 4(- 4%2\$/1% FreeBSD). >1/, O#: \$' \$/4; " // ' 20#4; ?#3%\$; O1' " &' O%4 !"#%&' ()*+,)!"- \$*' /mail , \$%- -% - # , /C2\$3' \$/4/" \$#4; - # , 4(% . \$/" \$' 5' -%&' ' - O#: \$#38+ 1/2. 12%+.



>1' 33#, /' +/" ' O#4; ?#3%/4(" / 3- 4<: %C\$/ @FreeBSD.org.

F#" #&) (O7&E) - 7=*: 7O4(



\ T. , /\$ O1' " ' +%\$; O#: \$. \$#4; - # # \$!"#%&' ()*+,)!"- \$*' @FreeBSD.org.
 Q24' 38 % . \$/" \$' 5' &' 1#3%" 8 -% - # , ' " O#4; ?#3%/4; , 3#+ " / 1%?1/G/" # # \$O1%34(\$; O#: \$. # \$, 1. =#=#.

```
\ T., /$ , #6%34/" ?%=#4#3#- 2##67/" ' ( 2 ' +/" /+ 0#4; ?#3%$/4(
SASL: (Authenticated sender: %&'_()*+,)!"-*$').
\ B% A#2$/ , /C2$3.<$ 1%?4' : " 8/ #=1%"' : /"' ( 0# 2- #1#2$' , 4(
2#- 1%7/" ' ( 0#08$#- 3?4#+% 0/1/6#1#+ 0%1#4/C.
```

7.2.1.1. M' 9\$1: 7\$%- /*+ 1\$#- 1: /\$=\$ MTA &15 9+, +' O1#* K1+#(, \$//SE 9\$4(O % SMTP- '+, %*' FreeBSD.org

N%- 9/ 3#?+#9" # ' 20#4; ?#3%; 4#-%4; " 8C MTA , 4(0/1/284-' 4#-%4; " # #S01%34/" " 8A O' 2/+ "% SMTP-2/13/18 FreeBSD.org.

G9(: 79 1. H\$"#&E=#, *) (7 Postfix

```
Z$#68 2##67' $; 4#-%4; "#+. *-?/+04(1. Postfix, : $# 4<6#/ O' 2; +# #S
! "$$&'()*+,)!"-*$'@FreeBSD.org , #49" # 68$; 0/1/" %01%34/" # "% 2/13/18 FreeBSD.org,
, #6%3; $/*$# 3 3%G main.cf:
```

```
sender_dependent_relayhost_maps = hash:/usr/local/etc/postfix/relayhost_maps
smtp_sasl_auth_enable = yes
smtp_sasl_security_options = noanonymous
smtp_sasl_password_maps = hash:/usr/local/etc/postfix/sasl_passwd
smtp_use_tls = yes
```

L#?, %C\$/ 5%C4 /usr/local/etc/postfix/relayhost_maps 2# 24/, . < 7' + 2#, /19' + 8+:

```
A*0' , &28%<?>%A*)' <2@FreeBSD.org [smtp.freebsd.org]:587
```

L#?, %C\$/ /usr/local/etc/postfix/sasl_passwd 2# 24/, . < 7' + 2#, /19' + 8+:

```
[smtp.freebsd.org]:587 A*0' , &28%<?>%A*)' <2: A*08*+%<?
```

Q24' 0#: \$#38C 2/13/1 ' 20#4; ?./S2(, 1.= ' + ' 4<, ; +', 38 + #9/\$/ ?%A#\$/; O1/, #S31%\$' \$; #S01%3-. ' + ' O' 2/+ 2 3%G/=# %, 1/2%. E4(, #2\$' 9/" ' (*\$#C &/4' , #6%3; \$/*\$# 3 3%G main.cf:

```
smtpd_sender_login_maps = hash:/usr/local/etc/postfix/sender_login_maps
smtpd_sender_restrictions = reject_known_sender_login_mismatch
```

L#?, %C\$/ 5%C4 /usr/local/etc/postfix/sender_login_maps 2# 24/, . < 7' + 2#, /19' + 8+:

```
A*0' , &28%<?>%A*)' <2@FreeBSD.org A*0' , &2<%1*<?(%3%8%<?>%A*)' <2
```

V, / , *; 7(: 2*&E) # ' # " # &E=#, *O7&2 Ñ *\$# ' + (0#4; ?#3%\$/4(SASL, ' 20#4; ?./+##/ , 4(

O#, - 4<: /" ' (- 4#- %4; " #+. *- ?/+04(1. Postfix.

G9(: 79 2. HS" #&E=#, *) (7 OpenSMTPD

```
Z$#68 .-%?%$; 4#-%4;" #+. *-?/+04(1. OpenSMTPD, :$# 32/ O' 2; +% #S  
!"#$%&'()*+,)!-"$*'@FreeBSD.org , #49" 8 68$; 0/1/" %01%34/" 8 "% 2/13/18 FreeBSD.org,  
, #6%3; $/ *$# 3 3%G smtpd.conf:
```

```
action "freebsd" relay host smtp+tls://freebsd@smtp.freebsd.org:587 auth <secrets>  
match from any auth A*0', &2<%1*<?(%3%8%<?>%A*)' <2 mail-from  
"_A*0', &28%<?>%A*)' <2_@freebsd.org" for any action "freebsd"
```

V, /, *, 7(: 2*&E) #' #' #&E=#, *O7&2 Ñ *\$# ' + (O#4; ?#3%\$/4(SASL, ' 20#4; ?. /+#/ , 4(O#, - 4<: /" ' (- 4#- %4; " #+. *- ?/+04(1. OpenSMTPD.

L#?, %C\$/ 5%C4 /usr/local/etc/mail/secrets 2# 24/, . < 7' + 2#, /19' + 8+:

```
freebsd A*0', &28%<?>%A*)' <2: A*08*+%<?
```

G9(: 79 3. HS" #&E=#, *) (7 Exim

```
Z$#68 "%01%3' $; 4#-%4;" 8C *-?/+04(1 Exim , 4( 0/1/284-' 32/C 0#: $8 #S  
example@FreeBSD.org "% 2/13/18 FreeBSD.org, , #6%3; $/ *$# 3 -#" 5' =. 1%&' < Exim:
```

```
Routers section: (at the top of the list):  
freebsd_send:  
É driver = manual route  
É domains = !+local_domains  
É transport = freebsd_smtp  
É route_data = ${lookup {${lc:$sender_address}} | search  
{/usr/local/etc/exim/freebsd_send}}
```

```
Transport Section:  
freebsd_smtp:  
É driver = smtp  
É tls_certificate=<local certificate>  
É tls_privatekey=<local certificate private key>  
É tls_require_ciphers =  
EECDH+ECDSA+AESGCM:EECDH+aRSA+AESGCM:EECDH+ECDSA+SHA384:EECDH+ECDSA+SHA256:EECDH+a  
RSA+SHA384:EECDH+aRSA+SHA256:EECDH+AESGCM:EECDH:EDH+AESGCM:EDH+aRSA:HIGH:!MEDIUM:!  
LOW:!aNULL:!eNULL:!LOW:!RC4:!MD5:!EXP:!PSK:!SRP:!DSS  
É dkim_domain = <local DKIM domain>  
É dkim_selector = <local DKIM selector>  
É dkim_private_key= <local DKIM private key>  
É dnssec_request_domains = *  
É hosts_require_auth = smtp.freebsd.org
```

```

Authenticators:
frebsd_plain:
É driver = plaintext
É public_name = PLAIN
É client_send = ^example/mail^examplePassword
É client_condition = ${if eq{$host}{smtp.frebsd.org}}

```

L#?, %C\$/ 5%C4 /usr/local/etc/exim/frebsd_send 2# 24/, . < 7' + 2#, /19' + 8+:

```
example@frebsd.org: smtp.frebsd.org: : 587
```

7.3. ? - ' (- % / * # *

) 2/ " #38/ 1%?1%6#\$: ' - ' 0#4. : %< \$ " %2\$%3" ' - % " % 0/138/ " /2- #4; - # +/2(&/3. B%2\$%3" ' - #3/: %/\$?% #6. : /" ' / 0#, #0/: " #=# 01%3' 4%+ ' 2#=4%G/" ' (+ 01#/- \$% ' " %01%34(/\$ /=# 0/138/ G%=' 3 2##67/2\$3/ 1%?1%6#\$: ' - #3. B%2\$%3" ' - \$%- 9/ " /2D\$ 4' : ". < #3/\$2\$3/" " #2\$; ?% , /C2\$3' (0#, #0/: " #=# 3 \$:/ " ' / *\$#=# " %: %4; " #=# 0/1' #, %.

E4(-#++' \$\$/1#3: " / -#++' \$; \$/ " ' :/=# 6/? 01/, 3%1' \$/4; " #=# #, #61/" ' (+/" \$#1%. P%, #- . +/" \$' 1. C\$/ *\$# #, #61/" ' / 2\$1#- #C Approved by: 3 2##67/" ' ' -#++' \$%.

I #=, % "%2\$%3" ' - 1/G%/ \$, : \$# 0#, #0/: " 8C #23# ' 4 #2' #38 ' =#\$3 - 2%+#2\$#(\$/4; " #C 5' - 2%&' ' ' ?+/" /" ' C, "%2\$%3" ' - #6W(34(/\$ #6 *\$#+, 380#4" ((-#++' \$ 3 mentors. F\$#\$ 5%C4 "%A#, ' \$2(3 2' 1#\$2- #C 3/\$- / admin - %9, #=# 1/0#?' \$#1' (. >#, 1#6" %(' " 5#1+%&' (# \$#+, - % - 0#4. : ' \$; , #2\$. 0 - *\$' + 3/\$- %+, , #2\$. 0" % 3 3/\$- / "admin".

8. < , +&%- , * (+1: /- 5 9, \$%+, #- 9+, +& # \$)) * (\$)

J/&/" ?' 1#3%" ' / - #, % Ñ #, ' " ' ? 20#2#6#3 0#38G/" ' (-%: /2\$3% 01#=1%++ " #=# #6/20/: /" ' (. L4/, . < 7' / 1/- #+/" , %&' ' 01' +/" ' +8 - -#++' \$%+ 3 3/\$- . main (-CURRENT) 1/0#?' \$#1' (src. E1. = ' / 3/\$- ' , % \$%- 9/ , /1/3; (ports ' docs ' +/<\$ 2#62\$3/" " 8/ 0#4' \$' - ' 01#3/1- ' ' 1/&/" ?' 1#3%" ' (, " # , %" " 8/ 1/- #+/" , %&' ' 3 &/4#+ 01' +/" ' +8 - -#++' \$%+ , \$1/6. < 7' + 1/&/" ?' ' :

¥) 2/ " /\$1' 3' %4; " 8/ ' ?+/" /" ' (, #49" 8 68\$; 01#3/1/" 8 0/1/, ' A 5' - 2%&' /C 3 1/0#?' \$#1' ' .

¥ J/&/" ?' 1#3%" ' / + #9/\$ 01#3#, ' \$; 2(0# *4/- \$1#" " #C 0#: \$/ , 3 Bugzilla, 3 Phabricator ' 4' 2 0#+#7; < , 1. =#=# +/A%" ' ?+% . ># 3#?+#9" #2\$' 1/&/" ?' 1#3%" ' / , #49" # 68\$; 0. 64' : " 8+.

¥ J%?1%6#\$: ' - , #3/\$2\$3/" " 8C ?% ' ?+/" /" ' / - #, % , \$%- 9/ #6(?% " 3" #2' \$; 32/ " /#6A#, ' +8/ ' ?+/" /" ' (, 23(?% " 8/ 2 01#3/1- #C.

¥ J/&/"?' 1#3%" ' / -#, % + #9/\$ 68\$; ' \$/1%\$' 3" 8+ 01#&/22#+, - # \$ #18C 01#, #49%/\$2(, # \$/A 0#1, 0#-% 0%\$: " / 6. , /\$ =#\$#3 - -#++' \$..) : %2\$' #2\$' , 0#24/ # \$01%3- ' 0%\$: % " % 1/&/"?' 1#3%" ' /, # " , #49/" 0#4. : ' \$; (3" #/ 0#, \$3/19, /" ' / "38=4(, ' \$ A#1#G#" 0/1/, -#++' \$#+. @#" # , #49" # 68\$; (3" 8+, ' *\$# + #9/\$ 01' " ' +% \$; 4<6. < 5#1+., - # \$ #1(' +// \$ 2+824 , 4(+/\$#, % 1/&/"?' 1#3%" ' (.

¥ N% C+-%. \$8 " / (34(< \$2(?%+/" #C 01#3/1- /.

M" #=, % 01#3/1-% -#, % ?%" ' +%/ \$ 6#4; G/ 31/+/" ' , : /+ A#\$/4#2; 68, #2#6/" " # , 4(6#4; G#=# 0# #6WD+. 5. " - &' # "%4%. >1' " (\$8/ 20#2#68 . 2-#1' \$; 01#3/1-. 3%G' A 0%\$: /C:

¥ >1#3/1(CS/ 0%\$: ' , 1. = ' A 4<, /C. Q24' 38 0#++#=#/\$/, 32/ 6. . . \$ 6#4// #A#\$" # , /4%\$; \$# 9/ 2%+ #/ , 4(3%2; , #61#9/4%\$4; " #2\$; Ñ " %G% 3%4< \$%.

¥ >' " =. CS/ 0%\$: . Q24' # " 21#: " 8C, . -%9' \$/ 01' : ' " 8, 0#: /+ . , 4(3%2 3%9" #, : \$#68 *\$#\$ 0%\$: 684 01' " (\$, ' 0' " =. CS/ -%9, 8/ 0%1. , " /C. Q24' # " " / 21#: " 8C, #67/01' " (\$ (3/94' 3% (: %2\$#\$% 0' " =% Ñ #, " % " /, /4(. >#+" ' \$/, : \$# 38 01#2' \$/ . , 1. = ' A 01#5/22' # " %4; " 8A 1%?1%6#\$: ' -#3' A &/" " #/ 31/+(.

¥ @61%\$' \$/2; ?% 0#++#7; < 3 20' 2- ' 1%2284-' , IRC ' \$., . E1. = ' / +#=. \$ 4' 6# 0#++#; ; 3%+ "%01(+. <, 4' 6# 01/, 4#9' \$; 1/&/" ?/" \$%.

¥ J%?, /4' \$/ 3%G 0%\$: " % " /2- #4; -# +/" ; G' A 0%\$: /C, - # \$ #18/ #2" #383%< \$2(, 1. = " % , 1. = / . Z/ + +/" ; G/ 3%G 0%\$: , \$/ + 38G/ 3/1#(\$ " #2\$; , : \$# - \$#-\$# 6/=4# /=# 01#2+#\$1' \$.

>1' 3" /2/" ' ' - 1. 0" 8A ' ?+/" /" ' C 0#4/?" # , /19%\$; *\$# 3 . + / 2 2%+ #=# " %: %4% 1%6#\$8, 0#2- #4; - . 1%?6' /" ' / - 1. 0" 8A ' ?+/" /" ' C " % 6#4// +/4- ' / : %2\$# 683%/ \$?%\$1. , " ' \$/4; " # 0#2\$5%- \$. +.

J%?1%6#\$: ' -%+ 24/, . /\$. : %2\$3#3%\$; 3 01#3/1-%A -#, % -%- 3 1#4' %3\$#1#3, \$%- ' 3 1#4' 1/&/" ?/" \$#3. Q24' - \$#-\$# 4<6/?" # 01#3/1' 4 3%G -#, , 38, #49" 8 # \$3/\$' \$; \$/ + 9/ , 4(-#=#- \$# , 1. =#=#. @61%\$' \$/ 3" ' +%" ' /, : \$# A#\$ (4<6#C + #9/\$ 01#3/1' \$; ' , %\$; #61%\$" . < 23(?; 0# 0%\$: . , \$#4; - # 2##\$3/\$2\$3. < 7' C *-20/1\$ 0# \$/+ / + #9/\$ #, #61' \$; ' ?+/" /" ' / . @68: " # *\$# -#++' \$\$/1, - # \$ #18C 1/= . 4(1" # 1%6#\$%/ \$ 2 1%22+%\$1' 3%/ + 8+ -#, #+.

) "/ - # \$ #18A 24. : % (A + #9/\$ " / #-%?%\$; 2(*-20/1\$ 0# 01/, +/\$" #C #64%2\$' .) \$%- ' A 24. : % (A , #2\$%\$#: " # 01#3/1- ' #08\$" 8+ 1%?1%6#\$: ' -# + 3 2#: /\$" ' ' 2 2##\$3/\$2\$3. < 7' + \$/2\$' 1#3%" ' /+.

9. Q", /- 1 ' \$\$\$8H+/* E \$ # \$)) * (- >

) *\$#+ 1%?, /4/ 2#, /19%\$2(" /- # \$ #18/ 01/, 4#9/" ' (' \$1%, ' &' ' 0# 5#1+%\$' 1#3%" ' < 9. 1" %4#3 - #++' \$#3.

9.1. < \$4+) " %- D/O ' \$\$\$8H+/* 5 # \$)) * (\$%?)

>1' 5' -2%&' ' ' ?+/" /" ' (3 Git, Subversion ' 4' , 1. =#C 2' 2\$/+ / -#" \$1#4(3/12' C (LI)) 3%+ 01/, 4%=#/\$2("%0' 2%\$; \$/-2\$ 2 #0' 2%" ' /+ -#++' \$% Ñ 2##67/" ' / # -#++' \$/. B%2- #4; -# 3%9" # *\$# 2##67/" ' / # -#++' \$/? LS# ' \$ 4' 01' 4%=#\$; ?" %: ' \$/4; " 8/ . 2' 4' (, 4(/=# "%0' 2%" ' (?M+// \$ 4' ?" %: /" ' /, /24' 38 01#2\$# " %0' G/\$/ , 78+*A<' (* %0, 51*?)

' 5#1+%&' <. F\$# 0#38G%/\$ *55/- '\$ 3"#2\$; 01#2+#\$1% 9. 1"%4% Git ' 0#?3#4(/\$ -#+" , / git log --oneline #\$\$61%9%\$; -#1#\$- ' C A*G ' \$/+. "% #, "#C 80-2' +3#4; "#C 2\$1#- /. H#1#G' + *+0' 1' : /2- ' + 01%3' 4#+ (34(/\$2(., /19%" ' / , 4' " 8 " ' 9/ 67 2' +3#4#3, % 0# 3#?+#9" #2\$' Ñ #- #4# 50 ' 4' +/" ; G/.

9.4. O\$8- %: (+ # ' (, \$#+ (+) O 9, +R* #' ' "#- 7- /* +) #)\$ 9\$ /+ / (-, + ' 1* K(\$ 9, *) +/*) \$

Q24' ' ?+/" /" ' / # \$" #2' \$2(- #01/, /4D" " #+. -#+0#" /" \$., 2\$1#- % \$/+8 +#9/\$ 68\$; 01/, 3%1/" % ' +/" /+ *\$#=# -#+0#" /" \$%' , 3#/\$#: ' /+ (:). ># 3#?+#9" #2\$' ' 20#4; ?. CS/ \$#\$ 9/ 01/5' -2, -#\$#18C 01' +/" (42(3 01/, 8, . 7' A -#++' \$%A - \$/+ 9/ 5%C4%+.

" foo: Add -k option to keep temporary data

) -4<: '\$ / 01/5' -2 3 4' +' \$ 67 2' +3#4#3, : \$68 git log --oneline ' ?6/=4 0/1/" #2%.

9.5. ? - 9*L * (+ 9+, %" 3 8" #%" (+) O ' 7- =1- %/\$E 8" #%O

>/13%(6. -3% \$/+8 , #49" % 68\$; ?%=4%3" #C. >1/5' -2, /24' #" /2\$; , 2 ?%=4%3" #C 6. -38 " / 0' G/\$2(, /24' *\$# " / \$1/6. /\$2((" %01' +/1, USB: 0' G/\$2(2 ?%=4%3" #C 6. -38).

9.6. ? + 7- #- /4*%- E(+ ' (, \$#" (+) O 7/- #-) * 9, +9* /- /* 5

B/ 2\$%3; \$/ \$#: -. ' 4' , 1. = / ?" %- ' 01/0' "%" ' (3 -#" &/.) *\$#+ # \$" #G/" ' ' 2\$1#- % \$/+8 0#, #6" % ?%=#4#3-. 3 =%?/\$/.

9.7. ! - 7&+1* (+ (+) " * (+1\$ 9* ' :) - 9" ' (\$E ' (, \$#\$E

@\$, /4' \$/ \$/4# # \$ \$/+8 0. 2\$#C 2\$1#- #C.

B/- # \$ #18/ \$1' 3' %4; " 8/ -#++' \$8 " / \$1/6. <\$ \$/4% ' 2#, /19%\$ \$#4; -# ?%=#4#3#-.

" Is: Fix typo in usage text

9.8. A=, - /* 4: (+ ' \$\$8H+/* 5 &\$ 72 # \$1\$/\$#

git log ' git format-patch , /4%<\$ # \$2\$. 0 3 2##67/" ' ' -#++' \$% " : /\$81/ 01#6/4%. >/1/" #2 2\$1#- "% 72-C -#4#" -/ #6/20/: ' 3%/\$ 2##3/\$2\$3. <7' C # \$2\$. 0 0# 01%3#+. -1%<. @=1%" ' : /" ' / 2##67/" ' C 72 2' +3#4%+' \$%- 9/ ., /19' 3%/\$ 2##67/" ' / -#++' \$% 3 5#1+%\$' 1#3%" " 8A 0%\$: %A " ' 9/ 1/-#+/" , #3%" " #=# RFC 2822 #=1%" ' : /" ' (, 4' " 8 2\$1#- ' *4/- \$1#" " #C 0#: \$8 3 78 2' +3#4#3. F\$# #=1%" ' : /" ' / A#1#G# 1%6#%/\$ 2 1%?4' : " 8+ ' ' " 2\$1. +/" \$%+' , -#\$#18/ +#=#. \$ # \$ #61%9%\$; 2##67/" ' (-#++' \$#3; 0/1/" #2 2\$1#- +#9/\$ 68\$; " /0#24/, #3%\$/4; " 8+ 01' 6#4; G/C , 4' " / 2\$1#- ' .

9.9. M' 9\$1: 7"E(+ /- ' (\$5H++ %, +) 5, 9\$%+1* (+1: /\$+ /- #1\$/+/* +

F\$# 20#2#62\$3. /\$ - 1%\$-#2\$' \$/+ ' #6/20/: ' 3%/\$ /, ' " ##61%?' /, 3- 4<: %(%3\$#+%\$' : /2- ' =/" /1' 1. /+8/ 2##67/" ' (-#++' \$#3 (" %01' +/1, 2#?, %3%/+8/ git revert). F\$# 3%9" # 01' : \$/" ' ' 20' 2- % \$/+ -#++' \$#3. E. +%C\$/ # \$/+ / -% - # ?%3/1G/" ' ' 51%?8 Ç01' 01' +/" /" ' ' *\$# ' ?+/" /" ' / O#?3#4' \$É (when applied, this change will É)È.

```
" foo: Implement the -k (keep) option
] foo: Implemented the -k option
] This change implements the -k option in foo
] -k option added
```

9.10. 6\$' , +&\$(\$4: (+' : /- (\$) , 4(\$ * 9\$4+) ", - /+ /- (\$) , #-

@6W(2" ' \$/, : /=# , #2\$' =/\$ ' ?+/" /" ' / ' O#: /+. # " # , /4%/\$2(, % " / -% -.

B/ 01/, O#4%=%C\$/ , : \$# : ' \$\$/4; ?" %- #+ 2 01#64/+#C. @6W(2" ' \$/ 01/, 82\$#1' < ' +#\$' 3%&' < ' ?+/" /" ' (.) -4<: ' \$/ , %" " 8/ \$/2\$' 1#3%" ' (01#' ?3#, ' \$/4; " #2\$' , /24' #' ' . 3%2 /2\$; .

Q24' 3 ' ?+/" /" ' (A /2\$; #=1%" ' : /" ' (' 4' " /O#4" 8/ %20/- \$8, #0' G' \$/ ' A 3 2##67/" ' ' -#++' \$%.

9.11. <\$&") - E(+,) \$D/\$ 1* 4- ' (* ' \$\$8H+/* 5 # \$)) * (- \$R\$,) * (: #- # # \$)) +/(- , ** % # \$&+

M" #=, % 01' " %0' 2%" ' ' 2##67/" ' (-#++' \$% 38 +#9/\$/ #6" %1. 9' \$; , : \$# 0' G/\$/ #, " #-, 3% 01/, 4#9/" ' (, #6W(2" (< 7' A -% -#C-\$# 24#9" 8C' 4' ?%0. \$%" " 8C %20/- \$' ?+/" /" ' (.) \$%- ' A 24. : %(A 2\$#' \$ O#, . +\$%; , 6. , /\$ 4' O#4/?" # ' +/\$; *\$# #6W(2" /" ' / 3 3' , / -#++/" \$%1' (3 2%+##+ -#, /.

9.12. ?- 9*L * (+ ' \$\$8H+/* 5 # \$)) * (\$% &15 ' +85 % 8" &" H+)

>1' " %0' 2%" ' ' 2##67/" ' (-#++' \$% , 4(' ?+/" /" ' (. 3%2 /2\$; 3/2; -#" \$/- 2\$ 3 =#4#3/ Ñ : \$# 38?3%4# ' ?+/" /" ' /, %4; \$/1"%\$' 3" 8/ O#, A#, 8, -#\$#18/ 1%22+%\$1' 3%4' 2; ' 684' # \$- 4#" /" 8, #=1%" ' : /" ' (' ?+/" /" ' (' \$%- , %4//. >1/, 2\$%3; \$/, : \$# 38 3#?31%7%/\$/2; - ' ?+/" /" ' < : /1/? =#, ' 4' , 3%, ' " %0' G' \$/ 2##67/" ' / -#++' \$% \$%- ' + #61%?##+, : \$#68 # " # 01/, #2\$%3' 4# *\$#\$ " /#6A#, ' +8C -#" \$/- 2\$.

9.13. 6\$\$\$8H+/* 5 \$ # \$)) * (- > &\$1D/O 8O (:

' -) \$&\$' (- (\$4/O) *

) 8 + #9/\$/ 3-4<: %\$; 2284- ' "% 2##67/" ' (3 0#: \$#38A 1%2284-%A, 2%CS8 2 1/? . 4; %\$%+ ' \$/2\$' 1#3%" ' (01#' ?3#, ' \$/4; "#2\$' ' 4' 2284- ' "% 01#3/1- ' -#, %, @, "%-#, 2##67/" ' / # -#++' \$/ , #49" # 2#, /19%\$; 32< 2##\$3/\$2\$3. < 7. < ' " 5#1+%&' < "% 24. : %C, /24' *\$' 2284- ' 2\$%" . \$ "/, #2\$. 0" 8 3 6. , . 7/+.

!"%4#=: "#, -#++' \$ + #9/\$ 2284%\$; 2("% 01/, 8, . 7' C -#++' \$, "%01' +/1, 3 24. : %/ ' 201%34/" ' (#G' 6- ' ' 4' #-\$-%\$. >#++' +# ' , /" \$' 5' -%\$#1% -#++' \$% (1/3' ?' ' ' 4' A/G%), 3-4<: ' \$/ 2\$1#- . \$/+8 ' ? . 0#+(" . \$#=# -#++' \$% (' 4' , 1. =. < 0#, A#, (7. < -1%\$- . < 2284- .). L -%9, #C + '=1%&' /C 2' 2\$/+8 -#" \$1#4(3/12' C (#\$ CVS - Subversion ' ?%\$/+ - Git) ' , /" \$' 5' -%\$#18 1/3' ?' C ' ? 01/, 8, . 7' A 2' 2\$/+ +#=. \$ 2\$%" #3' \$; 2(\$1. , "8+' , 4(#24/9' 3%" ' (.

9.14. J#- D* (+ /+\$8>\$&*) O+) +(- &- //O+ % /* D/+E

4- ' (*

>#+' +# 3-4<: /" ' (' " 5#1+%\$' 3" #=# 2##67/" ' (2 -%9, 8+ -#++' \$#+, + #9/\$ 0#\$1/6#3%\$; 2("/- #\$\$\$1(, #0#4" ' \$/4; "%(' " 5#1+%&' (.

F\$% ' " 5#1+%&' (2#2\$#' \$' ? #, "#C ' 4' "/-#4; -' A 2\$1#-, 2#, /19%7' A -4<: /3#/ 24#3# ' 4' 51%?. , , 3#/\$#: ' /, \$%6. 4(&' ' , 4(5#1+%\$' 1#3%" ' (' ?%\$/+ , #0#4" ' \$/4; " . < ' " 5#1+%&' <.

E4(-4<: /38A 24#3, =, / , #0. 2\$' +8 + "#9/2\$3/" " 8/ ?" %: /" ' ((" %01' +/1, PR: 2# 20' 2- #+ PR : /1/? ?%0(\$. <), 1%?1/G%/2(' 20#4; ?#3%\$; #, "# ' \$# 9/ -4<: /3#/ 24#3# "/-#4; -# 1%?, : \$#68 ' ?6/9%\$; "/#, "#?" %: "#2\$' ' 4' . 4. : G' \$; : ' \$%/+#2\$; .

I 4<: /38/ 24#3% ' 4' 51%?8:

PR:	B#+/1 #\$: D\$% # 01#64/+ / (/24' /2\$;), "% -#\$\$\$18C 34' (/ \$, % " 8C -#++' \$ (#68: " # 0. \$/+ ?%- 18\$'). O#9" # . -%?%\$; "/-#4; -# " #+/1#3 PR 3 #, "#C 2\$1#- /, 1%?, /4((' A ?%0(\$8+' ' 4' 01#6/4%+' .
Reported by:	M+ (' %, 1/2 *4/- \$1#" "#C 0#: \$8 4' &%, 2##67' 3G/=# # 01#64/+ /; , 4(1%?1%6#\$: ' - #3 Ñ \$#4; -# ' + (0#4; ?#3%\$/4(3 - 4%2\$/1/ FreeBSD. @68: " # ' 20#4; ? . /\$2(, -#=#, % " /\$ PR, "%01' +/1, /24' 01#64/+ % 684% 2##67/" % 3 0#: \$#3#C 1%2284- /.
Submitted by:	M+ (%3\$#1%, - #\$\$\$18C #S01%3' 4' ?+/" /" ' / 6/? 01/, #2\$%34/" ' (0#4" #=# (/ / -#11/- \$" #=# 0%\$: %, #2#6/" " # 6/? -#11/- \$" #=# %, 1/2% *4/- \$1#" "#C 0#: \$8. @S01%34/" " 8/ 0%\$: ' , #49" 8 ' +/\$; . -%?" " #=# %3\$#1% 2 0#++#7; < -#+" , 8 git commit --author 2 0#4" 8+ ' +/" /+ ' -#11/- \$" 8+ %, 1/2## *4/- \$1#" "#C 0#: \$8. E# 0/1/A#, % "% git, -#=#, % 0#(3' 4%2; 3#?+ #9" #2\$; 1%?, /4(\$; 0#4(%3\$#1% ' -#++' \$/1%, *\$# ' 20#4; ?#3%4#2; , 4(01' 24%" " 8A 0%\$: /C.

<p>Reviewed by:</p>	<p>M+(' %, 1/2 *4/- \$1#" "#C O#: \$8 : /4#3/-% ' 4' 4<, /C, -#\$#18/ O1#3/1' 4' ' ?+/" /" ' /; , 4(1%?1%6#\$: ' - #3 , #2\$%\$#: " # . -%?%\$; ' +(O#4; ?#3%\$/4(3 - 4%2\$/1/ FreeBSD. Q24' O%\$: 684 #S01%34/" 3 20' 2#- 1%2284-' , 4(O1#3/1-' ' O#4. : ' 4 O#4#9' \$/4; " 8C #S?83, \$# . -%9' \$/ \$#4; - # "%?3%" ' / 20' 2-%. Q24' 1/&/" ?/" \$ " / (34(/\$2(. : %2\$" ' - #+ O1#/- \$%, . -%9' \$/ ' + (, *4/- \$1#" ". < O#: \$. ' , /24' *\$# O#1\$, 3" /G" << 1#4; , " %01' +/1, 2#01#3#9, %< 7 /=#:</p> <p>>1#3/1/" # 1%?1%6#\$: ' - #+: [source,shell] É. Reviewed by: username É.</p> <p>>1#3/1/" # 2#01#3#9, %< 7 ' + O#1\$#3, " / (34(< 7 ' +2(1%?1%6#\$: ' - #+: [source,shell] É. Reviewed by: Full Name <valid@email> (maintainer) É.</p>
<p>Tested by:</p>	<p>M+(' %, 1/2 *4/- \$1#" "#C O#: \$8 : /4#3/-% ' 4' 4<, /C, -#\$#18/ O1#3/1' 4' ' ?+/" /" ' /; , 4(1%?1%6#\$: ' - #3 Ñ O1#2\$# ' + (O#4; ?#3%\$/4(3 - 4%2\$/1/ FreeBSD.</p>
<p>Discussed with:</p>	<p>M+(' %, 1/2 *4/- \$1#" "#C O#: \$8 : /4#3/-% ' 4' 4<, /C, -#\$#18/ 3" /24' 3- 4%, 3 ' 201%34/" ' /, O1/, #2\$%3' 3 2#, /19%\$/4; " . < #61%\$". < 23(?; ; , 4(1%?1%6#\$: ' - #3 Ñ O1#2\$# ' + (O#4; ?#3%\$/4(3 - 4%2\$/1/ FreeBSD. @68: " # ' 20#4; ? . /\$2(, 4(. O#++ " %" ' (\$/A, - \$# " / O1#3#, ' 4 (3" #=# 1/&/" ?' 1#3%" ' (, \$/2\$' 1#3%" ' (' 4' #, #61/" ' (' ?+/" /" ' (, " # \$/+ " / +/" // . : %2\$3#3%4 3 #62. 9, /" ' ' , 23(?%" " #+ 2 ' ?+/" /" ' /+, : \$# O1' 3/4# - . 4. : G/" ' (+ ' 4. : G/+ . O#" ' +% " ' < /=# 34' (" ' (" % O1#/- \$ FreeBSD.</p>

<p>Approved by:</p>	<p>M+(' %, 1/2 *4/- \$1#" "#C O#: \$8 4' &%' 4' 4' &, . \$3/1, ' 3G' A ' ?+/" /"' /; , 4(1%?1%6#\$: ' -#3 Ñ 01#2\$# ' +(O#4; ?#3%\$/4(3 -4%2\$/1/ FreeBSD.</p> <p>Q2\$; " /2- #4; -# 24. : %/3, -#=#, % . \$3/19, /"' / (34(/\$2(#68: "#C 01%- \$' -#C:</p> <p>¥ -#=#, % "#38C -#++' \$\$/1 "%A#, ' \$2(O#, "%2\$%3"' : /2\$3#+</p> <p>¥ -#++' \$8 3 #64%2\$; , /1/3%, . -%?" " . < 3 5%C4/ LOCKS (src)</p> <p>¥ 3# 31/+(&' -4% 380. 2-%</p> <p>¥ -#++' \$8 3 1/0#?' \$#1' C, =, / . 3%2 " /\$ 01%3% "% -#++' \$ (" %01' +/1, -#++' \$\$/1 src , /4%/\$ -#++' \$ 3 docs)</p> <p>¥ -#++' \$8 3 0#1\$, 0#, , /19' 3%/+8C -/+-\$#, 1. =' +</p> <p>)# 31/+("%2\$%3"' : /2\$3% O#4. : '\$ / #, #61/"' / "%2\$%3"' -% O/1/, -#++' \$#+. K-%9' \$/ ' +(O#4; ?#3%\$/4("%2\$%3"' -% 3 *\$#+ O#4/ ' #\$/; \$/, : \$# #" (34(/\$2("%2\$%3"' -#+:</p> <div style="border: 1px solid gray; padding: 5px; margin: 10px 0;"> <p>Approved by: , &2-8%<?>%A*)' <2-(*)*A(, 1* (mentor)</p> </div> <p>Q24' -#++' \$8 684' . \$3/19, /" 8 -#+%", #C, . -%9' \$/ "%?3%"' / -#+%", 8, ?% -#\$#18+ 3 2-#6-%A 24/, ./ \$ ' +(O#4; ?#3%\$/4(. \$3/19, %< 7 /=#. B%01' +/1:</p> <div style="border: 1px solid gray; padding: 5px; margin: 10px 0;"> <p>Approved by: re (, &2-8%<?>%A*)' <2)</p> </div>
<p>Obtained from:</p>	<p>B%?3%" ' / O1#/- \$% (/24' /2\$;), ' ? -#\$#1#=# 684 O#4. : /" -#, . B/ ' 20#4; ? . CS/ *\$. 2\$1#-. , 4(. -%?" ' (' +/" ' #\$, /4; "#=# : /4#3/- %.</p>
<p>Fixes:</p>	<p>I #1#\$- ' C A*G Git' ?=#4#3#- -#++' \$%, -#\$#18C ' 201%34/" *\$' + ' ?+/" /"' /+, -%- 3#?31%7%/\$2(-#+%", #C git log -n1 --format:'%h ("%s")' GIT-COMMIT-HASH. O8 3- 4< : %/+ ?=#4#3#- -#++' \$%, : \$#68 +#9" # 684# "%CS' . -%?" " 8C -#++' \$, %9/ 3 24. : %/, /24' 6. , . 7%(+' =1%&' (2' 2\$/+8 -#" \$1#4(3/12' C 2, /4%/\$ 2284- ' O# A*G. " /, /C2\$3' \$/4; " 8+' .</p>
<p>MFC after:</p>	<p>Z\$#68 O#4. : '\$; "%0#+' "%" ' / O# *4/- \$1#" "#C O#: \$/ # ?%04%" ' 1#3%" " #+ MFC : /1/? #01/, /4D" "#/ 31/+(, . -%9' \$/ -#4' : /2\$3# , "/C, " /, /4; ' 4' +/2(&/3, O#24/ -#\$#18A 04%" ' 1. /\$2(380#4" ' \$; MFC.</p>
<p>MFC to:</p>	<p>Q24' -#++' \$. , #49" # 68\$; 2, /4%" # 24' (" ' / 3 0#, + " #9/2\$3# 2\$%6' 4; " 8A 3/\$#-. , -%9' \$/ "%?3%"' (3/\$#- .</p>
<p>MFH:</p>	<p>Q24' -#++' \$. , #49" # 68\$; 2, /4%" # 24' (" ' / 3 -3%1\$%4; " . < 3/\$- . O#1\$#3, . -%9' \$/ -3%1\$%4; " . < 3/\$- .. B%01' +/1, 202102.</p>
<p>Rel notes:</p>	<p>Q24' ' ?+/" /"' / (34(/\$2(-%" , ' , %\$#+ , 4(3- 4< : /"' (3 01' +/: %"' (- 380. 2- . 24/, . < 7 /C 3/12' ' ' ?3/\$- , . 2\$%" #3' \$/ ?" %: /"' / yes.</p>

<p>I %", ', %\$%+' (34(< \$2(' ?+/" /"' (, 3', '+8/ 0#4; ?#3%\$4(+, "#38/ 5. "-&' ', "%1. G/"' (, 2#3+/2\$' +#2\$' ' \$, .</p>	<p>Q24' 38 ?%684' .2\$%" #3' \$; *\$. 2\$1#-. ' 4' A#\$' \$/ 01/, #2\$%3' \$; 6#4// 0#, 1#6" . < ' " 5#1+%&' <, , #6%3; \$/ ?%0' 2; 3 5% C4 RELNOTES 3 - #1" / , /1/3% ' 2A#, " #=# -#, % src.</p>
<p>R% C4 RELNOTES ' 20#4; ? . /\$2(, 4(5#1+' 1#3%" ' (, 01' +/: %" ' C - 380. 2- . , 4(24/ , . < 7 /=# 1/4' ?%.</p>	<p>B/ ' 20#4; ? . CS/ 2\$1#-. Rel notes: , 4(#0' 2%" ' (' ?+/" /"' (: /D /, ' " 2\$3/" " #/, #0. 2\$' +#/?" %: /" ' / - yes.</p>
<p>Security:</p>	<p>Q24' ' ?+/" /"' / 23(?% " # 2 . (?3' +#2\$; < ' 4' . =1#?#C 6/?#0%2" #2\$' , . - %9' \$/ #, " . ' 4' "/2- #4; - # 2284#- 4' 6# #0' 2%" ' / 01#64/+8. ># 3#?+ #9" #2\$' 3- 4<: ' \$/ URL VuXML ' 4' ' , /" \$' 5' - %\$#1 CVE.</p>
<p>Event:</p>	<p>@0' 2%" ' / 2#68\$' (, 3 1%+- %A - # \$#1#=# 684 380#4" /" *\$#\$ - #+++' \$. Q24' *\$# 0#3\$#1(< 7 //2(2#68\$' / , , #6%3; \$/ =#, ' 4' , %9/ +/2(& . B%01' +/1, *\$# + #9/\$ 68\$; FooBSDcon 2019. M, / (*\$#C 2\$1#- ' Ñ #\$, %\$; , #49" #/ - # " 5/1/" &' (+, 32\$1/: %+ ' , 1. = ' + 0#, #6" 8+ + /1#01' (\$' (+, % \$%- 9/ 0#- %?%\$; , : \$# ' A 01#3/, /" ' / 0#4/?" #. >#9%4. C2\$%, " / ' 20#4; ? . CS/ 2\$1#-. Sponsored by: , 4(*\$#=#, \$%- -% - #"% 01/, "%?" %: /" % , 4(#1=%" ' ?%&' C, 20#" 2' 1. < 7' A #01/, /4D" " 8/ 5. "-&' ' , ' 4' 1%?1%6#\$: ' - #3, 1%6#\$%< 7' A " %, " ' + ' .</p>
<p>Sponsored by:</p>	<p>@1=%" ' ?%&' ' , 20#" 2' 1#3%3G' / *\$# ' ?+/" /"' / (/24' /2\$;). J%?, /4(CS/ "/2- #4; - # #1=%" ' ?%&' C ?%0(\$8+' . Q24' \$#4; - #: %2\$; 1%6#\$8 684% 20#" 2' 1#3%" % ' 4' 1%?" 8/ 2. ++8 20#" 2#12- #C 0#, , /19- ' 684' 01/, #2\$%34/" 8 1%?" 8+ %3\$#1%+, . - %9' \$/ 2##\$3/\$2\$3. < 7. < ' " 5#1+%&' < 3 2- #6- %A 0#24/ - %9, #=# ' +/" ' 20#" 2#1%. B%01' +/1, Example.com (alice, code refactoring), Wormulon (bob), Momcorp (cindy) 0#- %?83%/ \$, : \$# Alice 684% 20#" 2' 1#3%" % Example.com , 4(1/5%- \$#1' " =% - #, %, 3 \$# 31/+(- % - Wormulon 20#" 2' 1#3%4 1%6#\$. Bob, % Momcorp 20#" 2' 1#3%4 1%6#\$. Cindy. E1. = ' / %3\$#18 4' 6# " / 684' 20#" 2' 1#3%" 8, 4' 6# 1/G' 4' " / . - %?83%; 20#" 2#12\$3#.</p>
<p>Pull Request:</p>	<p>F\$# ' ?+/" /"' / 684# # \$01%34/" # - % - ?%01#2 " % 01' " (\$' / ' ?+/" /"' C (pull request) ' 4' ?%01#2 " % 24' (" / (merge request) 3 #, " ' ' ? 0. 64' : " 8A Git-1/0#?' \$#1' /3 FreeBSD \$#4; - #, 4(: \$/" ' (. @ " # , #49" # 3- 4<: %\$; 0#4" 8C URL ?%01#2% " % 3- 4<: /" ' / ' ?+/" /"' C, \$%- -% - #"' : %2\$# 380#4" (< \$ 1#4; 1/&/" ?' C - #, % . B%01' +/1: https://github.com/freebsd/freebsd-src/pull/745</p>

Closes:	FS# ' ?+/" /"' / ?%3/1G%/\$ 2/1' < 0%\$: /C, #62. 9, %3G' A2(O# . -%?" " #+. % , 1/2. 3 pull request "% GitHub, ' ?%- 183%/\$, %" " 8C ?%01#2. @" # , #49" # 3- 4<: %\$; O#4" 8C URL ?%01#2% " % 3- 4<: /"' /' ?+/" /"' C, \$%- -%- #' ' : %2\$# 380#4" (<\$ 1#4; 1/&/" ?' C - #, % . B%01' +/1: https://github.com/freebsd/freebsd-src/pull/745
Co-authored-by:	M+ (' % , 1/2 *4/- \$1#" "#C O#: \$8 , #0#4"' \$/4; " #=# %3\$#1% - #++' \$%. GitHub 2#, /19' \$ O#, 1#6" #/ #0' 2%" ' / \$1/C4/1% Co-authored-by O# % , 1/2. https://docs.github.com/en/pull-requests/committing-changes-to-your-project/creating-and-editing-commits/creating-a-commit-with-multiple-authors .
Signed-off-by:	ID O#, \$3/19, %/\$ 2##\$3/\$2\$3' / \$1/6#3%" ' (+ https://developercertificate.org/
Differential Revision:	>#4" 8C URL #6?#1% 3 Phabricator. FS% 2\$1#- % 1#&@) * %- OE "#\$&71) 7. \$O9#4#. . B%01' +/1: https://reviews.freebsd.org/D1708 .

G9(: 79 4. I 59) *& (= : 7) 7) (. 1&2 4#: : (O*) * #S) #, 7 PR

I #++' \$ #2" #3%" "% O%\$: / ' ? PR, O1/, #2\$%34/" "#=# E9#" #+ L+' \$#+. >#4/ "PR" 3 2##67/" ' ' - #++' \$% ?%O#4" /" #.

...

PR: 12345

K: %2\$"' - . 2\$%" %34' 3%/\$ %3\$#1% O%\$: % 2 O##+7;< git commit --author "John Smith <John.Smith@example.com>"

G9(: 79 5. I 59) *& (= : 7) 7) (. 1&2 4#: : (O*, O97%5JK7' # "9#, 794(

) "#2(\$2(' ?+/" /"' (3 2' 2\$/+ . 3' 1\$. %4; " #C O%+(\$' . >#24/ #S01%3-' O%\$: /C 3 2##\$3/\$2\$3. < 7' C 20' 2#- 1%2284-' (3 , %" "#+ 24. : %/, [freebsd-arch](#)) ' . \$3/19, /"' (' ?+/" /"' C.

...

Reviewed by: -arch

G9(: 79 6. I 59) *& (= : 7) 7) (. 1&2 4#: : (O*, O97%5JK7' # #1#%97) (2

P%- #++' \$' \$; O#1\$ O#24/ 2#=4%2#3%" ' (2 . -%?" " 8+ MAINTAINER, -#\$#18C , %4 , #61# "% - #++' \$.

...

Approved by: abc (maintainer)

V, / abc Ñ ' + (. : DS" #C ?%O' 2' 4' &%, #, #61' 3G/=# - #++' \$.

G9(: 79 7. I 59) *& (=: 7) 7) (. 1&2 4#: : (O*, ,) #S2K7' # 4#1 (= OpenBSD

I #++' \$ "/- #S#1#=# - #, % " % #2" #3/ 1%6#S8, 380#4" /" " #C 3 01#/- \$/ OpenBSD.

...

Obtained from: OpenBSD

G9(: 79 8. I 59) *& 4#: : (O#, 1&2 "9*, 4(, FreeBSD-CURRENT \$="&*) (9#, *) - : 4#: : (O#: , FreeBSD-STABLE, "#S&715J K77, 97: 2.

I #++' \$ "/- #S#1#=# - #, % - #S#1#+. 6. , /\$ 2, /4%" # 24' (" ' / ' ? 3/\$- ' FreeBSD-CURRENT 3 3/\$-. FreeBSD-STABLE : /1/? , 3/ "/, /4' .

...

MFC after: 2 weeks

V, / 2 Ñ - #4' : /2S3# , "/C, "/, /4; ' 4' +/2(&/3, O#24/ - #S#18A ?%O4%" ' 1#3%" # MFC.)%1' %" \$ weeks + #9/\$ 68\$; Ñ day, days, week, weeks, month, months.

Z%2\$# "/#6A#, ' + # - #+6' "' 1#3%\$; ' A.

J%22+#S1' + 2' \$. %&' <, - #=#, % O#4; ?#3%\$/4; #S01%3' 4 PR 2 - #, #+ ' ? O1#/- \$% NetBSD. J%?1%6#S: ' -, O1#2+%S1' 3%(PR, 3' , ' \$, : \$# *\$# "/ \$% : %2\$; , /1/3%, 2 - #S#1#C # " #68: " # 1%6#S\$/S, O#*\$#+. # " #S01%34(/S ' ?+/" /" ' / "% 1/&/" ?' 1#3%" ' / 3 20' 2#- 1%2284- ' arch. >#2- #4; - . ' ?+/" /" ' / 24#9" #/, 1%?1%6#S: ' - 1/G%/\$ #S4#9' \$; MFC "% +/2(&, : \$#68 #6/20/: ' \$; , #2\$S\$# : "#/ \$/2\$' 1#3%" ' /.

E#O#4' '\$/4; "%(' " 5#1+%&' (, - #S#1. < " . 9" # 3- 4<: ' \$; 3 - #++' \$, 6. , /\$ 38=4(, /\$; O1' +/1" # \$%-

G9(: 79 9. G9(: 79 #L71() A) #' # @59) *&* 4#: : (O#,

PR: 54321
Reviewed by: -arch
Obtained from: NetBSD
MFC after: 1 month
Relnotes: yes

10. <, +&9\$4(* (+1: /- 5 1* @+/7* 5 &15 /\$%O> R- E1\$%

>#4" % (O#4' \$' -% 4' &/"?' 1#3%"' (O1#/- \$% FreeBSD , #2\$. O" % O# 2284- / <https://www.FreeBSD.org/internal/software-license>. @2\$%4; " % (: %2\$; *\$#=# 1%?, /4% O1/, "%?" %: /" % , 4(\$#=#, : \$#68 O#+#; : 3%+ " %: %\$; 1%6#\$. I %- O1%3' 4#, /24' 2#+ " /3%/\$/2; Ñ 201%G' 3%CS/. E%\$; 2#3/\$=#1%?, # O1#7/, : /+ ' 201%34(\$; , /1/3# ' 2A#, " #=# - #, %.

>1#/- \$ FreeBSD O1/, 4%=%/\$ ' ' 20#4; ?. /\$ 24/, . < 7' C \$/- 2\$ 3 -%: /2\$3/ O1/, O#: \$' \$/4; " #C 2A/+8 4' &/"?' 1#3%"' (:

```
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 *
 * [id for your version control system, if any]
 */
```

>1#/- \$ FreeBSD "%2\$#(\$/4; " # " / 1/- #+/" , . /\$ ' 20#4; ?#3%\$; \$%- "%?83%/+. < Ç1/- 4%+" . < #=#3#1- . È 3 " #3#+ - #, /. M?-?% 6#4; G#=# : ' 24% . : %2\$"' - #3 O1#/- \$% FreeBSD 2#64< , /"' / *\$#C #=#3#1- ' 2\$%4# ?%\$1. , "' \$/4; " 8+ , 4(+ " #=' A - #++/1: /2- ' A 3/" , #1#3. Q24' 3%G - #, 3 , /1/3/ 2#, /19' \$ 1/- 4%+" . < #=#3#1- . , O#9%4. C2\$%, 1%22+#\$1' \$/ 3#?+#9" #2\$; /D . , %4/"' (. T#4// \$#=#, O#9%4. C2\$%, 1%22+#\$1' \$/ 3#?+#9" #2\$; ' 20#4; ?#3%"' (38G/. - %?" " #C 4' &/"?' ' , 4(3%G/=# - #, %.

>1#/- \$ FreeBSD "/ 01' 3/\$2\$3. /\$ 0#4" #2\$; < "#38/ 4' &/"?' ' ' 3%1' %&' ' 2\$%", %1\$ " 8A
4' &/"?' C. B#38/ 4' &/"?' ' \$1/6. <\$ #, #61/"' (core@FreeBSD.org , 4(1%?+/7/"' (3
1/0#?' \$#1' ' src. Z/+ 6#4; G/ 1%?4' : " 8A 4' &/"?' C ' 20#4; ?./S2(3 , /1/3/, \$/+ 6#4; G/
01#64/+ *\$# 2#?, %D\$, 4(\$/A, -\$# 9/4/\$ ' 20#4; ?#3%; *\$#\$ -#, , #68: "# ' ?-?%
"/01/, 3' , /" " 8A 0#24/, 2\$3' C 04#A# 25#1+. 4' 1#3%" "#C 4' &/"?' ' .

>#4' \$' -% 01#/- % \$1/6. /\$, : \$#68 -#, 0#, "/- # \$#18+' "/-BSD 4' &/"?' (+ ' 1%?+/7%42(
\$#4; -# 3 #01/, /4D" " 8A 1%?, /4%A 1/0#?' \$#1' (, % 3 "/- # \$#18A 24. : %(A -#+0' 4(&' (, #49" %
68\$; . 24#3" #C ' 4' , %9/ # \$- 4<: /" % 0# . + #4: "%' <. B%01' +/1, (, 1# GENERIC , #49" #
-#+0' 4' 1#3%; 2(\$#4; -# 0#, 4' &/"?' (+ ' , , /" \$' : " 8+' ' 4' 2. 7/2\$3/" " # 2A#9' + ' 2
4' &/"?' /C BSD. >1#=1%++ "#/ #6/20:/ /" ' / 0#, 4' &/"?' (+ ' GPL, APSL, CDDL ' \$0. "/
, #49" # -#+0' 4' 1#3%; 2(3 GENERIC.

J%?1%6#\$: ' -%+ 24/, ./S 0#+ "' \$; , : \$# 3 # \$- 18\$##+ ' 2A#, "#+ -#, / 01%3' 4; "#/ 0#" ' +%" ' /
Ç#\$- 18\$#2\$' È \$%- 9/ 3%9" #, -%- ' 01%3' 4; "#/ 0#" ' +%" ' / Ç' 2A#, "#=# -#, %È, 0#2- #4; -.
"/01%3' 4; "#/ #61%7/"' / 2 ' "\$/44/- \$. %4; "#C 2#62\$3/" " #2\$; < ' +// \$ 2/1; D?" 8/
0#24/, 2\$3' (. U<68/ 3#01#28 ' 4' #0%2/"' (24/, ./S "/+/, 4/" " # , #3#, ' \$; , # 23/, /" ' (
#2" #3" #C -#+%" , 8.

11. A(' 1+D* %- / * + 1 * @+ / 7 * E, 9, +&\$' (- %1+ / / O > 9, \$+ # (" FreeBSD

J%?4' : "#/ 01#=1%++ "#/ #6/20:/ /" ' / ' 4' , %" " 8/ 2. 7/2\$3. <\$ 3 1/0#?' \$#1' (A, =, / 01#/- \$
FreeBSD 0#4. : ' 4 20/&' %4; " . < 4' &/"?' < , 4(' A ' 20#4; ?#3%"' (. >1' +/1#+ +#=. \$ 24. 9' \$;
G1' 5\$8 Terminus , 4(' 20#4; ?#3%"' (2 vt(4). P, /2; %3\$#1 E' + ' \$%1 ^ /- #3 1%?1/G' 4 " %+
' 20#4; ?#3%; G1' 5\$ "Terminus BSD Console" 0#, 4' &/"?' /C BSD 2 , 3. +(0. " - \$%+' , % " / 0#,
#68: "#C Open Font License, - # \$#1. < # " #68: "# 01' +/" (/ \$.

@: /3' , "#, 1%?. + "# 3/2\$' . : D\$ 32/A 0#, #6" 8A 1%?1/G/"' C 4' &/"?' C. L *\$#C &/4; <
core@FreeBSD.org 1/G' 4 2#A1%" (\$; ' A %1A' 3. I %9, 8C 1%?, - # =, % 01#/- \$. FreeBSD
01/, #2\$%34(/S2(20/&' %4; "%(4' &/"?' (, + 8 \$1/6. /+ . 3/, #+4(\$; core@FreeBSD.org.
J%?1%6#\$: ' - ' , . : %2\$3. < 7' / 3 #1="'" %&' ' \$%- #=# 1%?1/G/"' (, 0#9%4. C2\$%, 01' 284%CS/
, /\$%4' " % core@FreeBSD.org, 3- 4<: %(:

- ¥ I # " \$%- \$" 8/ , %" " 8/ 4' &' 4' #1="'" ?%&' C, 01/, #2\$%34(< 7' A 20/&' %4; " . < 4' &/"?' < .
- ¥ I %- ' / 5% C48, - % \$%4#=' ' \$, . 3 1/0#?' \$#1' (A #A3%\$83%< \$2(01/, #2\$%34/"' /+ 4' &/"?' ' ,
3- 4<: % ("#+ /1% 1/3' ?' C, 3 - # \$#18/ 684 , #6%34/" 4<6#C +% \$/1' %4 2 #2#68+'
. 24#3' (+ ' 4' &/"?' 1#3%"' (.
- ¥ E % \$% 32\$. 04/"' (4' &/"?' ' ' 3 2' 4. . Q24' " / 2#=#4%2#3%" # ' " #/, *\$# 6. , /\$, % \$% 38, %: '
4' &/"?' ' %3\$#1+' 2##\$3/\$2\$3. < 7' =# 01#=1%++ "#=# #6/20:/ /" ' (.
- ¥ N /- 2\$ 4' &/"?' ' .
- ¥ >1' +/: %" ' / # 4<68A #=#1%"' : /" ' (A, ' 2- 4<: /" ' (A ' 4' #2#68A . 24#3' (A, - # \$#18/
01' +/" (< \$2(-#" - 1/\$" # - ' 20#4; ?#3%"' < 4' &/"?' #" " 8A +% \$/1' %4#3 3 FreeBSD.
- ¥ U < 6% (, 1. =% (2##\$3/\$2\$3. < 7% (" 5#1+%&' (.

I%- \$#4; -# core@FreeBSD.org .6/, ' \$2(, : \$# 2#61%" 8 32/ "/#6A#, '+8/ ,%" "8/ ' #' ' -#11/- \$" 8, 2/- 1/\$%1; #S01%3' \$ 0#, \$3/19, /"' / # 0#4. : /"' ' , 0#, 0' 2%" "#/ PGP, 3-4< : %(, /\$%4' 4' &/"?' ' . FS# 0#, \$3/19, /"' / 6. , /\$ 0#2S#(" # %1A' 3' 1#3%\$; 2(' 24. 9' \$; "%G' + 0#2S#(" " 8+ 23' , /\$ /4; 2S3#+ # 01/, #2S%34/" ' ' 4' &/"?' ' .

! 1A' 3 4' &/"?' C , #49/" 2#, /19%\$; \$#4; -# 23/, /"' (# 01/, #2S%34/" " 8A 4' &/"?' (A; *\$# "/ +/2\$#, 4(#62. 9, /"' C 3#01#2#3 4' &/"?' 1#3%" ' (' 4' , 1. =' A \$/+. E#2\$. 0 - ,%" " 8+ 3 %1A' 3/ 4' &/"?' C 6. , /\$ 01/, #2S%34(\$; 2(0# ?%01#2. 3 core@FreeBSD.org.

12. ; +=* SPDX % &+, +%+

>1#/- \$' 20#4; ?. /\$ \$/=' **SPDX** 3 "%G/C ' 2A#, "#C 6%?/. B%, %" " 8C +##+/" \$ *\$' \$/=' 38, /4/" 8 #S2\$. 0%+', : \$#68 %3\$#+%\$' ?' 1#3%" " 8/ 21/, 2S3% +=4' 01#=1%++"# ' ?34/- %\$; 4' &/"?' "# " 8/ .24#3' (.)2/ \$/=' **SPDX-License-Identifier** 3 , /1/3/ 24/, ./ \$ 2: ' %\$; ' " 5#1+%\$' 3" 8+' .)2/ 5%C48 3 , /1/3/ ' 2A#, " 8A -#, #3 FreeBSD 2 *\$' + ' \$/=#+ ' %%- 9/ 2#, /19%\$ -#0' < 4' &/"?' ' , 1/= 4' 1. < 7/C ' 20#4; ?#3%" ' / ,%" "#=# 5%C4%. Q24' 3#?' ' -%/\$ 01#\$' 3#1/: ' /, 1. -#3#, 2S3#3%\$; 2(24/, ./ \$, #24#3" 8+ \$/- 2\$#+ 4' &/"?' ' . >1#/- \$ 2S%1%/S2(24/, #3%\$; **LO/&' 5' -%&' ' SPDX, 3/12' (2.2. M' 2\$1. -&' <, -% 0#+/: %\$; ' 2A#, " 8/ 5%C48, ' , #0. 2\$' +8/ %4/=61%' : /2- ' / 381%9/" ' (+#9" # "%CS' 3 >1' 4#9/" ' ' D' >1' 4#9/" ' ' E. >1#/- \$ 6/1/\$ ' , /" \$' 5' -%\$#18 ' ? 20' 2- % , #0. 2\$' +8A -1%\$- ' A 4' &/"?' "# " 8A ' , /" \$' 5' -%\$#1#3 **SPDX**. >1#/- \$' 20#4; ?. /\$ \$#4; -# \$/= **SPDX-License-Identifier**.**

># 2#2S#(" ' < "% +%1\$ 2021 =#, % 01' +/1" # 25 000 ' ? 90 000 5%C4#3 3 , /1/3/ 684' 0#+/: /" 8.

13. A(/\$L + / * 5 ' , - 7, - 8\$ (4 * #-) *

>1' 1%6#\$/ "/ 0#21/, 2S3/" "# 2 3%G' + 2#62\$3/" " 8+ -#, #+ ' 4' 2 -#, #+, -# \$#18C . 9/ A#1#G# ?%1/- #+/" , #3%4 2/6(-% 3%G% ?#" % #3/\$2S3/" "#2\$' , 3/1#(\$"#, "/ \$ #2#6#C "/#6A#, '+#2\$' 2#=#4%2#383%\$; , /C2\$3' (2 , 1. =' + ' -#++' \$\$/1%+ ' 0/1/, 3" /2/" ' /+ ' ?+/" /" ' C. FS# 9/ # \$" #2' \$2(' - ' 201%34/" ' < #G' 6#- 3 (3" # ?%61#G/" " 8A : %2\$(A 2' 2\$/+8 (- 2#9%4/" ' <, %\$- ' / #64%2\$' 2. 7/2\$3. <\$). >1' ' ?+/" /" ' ' : %2\$/C 2' 2\$/+8, -# \$#18/ 0#, , /19' 3%< \$2((5#1+%4; " # ' 4' " /5#1+%4; " #), 1%22+#\$1' \$/ 3#?+#9" #2\$; ?%01#2% 1/&/"?' 1#3%" ' (, -% *\$# , /4%4 68 1%?1%6#\$: ' - , # 0#4. : /" ' (01%3 -#++' \$\$/1%. E4(0#1\$#3 23(9' \$/2; 2 2#01#3#9, %< 7' +, . -%?" " 8+ 3 0/1+//" "#C **MAINTAINER** 3 5%C4/ Makefile.

Z\$#68 #01/, /4' \$; , 0#, , /19' 3%/S2(4' #01/, /4D" "%(: %2\$; , /1/3%, 01#3/1; \$/ 5%C4 **MAINTAINERS** 3 -#1" / , /1/3%. Q24' \$%+ "' -#=# " / . -%?" #, 01#2+#\$1' \$/ ' 2\$#1' < ' ?+/" /" ' C, : \$#68 . 3' , /\$; , - \$# 3" #2' 4' ?+/" /" ' (3 01#G4#+. Z\$#68 383/2\$' 20' 2#- ' +D" ' %, 1/2#3 *4/- \$1#" "#C 0#: \$8 32/A %3\$#1#3 -#++' \$#3 , 4(?%, %" "#=# 5%C4% ?% 0#24/, " ' / 2 =#, %, % \$%- 9/ -#4' : /2\$3# -#++' \$#3 -%9, #=# %3\$#1%, #2#1\$' 1#3%" " 8A 0# .683%" ' < -#4' : /2\$3% -#++' \$#3, ' 20#4; ?. CS/:

```
% git -C /path/to/repo shortlog -sne --since="2 years" -- relative/path/to/file
```

Q24' ?%01#28 #2\$%< \$2(6/? #3/\$% ' 4' -#++' \$\$/1' " 8+ #61%?#+ , /+#" 2\$1' 1. /\$ #2. 2\$3' / ' " \$/1/2% - ?%\$1#" . #C #64%2\$' , +#9" # 2+/4# 380#4" (\$; -#++' \$.

#

M?6/=CS/ #S01%3-' 4' : " 8A 0' 2/+ 2#01#3#9, %< 7' +. E1. =' A 4<, /C + #9/S
?' ' \$/1/2#3%\$; " / \$#4; - #' \$#=#38C 1/? . 4; \$%\$, " # ' #62. 9, /" ' /.

Q24' /2\$; -%- ' /-4' 6# 2#+ " /" ' (#S" #2' \$/4; " # -#++' \$% 0# 4<6#C 01' : ' " /, "/#6A#, ' + #
01#3/2\$' /=# 1/&/" ?' 1#3%" ' / 0/1/, 380#4' /" ' /+. U. : G/ 0#4. : ' \$; - 1' \$' -. 21%?. , : /+
-#=#, % # " 2\$%" /\$: %2\$; < 1/0#?' \$#1' (. Q24' -#++' \$ 38?83%/ \$ 20#18, 3#?+#9" #, 2\$# ' \$
1%22+#\$1/\$; 3#?+#9" #2\$; #S-%\$% ' ?+/" /" ' C , # 1%?1/G/" ' (3#01#2%. >#+ " ' \$/, : \$# 2
2' 2\$/+ #C - # " \$1#4(3/12' C + 8 32/=, % + #9/+ 3/1" . \$; 32D #61%\$ " #.

B/ #20%1' 3%CS/ " %+/1/" ' (, 1. =' A. Q24' # " ' 3' , (\$ ' " #/ 1/G/" ' / 01#64/+ 8 ' 4' , %9/' " . <
01#64/+. , 2- #1// 32/= #, *\$# " / 0#\$#+. , : \$# # " ' =4. 08, ' + / < \$ 2#+ " ' \$/4; " #/ 01# ' 2A#9, /" ' /
' 4' 08\$%< \$2(1%?1. G' \$; : . 9#C \$1. , , 4' : " 8C ' + ' , 9 ' 4' FreeBSD, % 01#2\$# 0#\$#+. , : \$# .
' ' A ' " #C 3?-4(, " % + ' 1. J?" #/ Ñ *\$# A#1#G#.

Z/2\$ " # 381%9%CS/ " /2#=#4%2' /. @6#2" #383%CS/ 23#< 0#?' &' < 0# /D , #2\$# ' " 2\$3%+, 6. , ; \$/
: /2\$ " 8 #S" #2' \$/4; " # 3#?+#9" 8A " /, #2\$%\$- #3 ' 6. , ; \$/ # \$- 18\$8 , 4(0#" ' + " ' (' A
1/G/" ' (' 4' , %9/' A 3' , /" ' (01#64/+ 8.

>1' + ' \$/ ' 201%34/" ' / .) 2/ + 8 " / 6/?=1/G" 8. I #=#, % 38 2#3/1G' 4' #G' 6- . , ' ?3' " ' \$/2; '
01#, #49%CS/ 9' \$; , %4; G/. B/ - #1' \$/ 2/6(' . 9 \$/+ 6#4// " / 3' " ' \$/ , 1. =' A ?% 23#<
#G' 6- . . B/ \$1%\$; \$/ 31/+(" % 2+. 7/" ' / ' 4' 3?'% + " 8/ #63' " /" ' (Ñ 01#2\$# ' 201%3; \$/
01#64/+. ' , 3' =%CS/2; , %4; G/.

>#01#2' \$/ # 0#+#7' . M7' \$/ (' 01/, #2\$%34(CS/) 1/&/" ?' ' -#44/= . @, " # ' ? 01/' +. 7/2\$3
#\$- 18\$#=# 01#=#1#+ " #=# #6/20/: /" ' (?%- 4< : %/\$2(3 6#4; G#+ - #4' : /2\$3/ 01#3/1(< 7' A;
" # *\$# " / 1%6#\$%/ \$, /24' " ' - \$# " / 01#3/1(\$ - #, .

14. S' 1* ' \$) /+%- +(+' : É

Q24' 38 3 : /+-\$# " / . 3/1/" 8, 6. , ; \$# \$/A" ' : /2- ' C 3#01#2 ' 4' 2#=#4G/" ' / 0# 01#/- \$.,
#6(?%\$/4; " # 201#2' \$/. Q24' 38 01#+#4: ' \$/, 38 " ' - #=#, % " / 01#, 3' " /\$2; 30/1D, .

Q24' 3#01#2 23(?% " 2 \$/A" ' : /2- #C 01#64/+ #C, ?%, %CS/ /=# 3 0. 64' : " 8A 20' 2- %A 1%2284- ' .
K, /19' \$/2; # \$ 2#64?" % " %O' 2%\$; 4' : " # \$#+. , - \$# ?" %/\$ #S3/\$. N%- - %9, 8C 2+#9/\$ ' ?34/: ;
0#4; ? . ' ? 3#01#2% ' #S3/\$%.

E4(%, + ' " ' 2\$1%\$' 3" 8A 3#01#2#3 ' 3#01#2#3, 23(?% " 8A 2 - # - 1/\$" 8+ 01#/- \$#+,
#61%7%CS/2; 3 24/, . < 7/+ 0#1(, - /:

¥) %G " %2\$%3" ' - ' 4' 683G' C " %2\$%3" ' - .

¥ @08\$ " 8C - #++' \$\$/1 Ñ 0# IRC, *4/- \$1# " #C 0#: \$/ ' \$., .

¥ U < 6%(- #+% " , % 2 1#4; < ("hat"), \$%- - %- 3 " /C 3%+ + #=#. \$, %\$; # - # " : %\$/4; " 8C #S3/\$.

¥ Q24' 32D /7D " / . 3/1/" 8, 201#2' \$/ " % LO' 2#- 1%2284- ' 1%?1%6#\$: ' - #3 FreeBSD.

I #=#, % 3%G 3#01#2 6. , /\$ 1/GD", /24' " ' - \$# " / . - %?%4 3%+ " % , # - . + /" \$%&' <, 2#, /19%7. <
#S3/\$ " % 3%G 3#01#2, ?%, # - . + /" \$' 1. CS/ /=#, \$%- - %- . , 1. =' A 3#?" ' - " /\$ \$#\$ 9/ 3#01#2.

15. Bugzilla

>1#/- \$ FreeBSD ' 20#4; ?. /\$ Bugzilla , 4(#24/9' 3% ' (#G' 6#- ' ?%01#2#3 "% ' ?+/' /"' (. Q24' 38 ' 201%3' 4' 01#64/+ . ' 4' 1/%4' ?#3%4' 01/, 4#9/' / ' ? 6%?8 ,%" " 8A PR, #6(?%\$/4; " # ?%- 1#C\$/ PR. N%- 9/ 6. , /\$ 3/94' 3#, /24' 38 "%C, D\$/ 31/+(?%- 18\$; , 1.= ' / PR, 23(?% " 8/ 2 3%G' + ' -#++' \$%+ ' .

I #++' \$\$/18 2 . : D\$" 8+ ' ?%0' 2(+ ' Bugzilla " / "% FreeBSD.org +=. \$ #6W/, ' "' \$; 2\$%1. < . : D\$" . < ?%0' 2; 2 . : D\$" #C ?%0' 2; < FreeBSD.org, 380#4" ' 3 24/, . < 7' / G%=' :

1.) #C, ' \$/, ' 20#4; ?. (2\$%1. < . : D\$" . < ?%0' 2; .
2. @\$- 18\$; " #3. < #G' 6- . .) 861%\$; Services 3 -%: /2\$3/ 01#, . - \$% ' Bug Tracker 3 -%: /2\$3/ -#+0#"/" \$%.) #0' 2%" ' ' #G' 6- ' 0/1/: ' 24' \$/ %--. " \$8, - # \$18/ " . 9" # #6W/, ' "' \$; .
3.) #C, ' \$/, ' 20#4; ?. (. : D\$" . < ?%0' 2; FreeBSD.org, ' #2\$%3; \$/ -#++/" \$%1' C - \$#4; -# : \$# 2#?, %" " #C #G' 6- /, : \$#68 0#, \$3/1, ' \$; 34%, /"' /. E#0#4" ' \$/4; " 8/ 23/, /"' (# \$#+, -%- 2="/ /1' 1#3%\$; ' 4' . 2\$%" #3' \$; 0%1#4; , 4(3%G/C . : D\$" #C ?%0' 2' FreeBSD.org, 2+. 3 Kerberos ' LDAP 3/6-0%1#4; , 4(- 4%2\$/1% FreeBSD.
4. Q24' " /#6A#, ' + # #6W/, ' "' \$; 6#4// , 3. A . : D\$" 8A ?%0' 2/C, #2\$%3; \$/ -#++/" \$%1' ' # \$ - %9, #C ' ? "' A.

) 8 + #9/\$/ . ?" %\$; 6#4; G/ # Bugzilla " %:

¥ J/- #+/" , %&' ' 0# 1%6#\$/ 2 2##67/" ' ' (+ ' # 01#64/+ %A FreeBSD

¥ <https://www.FreeBSD.org/support>

16. Phabricator

>1#/- \$ FreeBSD ' 20#4; ?. /\$ Phabricator , 4(?%01#2#3 "% 1/&/" ?' 1#3%" ' / -#, %. >#, 1#6" #2\$' + #9" # "%C\$' " % 2\$1%" ' &/ Phabricator 3 3' - ' .

>#9%4. C2\$%, ' 20#4; ?. C\$/ -#+% " , . git arc, 01/, #2\$%34(/+. < devel/freebsd-git-arc (. 2\$%" #3' \$/ 0#1\$ ' 4' 0%- /\$, ?%\$/+ 33/, ' \$/ git help arc , 4(0#4. : /"' (, #-. +/" \$%&' ') , , 4(2#?, %" ' (' #6" #34/" ' (1/&/" ?' C 3 Phabricator. F\$# . 01#2\$' \$, 1.= ' + 01#&/22 1/&/" ?' 1#3%" ' (' \$/2\$' 1#3%" ' (3%G' A 0%\$: /C.

I #++' \$\$/18 2 . : D\$" 8+ ' ?%0' 2(+ ' Phabricator " / "% FreeBSD.org +=. \$ 0/1/' +/" #3%\$; 2\$%1. < . : D\$" . < ?%0' 2; 3 FreeBSD.org, 380#4" ' 3 24/, . < 7' / G%=' :

1. M?+/" ' \$/ % , 1/2 *4/- \$1#" " #C 0#: \$8 3%G/C . : D\$" #C ?%0' 2' Phabricator "% 3%G FreeBSD.org email.
2. @\$- 18\$; " #3. < #G' 6- . 3 "%G/+ \$1/- /1/ #G' 6#- , ' 20#4; ?. (3%G. . : D\$" . < ?%0' 2; FreeBSD.org, 2+. Bugzilla , 4(0#4. : /"' (, #0#4" ' \$/4; " #C ' " 5#1+%&' ' .) 86/1' \$/ Services 3 -%: /2\$3/ 01#, . - \$% ' Code Review 3 -%: /2\$3/ -#+0#"/" \$%.) #0' 2%" ' ' ' .

```
#G' 6- ' ?%01#2' $/ O/1/' +/" #3%" ' / 3%G/C . : D$" #C ?%0' 2' Phabricator ' . -%9' $/
2284- . "% 3%G/# O#4; ?#3%$/4( Phabricator. B%01' +/1, https://reviews.freebsd.org/p/
bob_examp1e.com/
```

#

```
K: D$" 8/ ?%0' 2' Phabricator " / +#=. $ 68$; #6W/, ' " /" 8, O#9%4. C2$, " /
2#?, %3%CS/ " #3. < . : D$" . < ?%0' 2; .
```

17. 2(\$ +' (: #(\$

```
>#+ ' + # A1%" ' $/4/C 1/O#?' $#1' /3, /2$; ' , 1. = ' / . : %2$" ' - ' O1#/- $% FreeBSD ' - #+%" , 8, 2
-#$#18+' 3%+, 2-#1// 32/=#, O1/, 2$#' $ O#?' %- #+' $; 2( 3 1#4' - #++' $$/1%. I 1%$- # ' , %4/- #
"/ ' 2: /1083%< 7/, 3#$ #"' :
```

!"#\$% & (') * + , - ' " , % - . # / ' (0%122 <doceng@FreeBSD.org>

```
doceng Ñ *$# =1.00%, #3/$2$3/" "%( ?% ' " 51%2$1. - $. 1. 26#1- ' , #- . +/" $%&' ' ,
. $3/19, /" ' / " #38A - #++' $$/1#3 , #- . +/" $%&' ' ' #6/20/: /" ' / %- $. %4; " #2$' 3/6-2%CS%
FreeBSD ' , #- . +/" $%&' ' " % FTP-2%CS/ 3 2##3/$2$3' ' 2 , /1/3#+ Subversion. @" % " /
(34(/$2( #1=%" #+ O# 1%?1/G/" ' < - # " 54" - $#3. >#, %34(< 7// 6#4; G' " 2$3# #62. 9, /" ' C,
23(?% " 8A 2 , #- . +/" $%&' /C, O1# ' 2A#, ' $ 3 1%2284- / LO' 2#- 1%2284- ' >1#/- $%
E#- . +/" $%&' ' FreeBSD. >#, 1#6" // # - #+%" , / doceng + #9" # . ?" % $; 3 /D . 2$3/.
I #++' $$/18, ?% " $/1/2#3%" " 8/ 3 1%6#$/ "% , #- . +/" $%&' /C, , #49" 8 #? "%- #+' $; 2( 2
1. - #3#, 2$3#+ >1#/- $ , #- . +/" $%&' ' FreeBSD: 33/, /" ' / , 4( " #38A . : %2$" ' - #3.
```

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```
) # $ : 4/" 8 - #+%" , 8 J+: 88* K; 8: 71* L' <, >A FreeBSD <ree@FreeBSD.org>. F$% - #+%" , % #3/: %/$
?% . 2$%" #3- . 21#- #3 380. 2- % ' - # " $1#4; O1#&/22% 380. 2- % . ) # 31/+ ( ?%+ #1#?-' - #, %
' " 9/" /18 380. 2- % #64%, %< $ #- #": %$/4; " 8+ O1%3#+ O1' " ($ ( 1/G/" ' C O# 32/+
' ?+/" /" ' ( + 3 2' 2$/+ / , 4( 3/$- ' , #9' , %< 7/C 2$%$. 2% 380. 2- % . Q24' . 3%2 /2$; : $#-$#,
: $# 38 A#$' $/ 34' $; (merge) ' ? FreeBSD-CURRENT 3 FreeBSD-STABLE (- %-' + ' 68 " " 684'
' A ?" %: /" ' ( 3 4< 6#C + #+/" $ 31/+/" ' ), ' +/" " # 2 *$' + ' 4<, ; + ' " . 9" # #62. , ' $; *$#$
3#O1#2.
```

Gordon Tetlow <gordon@FreeBSD.org>

```
Gordon Tetlow Ñ *$# #3/$2$3/" " 8C ?% 6/?#0%2" #2$; FreeBSD, -#$#18C - . 1' 1. /$ 1%6#$
.$%&*(=* 4M, N' +* O' >%8*7(7%), <securi ty-offi cer@FreeBSD.org>.
```

69* ' \$#, - ' ' O1#* # \$)) * ((+, \$% FreeBSD

```
{dev-src-all}, {dev-ports-all} ' {dev-doc-all} Ñ *$# 20' 2- ' 1%2284- ' , -#$#18/ 2' 2$/+ %
. O1%34/" ' ( 3/12' (+ ' ' 20#4; ?./ $ , 4( # $O1%3- ' 2##67/" ' C # - #++' $%A. M(4# ' 1* " /
# $O1%34(C$/ O' 2; + % " %O1(+ . < 3 *$' 20' 2- ' . @ $O1%34(C$/ #3/$8 3 *$#$ 20' 2#- $#4; - # 3
$#+ 24. : %/, /24' # " ' - #1#$- ' / ' " /O#21/, 2$3/" " # 23(?% " 8 2 - #++' $#+.
```

69* '\$#, -'' O1#* , -7, -8\$(4* #\$\$ FreeBSD

) 2/ -#++' \$\$/18 O#, O' 2%" 8 "% 20' 2#- 1%2284- ' -developers. F\$#\$ 20' 2#- 684 2#?, %" , 4(#62. 9, /'' (3#01#2#3, 23(?" " 8A 2 2#67/2\$3#+ -#++' \$\$/1#3. >1' +/18 3- 4<: %< \$ =#4#2#3%" ' (Core, #6W(34/" ' (' \$, .

D8, 7%1 +*77;<1, +* >+*5%)9, 1%A FreeBSD O1/, "%?"%: /" ' 2- 4<: ' \$/4; "# , 4(' 20#4; ?#3%" ' (-#++' \$\$/1%+' FreeBSD. E4(1%?1%6#\$- ' FreeBSD -#++' \$\$/18 , #49" 8 ' +/\$; 3#?+#9" #2\$; # \$- 18\$# #62. 9, %\$; 3#01#28, -#\$#18/ 6. . \$ 1/G/" 8 , # ' A 0. 64' : "#=# #6W(34/" ' (. @\$- 1#3/" " 8/ #62. 9, /'' (1%6#\$\$ 3 O1#&/22/ " / O#, A#, (\$, 4(# \$- 18\$#C 0. 64' -%&' ' ' +#=. \$ "%31/, ' \$; FreeBSD.

) 2/ -#++' \$\$/18 FreeBSD #6(?" 8 " / O. 64' -#3\$; ' " / O/1/284\$; 2##67/" ' (' ? LO' 2#- 1%2284- ' 1%?1%6#\$: ' -#3 FreeBSD ?% O1/, /48 20' 2- % 1%2284- ' 6/? 1%?1/G/" ' (32/A %3\$#1#3. B%1. G' \$/4' 6. . \$. , %4/" 8 ' ? LO' 2#- 1%2284- ' 1%?1%6#\$: ' -#3 FreeBSD, : \$# O1' 3/, D\$ - O1' #2\$%" #3- / O1' 3' 4/= ' C "% -#++' \$. >#3\$#1" 8/ ' 4' 3#0' < 7' / "%1. G/" ' (+#=. \$ O1' 3/2\$' - O#2\$#(" #+. 4' G/" ' < O1' 3' 4/= ' C "% -#++' \$.

F\$#\$ 20' 2#-) 7 O1/, "%?"%: /" , 4(#6?#1% -#, % ' 4' -%- ' A-4' 6# \$/A" ' : /2- ' A #62. 9, /'' C. B% 2%+## , /4/, ' 20#4; ?#3%" ' / /=# 3 \$%- #+ -%: /2\$3/ 31/, ' \$ O1#/- \$. FreeBSD, \$%- -% 2#?, %D\$ 30/: %\$4/" ' / ?%- 18\$#=# 20' 2- %, =, / #67' / 1/G/" ' (, ?%\$1%=' 3%< 7' / 32/A O#4; ?#3\$%/4/C FreeBSD, O1' "' +%< \$2(6/? "#\$- 18\$#2\$' ". M O#24/, " //, " # " / +/" // 3%9" #/:) (4# ' 1*,) ("9(4*4(/ #%\$O#2O7&E\$O, */ ,) 7 #O" 9*, &2. O7 " (\$E: #) * !" (\$#4 9*\$-\$ &4(9* = 9*%#O3(4#, FreeBSD \$ 4#" (7. (CC:/BCC:)) * 195' #. \$" (\$#4 FreeBSD. B' - #=#, % " / #SO1%34(C\$/ O' 2; +# "% , 1. =#C 20' 2#- 1%2284- ' FreeBSD 2 -#O' /C (CC:/BCC:) "% LO' 2#- 1%2284- ' 1%?1%6#\$: ' -#3 FreeBSD. F\$# +#9/\$?%"%: ' \$/4; "# 2" ' ?' \$; O#4; ?. # \$, %" "#=# 20' 2- %.

18. ! " # \$ % \$ & ' (% \$ 9 \$ 8 O ' (, \$) " / - 4 - 1 " , - 8 \$ (O ' SSH

- Q24' 38 " / A#\$' \$/ -%9, 8C 1%? 33#, ' \$; O#1#4; O1' ' 20#4; ?#3%" ' ' **ssh(1)** ' ' 20#4; ? . /\$ / - 4<: ' , 4(% . \$/" \$' 5' -%&' ' , **ssh-agent(1)** 2#?, %" , 4(3%G/=# . , #62\$3%. Q24' 38 A#\$' \$/ ' 20#4; ?#3%\$; **ssh-agent(1)**, . 6/, ' \$/2; , : \$# ?%O. 2-%/\$/ /=# O/1/, ?%O. 2- #+ , 1. = ' A O1' 4#9/" ' C. B%O1' +/1, O#4; ?#3\$%/4' X #68: "# , /4%< \$ *\$# 3 .xsession ' 4' .xinitrc. >#, 1#6" #2\$' 2+. 3 **ssh-agent(1)**.
- L="/ /1' 1. C\$/ O%1. - 4<: /C 2 O#++#7; < **ssh-keygen(1)**. >%1% - 4<: /C #- %9/\$2(3 3%G/+ -%\$%4#=#/ \$HOME/.ssh/.

>#, , /19' 3%< \$2(\$#4; -# - 4<: ' ECDSA, Ed25519 ' 4' RSA.

- @\$O1%3; \$/ 3%G # \$- 18\$8C - 4<: (\$HOME/.ssh/id_ecdsa.pub, \$HOME/.ssh/id_ed25519.pub ' 4' \$HOME/.ssh/id_rsa.pub) : /4#3/- . , -#\$#18C "%2\$1% 3%/\$ 3%2 -%- -#++' \$\$/1%, : \$#68 /=# +#9" # 684# , #6%3' \$; 3 yourlogin 3 /etc/ssh-keys/ "% **freefall** .

N/O/1; **ssh-add(1)** +#9" # ' 20#4; ?#3%\$; , 4(% . \$/" \$' 5' -%&' ' #, ' " 1%? ?% 2/%" 2. @"

?%01%G' 3%/\$ 0%1#4; ". < 51%?. , 4(?%-18\$#=# -4<:% ' ?%\$/+ 2#A1%" (/ \$ /D 3 %="/ \$/ %.\$/" \$' 5' -%&' ' (ssh-agent(1)). M20#4; ?. C\$/ ssh-add -d , 4(. , %4/" ' (-4<: /C, 2#A1%" D" " 8A 3 %="/ \$/.

>1#3/1-% 2 0#+#7; < 01#2\$#C . , %4D" " #C -#+%", 8: ssh freefall.FreeBSD.org Is /usr.

E4(0#4. : /" ' (, #0#4" ' \$/4; " #C " " 5#1+%&' ' 2+. security/openssh-portable, ssh(1), ssh-add(1), ssh-agent(1), ssh-keygen(1) ' scp(1).

E4(' " 5#1+%&' ' # , #6%34/" ' ' , ' ?+/" /" ' ' ' 4' . , %4/" ' ' -4<: /C ssh(1), 2+. *\$. 2\$%; <.

19. O\$' ("9/\$' (: Coverity` &15 # \$)) * ((+, \$% FreeBSD

) 2/ 1%?1%6#\$: ' - ' FreeBSD +#=. \$ 0#4. : ' \$; , #2\$. 0 - 1/? . 4; \$%\$%+ "%%4' ?% Coverity , 4(32/= # 01#=1%+ + " #=# #6/20/: /" ' (01#/- \$% FreeBSD.) 2/, - \$# ?%' "\$/1/2#3%" 3 , #2\$. 0/ - 1/? . 4; \$%\$%+ %3\$#+%\$' : /2- #=# "%%4' ?% Coverity, + #=. \$?%1/= ' 2\$1' 1#3%; 2("% Coverity Scan.

) 3' - ' FreeBSD /2\$; + ' " ' -1. -#3#, 2\$3# , 4(1%?1%6#\$: ' - #3, -#\$#18/ ?%' "\$/1/2#3%" 8 3 1%6#\$/ 2 # \$: D\$%+ ' "%%4' ?% Coverity` : <https://wiki.freebsd.org/CoverityPrevent>. @61%\$' \$/ 3" ' +% " ' / , : \$# *\$# + ' " ' -1. -#3#, 2\$3# , #2\$. 0" # \$#4; -# 1%?1%6#\$: ' - %+ FreeBSD, 0#*\$#+. /24' 38 " / + #9/\$/ # \$- 18\$; *\$. 2\$1%" ' &. , 3%+ ". 9" # 6. , /\$ 0#01#2' \$; , #6%3' \$; 3%2 3 2##\$3/\$2\$3. < 7' C 20' 2#- , #2\$. 0% - 3' - ' .

B%- #"/&, 32/ 1%?1%6#\$: ' - ' FreeBSD, -#\$#18/ 2#6' 1%< \$2(' 20#4; ?#3%; Coverity` , 32/=, % + #=. \$?%01#2' \$; , #0#4" ' \$/4; " 8/ , /\$4' ' ' " 5#1+%&' < #6 ' 20#4; ?#3%" ' ' , ?%, %3 4< 68/ 3#01#28 3 20' 2- / 1%2284- ' 1%?1%6#\$: ' - #3 FreeBSD.

20. G\$1: L \$E ' 9* ' \$# 9, - %* 1 # \$)) * ((+, \$% FreeBSD

) 2/ . : %2\$" ' - ' 01#/- \$% FreeBSD , #49" 8 2#64< , %\$; D#174\$ " #, 717) (2, , #2\$. 0" 8C 0# 2284- / <https://www.FreeBSD.org/internal/code-of-conduct>. I %- - #++' \$\$/18, 38 01/, 2\$%34(/ \$/ 0. 64' : " #/ 4' &# 01#/- \$%, ' 3%G/ 0#3/, /" ' / #-%?83%/ \$ 2. 7/2\$3/" " #/ 34' (" ' / "% /=# #67/2\$3/" " #/ 3#201' (\$' /. F\$# 1. - #3#, 2\$3# 1%2G' 1(/ \$ 1%?, /48 D#174\$* " #, 717) (2, # \$" #2(7' /2(- - #++' \$\$/1%+.

1. K3%9%CS/ , 1. = ' A - #++' \$\$/1#3.
2. K3%9%CS/ , 1. = ' A . : %2\$" ' - #3.
3. @62. , ' \$/ 4< 68/ ?" %: ' \$/4; " 8/ ' ?+/" /" ' ("7971 - #++' \$#+.
4. K3%9%CS/ 2. 7/2\$3. < 7' A 2#01#3#9, %< 7' A (/24' # " ' . - %?" 8 3 0#4/ MAINTAINER 3 5% C4/ Makefile ' 4' 3 5% C4/ MAINTAINER 3 - #1" /3#+ - %\$%4#=#).
5. U< 6#/ #20%1' 3%/+ #/ ' ?+/" /" ' / , #49" # 68\$; # \$+/" /" # , # 1%?1/G/" ' (20#1%, /24' *\$#=# 0#\$1/6. /\$ 2#01#3#9, %< 7' C. M?+/" /" ' (, 23(?% " 8/ 2 6/?#0%2" #2\$; < , + #=. \$ 0/1/- 18\$;

0#9/4%"' (2#01#3#9, %< 7/=# 0# . 2+#\$1/"' < @\$3/\$2\$3/"' #=# ?% 6/?#0%2" #2\$; .

6. M?+/"' /"' (0#0%, %< \$ 3 FreeBSD-CURRENT , # FreeBSD-STABLE, /24' \$#4; -# *\$# (3" # "/ 1%?1/G/"' # " 9/" /1#+ 380.2-% ' 4' /24' #' ' "/ 01' +/"' +8 - FreeBSD-CURRENT. U< 6#/" /\$1' 3' %4; " #/ ' 4' " / 21#: " #/ ' ?+/"' /' / , -#\$#1#/ 01' +/"' +#, \$%- 9/ , #49" # #2\$%3\$; 2(3 FreeBSD-CURRENT -%- +'"' +. + 3 , " (0/1/, 24' ("' /+, : \$#68 /=# +#9" # 684# , #2\$%\$#: " # 01#\$/2\$' 1#3\$; . M" 9/" /1 380.2-% ' +/\$ \$/ 9/ 0#4" #+#: ' (3 #"\$ #G/"' ' ' 3/\$- ' FreeBSD-STABLE, : \$# ' 2#01#3#9, %< 7' C, 2#=#4%2" # 01%3' 4. _ 5.

7. B/ . 2\$1%' 3%CS/ O. 64' : " 8/ 1%?6#1-' 2 , 1. = ' + ' 1%?1%6#\$: ' -%+' ; *\$# 38=4(, ' \$ O4#A#.

8. L#64< , %CS/ 32/ O/1' #, 8 ?%+#1#?-' -#, % ' 23#/31+//"' # : ' \$%CS/ 1%2284-' committers ' developers , : \$#68 ?" %\$; , -#=#, % , /C2\$3. /\$?%+#1#?- -#, %.

9. Q24' 2#+ " /3%/\$/2; 3 -%- #+-4' 6# , /C2\$3' ' Ñ 2" %: %4% 201#2' \$/!

10. >1#3/1; \$/ 23# ' ?+/"' /"' (0/1/, ' A 01' +/"' /"' /+.

11. B/ 3" #2' \$/ ' ?+/"' /"' (3 01/, #2\$%34/"' "#/ 01#=#1%+" #/ #6/20:/ "' / 6/? 2,) # #' #, #61/"' (2##\$3/\$2\$3. < 7' A 2#01#3#9, %< 7' A.

I %- . 9/ #\$/+/: %4#2; , "%1. G/"' / " /-#\$#18A ' ?*\$' A 01%3' 4 +#9/\$ 2\$%\$; #2" #3%"' /+ , 4(31+//"' "#=# 4' G/"' (01%3 "% -#++' \$8 ' 4' , 01' 0#3\$#1" 8A "%1. G/"' (A , 4(' A 0#2\$#(" "#=# #S?83%. @\$, /4; " 8/ : 4/" 8 @2" #3" #C I #+% , 8 (Core Team) ' +/<\$ 01%3# 31+//"' "# 01' #2\$%" #3' \$; 01%3% "% -#++' \$8 , # \$/A 0#1, 0#-% #2" #3%"(-#+" , % 3 0#4" #+ 2#2\$%3/ " / 1%22+#\$1' \$ 3#01#2.) 24. : %/ Ç: 1/?38: %C" #C 2' \$. %&' ' È ("01' +/1, /24' -#++' \$\$/1 "% #2' \$. 7/16 1/0#?' \$#1' <), 31+//"' "#/ 4' G/"' / 01%3 +#9/\$ \$%- 9/ 68\$; #2. 7/2\$34/" # A1%"' \$/4(+ 1/0#?' \$#1' (. N#4; -# @2" #3%"(I #+% , % 2/3 6#4; G' " 2\$3% =#4#2#3 ' +/\$ 01%3# 01' #2\$%" #3' \$; 01%3% "% -#++' \$8 21#-# 6#4// : /+ "% " / , /4< ' 4' #S#?3\$; ' A 0#4" #2\$; <. F\$# 01%3' 4# 2. 7/2\$3. /\$ " / , 4(\$#=#, : \$#68 2, /4\$; #2" #3" . < -#+" , . 26#1' 7/+ 9/2\$#-' A , ' -\$#\$#1#3, -#\$#18/ +#=#. \$ ' ?6%34(\$; 2(# \$ -#++' \$\$/1#3 \$%- 9/ 4/=-# , -%- # \$ 0. 2\$8A 6%" #- ' ?-0# , =?' 1#3-' , % : \$#68 , %\$; 01#/-\$. 23#/=# 1#, % 01/, #A1%"' \$/4; " 8C -4%0%". Q24' -#\$-# 38A#, ' \$ ' ?-0# , -#" \$1#4(, 3%9" # ' +/\$; 3#?+#9" #2\$; " /+/, 4/"' "# 01' " (\$; +/18, % " / 68\$; 0%1%4' ?#3%" " 8+' , ' 2-. 22' /C.) # 32/A 24. : %(A -#++' \$\$/1, : ; ' 01%3% 01' #2\$%" #34/" 8 ' 4' #S#?3%" 8, ' +/\$ 01%3# "% Ç24. G%"' /È 3 #2" #3" #C -#+" , / , =, / #01/, /4(/\$2(#67%(01#, #49' \$/4; " #2\$; 01' #2\$%" #3-' . I #++' \$\$/1, : ; ' 01%3% 01' #2\$%" #34/" 8, \$%- 9/ +#9/\$?%01#2' \$; 0/1/2+#\$1 1/G/"' (: /1/? 30 , "/C ' -%9, 8/ 30 , "/C 0#24/ *\$#=# (/24' #67' C 21#- 01' #2\$%" #3-' " / +/"' // 30 , "/C). I #++' \$\$/1, : ; ' 01%3% 684' 0#4" #2\$; < #S#?3%" 8, +#9/\$?%01#2' \$; 0/1/2+#\$1 0# ' 2\$/: /"' ' 6 +/2(&/3. F\$# 0#4' \$' -% 0/1/2+#\$1% \$O9#'#) 78#9: *\$E) * , ' 3# 32/A 24. : %(A #2" #3%"(-#+" , % #2\$%34(/\$?% 2#6#C 01%3# -%- . , #34/\$3#1' \$; , \$%- ' 01#=' #1' 1#3\$; ?%01#2 " % 0/1/2+#\$1, /24' 2: ' \$%/ \$ 0/13#" %: %4; " #/ 1/G/"' / 01%3' 4; " 8+.

) # 32/A #2\$%4; " 8A %20/- \$%A 1%6#\$8 01#/- \$% #2" #3%"(-#+" , % (34(/\$2(0#, + " #9/2\$3#+ -#++' \$\$/1#3 ' 23(?%" % O7: (@7 "9*, (&*: (. N#\$ 5%- \$, : \$# -#\$-# 3A#, ' \$ 3 #2" #3" . < -#+" , . , " / #?" %: %/\$, : \$# ' + 0#?3#4/" # 38A#, ' \$; ?% 1#+-' #6#?" %: /" " 8A ? , /2; =1%"' '& Ç#2#68/ 0#4" #+#: ' (È #2" #3" #C -#+" , 8 %- \$' 3' 1. <\$2(\$#4; -# 01' , /C2\$3' (A 3 -%: /2\$3/ =1. 008, % " / ' " , ' 3' , . %4; " #. I %- # \$, /4; " 8/ 4' &% , : 4/" 8 #2" #3" #C -#+" , 8 Ñ *\$# 01/9, / 32/=# -#++' \$\$/18, ' \$#4; -# 3# 3\$#1. < #: /1/ , ; Ñ #2" #3%"(-#+" , %.

20.1. < \$&, \$8/\$' (*

1. K3%9%CS/, 1. = ' A - #++' \$\$/1#3.

FS# #?"%: %/\$, : \$# 38 , #49" 8 #S" #2' \$; 2(- , 1. = ' + - #++' \$\$/1#+ -% - - #44/=+ - 1%?1%6#\$: ' -%+, -% - #38+ ' #'' ' (34(< \$2(. B/2+#\$1(" "%G' O/1' #, ' : /2- ' / O#08S- ' , #-%?%\$; #61%\$" #/, - #++' \$\$/1#+ " / 2S%" #3(\$2(O# =4. O#2S' , ' "' : \$# " / 1%?, 1%9%/S 6#4; G/, : /+ -#=#, % - #44/= ' #S" #2(\$2(- 3%+ ' +/" "# \$%- . B/?%3' 2' +# #S \$#=#, ' 208S83%/+ 4' +8 32/=, % . 3%9/" ' / , 1. = - , 1. = . ' 4' " /\$ (. 32/A 683%< \$ O4#A' / , "'), +8 , #49" 8 #O) #\$(OES2 - , 1. = ' + - #++' \$\$/1#+ 2 . 3%9/" ' /+ 32/=, % Ñ -% - "% O. 64' : " 8A 5#1. +%A, \$%- ' 3 4' : " #C O/1/O' 2- /.

LO#2#6" #2\$; , #4=#21#: " #=# 2#S1. , "' : /2S3% Ñ *\$# 2%+#/ &/" "#/ , #2S#(" / O1#/- \$%, =#1%?, # 6#4// 3%9" #/, : /+ 4<68/ ' ?+/" "' (3 - #, /, ' O1/31%7/" ' / 20#1#3 # - #, / 3 O1#64/+8, 34' (< 7' / "% "%G. 20#2#6" #2\$; =%1+#"' : " # 1%6#\$\$; 3+/2\$/, "' O1' -% - ' A #62S#(\$/4; 2S3%A " / 2S# ' \$ \$#=#.

E4(2#64<, /" ' (*\$#=# O1%3' 4% " / #S01%34(CS/ *4/- \$1#" " 8/ O' 2; +% , -#=#, % 38 ?4' \$/2; ' 4' 3/, D\$/ 2/6(\$%- ' + #61%?#+, -#\$#18C +#9/\$ O#-%?%\$; 2(, 1. = ' + ' ?4' G" / -#" 51#" \$%&' # " " 8+. L" %: %4% . 20#- #CS/2; , ?%\$/+ O#, . +%CS/, -% - "%' 6#4// *55/- '\$' 3" # , #"/2S' 23#< \$#: - . ?1/" ' (, : \$#68 . 6/, ' \$; , 1. = ' A 3 23#/C O1%3#\$/, % " / O1#2S# 380. 2S' \$; O#1 , 4(- 1%\$- #31/+/" "#=# #64/=:/"' (?% 2: D\$, #4=#21#: " #=# -#" 54' - \$%. M" %: / *\$# #6/1" D\$2(" / \$#4; -# - 1%C" / " /1%&' #"%4; " #C \$1%\$#C 2' 4, " # ' \$/+, : \$# O#3\$#1(< 7' /2(O1#(34/" ' (O. 64' : " #C %=1/22' ' , +/G%< 7' / "%G/C 2#3+/2S" #C 1%6#\$/ , 6. , . \$ 2\$1#=# O1/2/- %\$; 2(1. - #3#, 2S3#+ O1#/- \$% ' +#=#. \$ O1' 3/2S' - O1' #2S%" #3- / ' 4' 4' G/" ' < 3%G' A O1%3 "% - #++' \$. J. - #3#, 2S3# O1#/- \$% 6. , /\$. : ' \$83%; -% - O. 64' : " 8/, \$%- ' O1' 3%\$" 8/ 2##67/" ' (, O1/, 2S%34/" " 8/ "% /=# 1%22+#1/" ' / . @#" # " / 6. , /\$ \$1/6#3%\$; 1%2- 18S' (O1' 3%\$" #C O/1/O' 2- ' , " # O1' +/\$ /D 3# 3"' +%" ' / , /24' . : %2S" ' - , 3#34/: D" " 8/ 3 9%4#6. , O1/, #2S%3(\$ /D , #61#3#4; " #.

) 2D *\$# "' - #=#, % " / (34(/\$2(3%1' %" \$#+, -#\$#18C 1. - #3#, 2S3# O1#/- \$% A#\$; 2- #4; - #- "' 6. , ; 1%, . /\$, " # /, ' " 2S3# 3%9" // . B' -% - #/ - #4' : /2S3# - #, % ' 4' O#4/?" 8A 2#3/\$#3 " / 2S# ' \$ \$#=#, : \$#68 *\$' + O#9/1\$3#3%\$; .

2. K3%9%CS/, 1. = ' A . : %2S"' - #3.

) 8 " / 32/=, % 684' - #++' \$\$/1#+. I #=#, %-\$# 38 684' - #" \$1' 6; < \$#1#+. >#+" ' \$/ #6 *\$#+ 32/=, % .) 20#+ "' \$/, -% - #3# *\$# Ñ O8S%\$; 2(O#4. : ' \$; O#++#7; ' 3"' +%" ' / . B/ ?%683%CS/, : \$# 3%G% 1%6#\$\$ 3 -%: /2S3/ -#" \$1' 6; < \$#1% 684% , 4(3%2 #: /" ; 3%9" % .) 20#+ "' \$/, -% - #3# *\$#. B/ #S=#3%1' 3%CS/, " / O1' "' 9%CS/ ' " / . "' 9%CS/ -#" \$1' 6; < \$#1#3. @\$" #2' \$/2; - "' + 2 . 3%9/" ' /+ . @"' Ñ "%G' 6. , . 7' / - #++' \$\$/18. @"' \$%- 9/ 3%9" 8 , 4(O1#/- \$%, -% - ' - #++' \$\$/18. MA 3- 4%, \$%- 9/ 3%9/" ' ?" %: ' +, -% - ' 3%G.) -#" &/ -#" , 38 2%+ ' 2, /4%4' + " #9/2S3# 3- 4%, #3, O1/9, / : /+ 2S%4' - #++' \$\$/1#+.) 2/=, % O#+ "' \$/ #6 *\$#+.

K: ' \$83%CS/ +##/" \$8, O#, " (\$8/ 3 1%?, /4/ K3%9%CS/, 1. = ' A - #++' \$\$/1#3, ' O1' +/" (CS/ ' A \$%- 9/ - -#" \$1' 6; < \$#1%+.

3. @62. , ' \$/ 4<68/?" %: ' \$/4; " 8/ ' ?+/" "' ("7971 - #++' \$#+.

J/O#?' \$1' C Ñ *\$# " / +/2\$#, =, / ' ?+/" / " ' (O/13#" %: %4; " # #S01%34(<\$2("% O1#3/1-.
-#11/- "\$ #2\$' ' 4' #62. 9, %<\$2(, 2" %: %4% *\$# O1# 2A#, ' \$ 3 O#: \$38A 1%2284-%A ' 4' 2
O#+#7;< 2/13' 2% Phabricator. I#+++' \$ O1# ?#C, /\$ \$4; -# O#24/ \$#=#, -%- 6., /\$
, #2\$' =" . \$# "/-#/ O#, #6' / -#" 2/" 2. 2%. FS# " / #?" %: %/\$, : \$# \$1/6. /\$2(1%?1/G/" ' / , 4(
' 201%34/" ' (-%9, #C #: /3' , "#C 2' "\$%-2' : /2-#C #G' 6-' ' 4' #O: %\$-' "% 2\$1%" ' &/
1. -#3#, 2\$3%, O1#2\$# O#4/?" # 1%?3' \$; : . \$; D, -#=#, % O1/, 4%=%/+##/ ' ?+/" / " ' / " / 2\$#4;
#: /3' , " # ' \$1/6. /\$ O1/, 3%1' \$/4; "#=# #62. 9, /" ' (U<, ' , /C2\$3' \$/4; " # " / O1#\$' 3
+%2G\$%6" 8A ' ?+/" / " ' C, /24' 1/? . 4; %\$ (3" # 4. : G/ \$#=#, : \$# 684# 1%" ; G/, ' + O1#2\$#
" / " 1%3' \$2(, -#=#, % *\$' ' ?+/" / " ' (2\$%" #3(\$2() 7#@ (1*)) #SOEJ. L#+8C 4. : G' C 20#2#6
. 6/, ' \$; 2(, : \$# 32D ' , D\$ O# O1#3' 4; "#+. O. \$' , Ñ *\$# O1#3/2\$' 1/&/" ?' 1#3%" ' / -#, %
#, "' + ' 4' " /2-#4; -' +', 1. = ' + ' -#+++' \$\$/1%+ ' .

Q24' 2#+ " /3%/\$/2; , ?%O1#2' \$/ 1/&/" ?' <!

4. K3%9%CS/ 2. 7/2\$3. < 7' A 2#O1#3#9, %< 7' A, /24' #"' . -%?" 8.

O" #=' / : %2\$' FreeBSD " / "(34(<\$2(:; /C-\$# 2#62\$3/" "#2\$; <" 3 \$#+ 2+824/, : \$#
-#" -1/\$" 8C : /4#3/- 32-#: ' \$ ' "%: " D\$ -1' : %\$; , /24' 38 3" /2D\$/ ' ?+/" / " ' (3 "/=#
#64%2\$; , " # 32D 9/ 4. : G/ 2" %: %4% O1#3/1' \$; . @, " # ' ? ' 20#4; ? . /+8A 2#=#4G/" ' C Ñ
, #6%34/" ' / 2\$1#-' maintainer 3 Makefile , 4(4<6#=# O%-/\$% ' 4' O#, , /1/3%, ?% -#\$#18/
%- \$' 3" # #S3/: %/\$ #, ' " ' 4' " /2-#4; -# 4<, /C; 2+. J/-#+"/, %&' ' ' O#4' \$' -' , /1/3%
' 2A#, " #=# -#, % , 4(, #- . +/" \$%&' ' O# *\$#+. O#3#, .. Q24' . . : %2\$- #3 - #, % /2\$; " /2-#4; -#
2#O1#3#9, %< 7' A, ' ?+/" / " ' (3 ?%\$1#" . \$8A #64%2\$(A, 3" /2D" " 8/ #, "' +
2#O1#3#9, %< 7' +, , #49" 8 68\$; O1#3/1/" 8 A#\$ (68 #, "' + , 1. = ' + 2#O1#3#9, %< 7' +.)
24. : %(A, -#=#, % "2#O1#3#9, /" ' / " : /=#-4' 6# " / (2" #, O#2+#\$1' \$/ 4#=' 1/O#?' \$#1' (, 4(
2##\$3/\$2\$3. < 7' A 5%C4#3 ' O1#3/1; \$/, 1%6#\$%4 4' -#\$-\$# " /, %3" # ' 4' O1/' +. 7/2\$3/" "#
3 *\$#C #64%2\$' .

5. U<6#/ #20%1' 3%/+##/ ' ?+/" / " ' / , #49" # 68\$; #\$/+/" / " # , # 1%?1/G/" ' (20#1%, /24' *\$#=#
O#\$1/6. /\$ 2#O1#3#9, %< 7' C. M?+/" / " ' (, 23(?% " 8/ 2 6/?#O%2" #2\$; <, +#=. \$ O/1/- 18\$;
O#9/4%" ' (2#O1#3#9, %< 7/=# O# . 2+#\$1/" ' < @\$3/\$2\$3/" "#=# ?% 6/?#O%2" #2\$; .

FS# +#9/\$ 68\$; \$1. , " # O1' " (\$; 3# 31/+ (-#" 54' -#\$3 (-#=#, % -%9, %(2\$#1#" % . 6/9, /" %,
: \$# #%" O1%3%, -#" /: " #), " # 2' 2\$/+%- #"\$1#4(3/12' C , /4%/ \$ " / " . 9" 8+ O1#, #49/" ' /
20#1#3, -#=#, % =#1%?, # O1#7/ O1#2\$# #\$/+/" ' \$; 20#1" #/ ' ?+/" / " ' / , . 20#-# ' \$; 32/A '
?%\$/+ O#O8\$%; 2(38(2" ' \$; , -%- 4. : G/ O#2\$. O' \$; . Q24' #-%9/\$2(, : \$# ' ?+/" / " ' / 32D-
\$%- ' 684# O1#3' 4; " 8+, /=# +#9" # 4/=-# 3/1" . \$; . Q24' 9/ " /\$, \$# O#4; ?#3%\$4(+ " /
O1' , D\$2(+ ' 1' \$; 2(2 #G' 6#: " 8+ ' ?+/" / " ' / + 3 , /1/3/, O#- % 32/ %- \$' 3" # #62. 9, %< \$ /=#
, #2\$# ' " 2\$3%. U<, ' #37) E 1/, -# \$1/6. <\$ #\$/+/" 8 ' ?+/" / " ' C 3 1/O#?' \$#1' ' , O#2-#4; - .
#62. 9, /" ' / #68: " # 38(34(/\$ O4#A' / ' 4' 20#1" 8/ ' ?+/" / " ' (/7D , # -#+++' \$%, " # 3
\$%- ' A 1/, -' A 24. : %(A #\$/+%" , #49"% O1# ?3#, ' \$; 2(6/? 20#1#3, : \$#68 +#9" # 684#
21%?. O/1/CS' - 38(2" / " ' <, 684# 4' ' ?+/" / " ' / #G' 6#: " 8+ ' 4' " /\$.

6. M?+/" / " ' (3" #2(\$2(3 FreeBSD-CURRENT , # FreeBSD-STABLE, /24' *\$# " / 1%?1/G/" #
20/&' %4; " # ' " 9/" /1#+ 380. 2-% ' 4' /24' #"' " / O1' +/" ' +8 - FreeBSD-CURRENT.
U<6#/ " /\$1' 3' %4; " #/ ' 4' " /21#: " #/ ' ?+/" / " ' / , -#\$#1#/ O1' +/" ' +#, \$%- 9/ , #49" #
#2\$%3%\$; 2(3 FreeBSD-CURRENT -%- + ' " ' +. + 3 , " (O/1/, 24' (" ' /+, : \$#68 /=# +#9" #
684# , #2\$%\$#: " # O1#\$/2\$' 1#3%\$; . M" 9/" /1 380. 2-% ' +/\$ \$/ 9/ O#4" #++#: ' (3
#\$" #G/" ' ' 3/\$- ' FreeBSD-STABLE, -%- . -%?" # 3 O1#3' 4/ _ 5.

F\$# /7D #, ' " 3#01#2, # -#\$#1#+ " / 2\$# \$ 20#1' \$; , 0#2- #4; -. ' " 9/" /1 380. 2- % " /2D\$ #- #: %\$/4; ". < #S3/\$2S3/" " #2\$; (' 0#4. : %/\$ 0# G%0- /), /24' ' ?+/" /" / #-%9/\$2("/. , %: " 8+. >#9#4. C2\$%, .3%9%CS/ *\$# ' #-?%83%CS/ ' " 9/" /1. 380. 2- % 0#4" #/ 2#S1. , " ' : /2S3#, - #, % , /4# - %2%/\$2(3/\$- ' FreeBSD-STABLE. K01%34/" ' / FreeBSD-STABLE + #9/\$: %2\$# - %?%\$; 2(' ?4' G" / - # " 2/13\$' 3" 8+ , 4(24. : %C" #=# "%64< , %\$/4(, # \$%- 9/ 2\$# \$ 0#+ " ' \$; , : \$# - # " 2/13\$' ?+ Ñ *\$# #4' : ' \$/4; "% (: /1\$% FreeBSD-STABLE, ' \$%+ , /C2\$3. < \$, 1. = ' / 01%3' 4%, : /+ 3 FreeBSD-CURRENT. N%- 9/ " /\$ 2+824% 3 \$#+ , : \$#68 FreeBSD-CURRENT 684 ' 208\$%\$/4; " 8+ 0#4' =# " #+, /24' ' ?+/" /" ' (" /+/, 4/" # 0/1/" #2(\$2(3 FreeBSD-STABLE. M?+/" /" ' (, #49" 8 68\$; 01#\$/2\$' 1#3%" 8 1%?1%6#\$: ' - %+' FreeBSD-CURRENT, 0#*\$#+. , %CS/ " /- # \$#1#/ 31/(0/1/, 24' (" ' /+, /24' \$#4; - # ' 201%34/" ' / 3 FreeBSD-STABLE " / (34(/\$2(- 1' \$' : /2- ' +, 21#: " 8+ ' 4' "%2\$#4; - # #: /3' , " 8+, : \$# , #4; "/CG// \$/2\$' 1#3%" ' / " / \$1/6. /\$2((' 201%34/" ' (#0/: %\$#- 3 1. - #3#, 2\$3%A, #: /3' , " 8/ ' 201%34/" ' (#G' 6#- /#0/: %\$#- ' \$.,). E1. = ' + ' 24#3%+ ' , 1. - #3#, 2\$3. C\$/2; ?, 1%38+ 2+824#+.

M?+/" /" ' (3 3/\$- %A 6/?#0%2" #2\$' (" %01' +/1, releng/9.3) , #49" 8 68\$; #, #61/" 8 : 4/" #+ =1. 008 Ñ \$%&* (= * 4M, N' + * 0' >%8*7(%7), <security-officer@FreeBSD.org> ' 4' , 3 " /- # \$#18A 24. : % (A, : 4/" #+ =1. 008 Ñ J+: 88* K; 8: 71* L' <, >%A FreeBSD <re@FreeBSD.org>.

7. B/ . 2\$1%' 3%CS/ 0. 64' : " 8/ 1%?6#1- ' 2, 1. = ' + ' 1%?1%6#\$: ' - %+' ; *\$# 38=4(, ' \$ 04#A#.

F\$#\$ 01#/- \$ 0#, , /19' 3%/\$ 0. 64' : " 8C ' + ' , 9, - # \$#18C #: /"; 3%9/" , 4(32/A "%2, #2#6/" " # /24' + 8 A#\$' + 01#, #49\$; 01' 34/- %\$; " #38A . : %2\$' ' - #3. T83%< \$ 24. : %' , - #, %, " /2+ # \$1("% 32/ . 2' 4' (2#A1%" (\$; 2%+ ##64%, %" ' /, 4<, ' \$/1(< \$ \$/10/" ' / ' #6+/" ' 3%< \$2(1/?- ' + ' 24#3%+ ' . U. : G//, : \$# + #9" # 2, /4%\$; 3 \$%- ' A 2' \$. %&' (A, Ñ + ' " ' + ' ?' 1#3%\$; 0#24/, 2\$3' (, 0#- % 32/ " / #2\$8" . \$ B/ 38" #2' \$/ = " /3" 8/ 24#3% "% 0. 64' - . ' " / 0/1/284%CS/ 4' : ". < 0/1/0' 2- . ' 4' , 1. = ' / : %2\$" 8/ 2##67/" ' (3 0. 64' : " 8/ 20' 2- ' 1%2284- ' , 0#: \$#38/ %4' %28, - %" %48 + = " #3/" " 8A 2##67/" ' ' C ' 4' 2#&' #4; " 8/ 2/\$' . N#, : \$# 4<, ' = #3#1(\$ #, ' " " % #, ' " , : %2\$# +/" // 01' . - 1%G/" #: /+ ' A 0. 64' : " 8/ 382- %?83%" ' (, ' \$%- ' / 2##67/" ' (" / ' + /< \$ + /2\$% 3 0. 64' : " #+ 01#2\$1%" 2\$3/ Ñ # " ' \$#4; - # . 2. =. 64(< \$ ' 6/? \$#=# 24#9" . < 2' \$. %&' <. Q24' : /4#3/- , #S01%34(< 7' C = " /3" #/ 2##67/" ' /, A#\$ (68 01#(3' 4 \$%- \$ ' #S01%3' 4 /=# 4' : " #, 01#(3' \$/ \$%- \$ ' 38 Ñ #2\$%3; \$/ *\$# 3 \$%C" / . Q24' 38 : . 32\$3. /\$/, : \$# , 1. = #C 1%?1%6#\$: ' - #S" #2' \$2(- 3%+ " /201%3/, 4' 3#, ' *\$# 01' : ' " (/ \$3+ 2\$1%, %" ' (, #61%\$' \$/2; - @2" #3" #C - #+ %", / (Core team), % " / 38" #2' \$/ *\$# " % 0. 64' - .. @2" #3" % (- #+ %", % 0#2\$%1%/\$2(382\$. 0' \$; 3 1#4' + ' 1#\$3#1&/3 ' 3/1" . \$; 2' \$. %&' < 3 1%?. + " #/ 1. 24#. Q24' 20#1 - %2%/\$2(' ?+/" /" ' C 3 - #, #3#C 6%?/ ' . : %2\$" ' - ' " / + #. \$ 01' CS' - 2# = 4%2' <, #2" #3" % (- #+ %", % + #9/\$ "%?" %: ' \$; \$1/\$; < 2\$#1#" . , . 2\$1%' 3%< 7. < 32/A, , 4(1%?1/G/" ' (20#1% .) 2/ 3#34/: D" " 8/ 2\$#1#" 8 , #49" 8 2# = 4%2' \$; 2(2 1/G/" ' /+, 01' " (\$8+ *\$#C \$1/\$; /C 2\$#1#" #C.

8. L#64<, %CS/ 32/ 0/1' #, 8 ?%+ #1#?-' - #, % ' 23#/31/+/" " #: ' \$%CS/ 1%2284- ' committers ' developers, : \$#68 ?" %\$; , - #, %, /C2\$3. /\$?%+ #1#?-' - #, %.

) "/2/" / " /0#, \$3/19, D" " 8A ' ?+/" /" ' C 3# 31/(?%+ #1#?-' - #, % Ñ *\$# 2/1; D?" % (#G' 6- %, ' # \$ - #+ + ' \$\$/1#3 #9' , %/\$2(, : \$# # " ' 6. , . \$ 3 - . 12/ 01# ' 2A#, (7/= #, 01/9, / : /+, 3/1" . 3G' 2; 0#24/ , #4=#=# #2. \$2\$3' (, ?%- #+ + ' \$' \$; 10 + / = %6%CS " %- #04/" " 8A ' ?+/" /" ' C. N/, - \$# ?4#. 0#\$1/64(/\$ *\$# + " % 1/= . 4(1" #C #2" #3/, 6. , . \$ 4' G/" 8 01%3 "% - #+ + ' \$8 , # 3#?31%7/" ' (' ? U% = /1(3/2D4#=# 0/1/3#20' \$%" ' (FreeBSD, - # \$#18C + 8

01#3#, ' + 3 V1/" 4%", ' ' .

9. Q24' 2#+"/3%/S/2; 3 -%- #+-4' 6# , /C2S3' ' Ñ 2"%: %4% 201#2' \$/!

O" #=' / #G' 6- ' 2#3/1G%< \$2(' ?-?% \$#=#, : \$# - \$#-\$# \$#1#0' \$2(' 01#2\$# 01/, O#4%=%/\$, : \$# ?"%/\$ 01%3' 4; " 8C 20#2#6 : \$#-\$# 2, /4%\$; . Q24' 38 " / , /4%4' *\$#=# 1%"; G/, 3/4' -% 3/1#(\$ " #2\$; , : \$# 38 " % 2%+## , /4/ " / ?"%/\$/, -%- . "%2 01' " (\$# , /4%\$; , ' 3%+ , /C2\$3' \$/4; " # " . 9" # 2"%: %4% 201#2' \$; , ' "%: / 38 1' 2- . /\$ / O#4" #2\$; < #0#?#1' \$; 2("% 0.64' -/. B/\$ " : /=# 0#2\$8, "#=# 3 3#01#2/ Ç- %-, : /1\$ 3#?; +', *\$# 2, /4%\$; ?È O8 . 9/ ?"%/+, : \$# 38 . + " 8C : /4#3/-; ' "%: / 38 " / 684' 68 - #++' \$\$/1#+.

10. >1#3/1; \$/ 23# ' ' ?+/" /" ' (0/1/, ' A 01' +/" /" ' /+.

Q24' 3%G' ' ?+/" /" ' (-%2%< \$2((, 1%, .6/, ' \$/2; , : \$# 38 0#-01/9" /+. + #9/\$/ -# +O' 4' 1#3%\$; -% - GENERIC, \$%- ' LINT. Q24' 3%G' ' ?+/" /" ' (-%2%< \$2(, 1. = ' A : %2\$/C 2' 2\$/+8, .6/, ' \$/2; , : \$# 38 0#-01/9" /+. + #9/\$/ -# +O' 4' 1#3%\$; O#4; ?#3%\$/4; 2- #/ 01#2\$1% 2\$3# 2 0##7; < make buildworld. Q24' 3%G' ' ?+/" /" ' (#"\$ #2(\$2(- 3/\$-/, .6/, ' \$/2; , : \$# \$/2\$' 1#3%" / / 01#3#, ' \$2("% + %G' "/, -#\$#1%(1%6#\$/ \$ 2 *\$' + -#, #+. Q24' 3%G/ ' ?+/" /" ' / + #9/\$ " %1. G' \$; 1%6#\$. , 1. = #C %1A' \$/- \$. 18, #6(?%\$/4; " # 01#\$/2\$' 1. C\$/ /=# "% 32/A 0#, , /19' 3%/+8A %1A' \$/- \$. 1%A. >#9%4. C2\$%, .6/, ' \$/2; , : \$# 3%G/ ' ?+/" /" ' / 1%6#\$/ \$, 4(0#, , /19' 3%/+8A " ' 2\$1. +/" \$#3 26#1-'. >#9%4. C2\$%, #61%\$' \$/2; -) . \$1/" /C 2\$1%" '&/ FreeBSD , 4(O#4. : /" ' (20' 2- % , #2\$. O" 8A 1/2. 12#3. ># +/1/ , #6%34/" ' (, 1. = ' A %1A' \$/- \$. 1 3 20' 2#- 0#, , /19' 3%/+8A 04%\$5#1+ FreeBSD 6. . \$ 01/, #2\$%34/" 8 2##3/\$2\$3. < 7' / #67' / 1/2. 128 , 4(\$/2\$' 1#3%" ' (.

11. B/ 3" #2' \$/ ' ?+/" /" ' (3 01/, #2\$%34/" " #/ 01#=1%++" #/ #6/20/: /" ' / 6/? 2,) #' # #, #61/" ' (2##3/\$2\$3. < 7' A 2#01#3#9, %< 7' A.

>1/, #2\$%34/" " #/ 01#=1%++" #/ #6/20/: /" ' / Ñ *\$# 32D, : \$# "%A#, ' \$2(3 , /1/3; (A -%\$%4#=#3 src/contrib, src/crypto ' 4' src/sys/contrib.

K0## (" . \$8/ 38G/ , /1/3; (01/, "%?"%: /" 8 , 4(01/, #2\$%34/" " #=# 01#=1%++" #=# #6/20/: /" ' (, #68: " # ' +O#1\$' 1. /+## 3 3/\$- . 3/" , #1%. R' -2%&' (' ?+/" /" ' C \$%+ + #9/\$ 38?3%\$; " /" . 9" 8/ 01#64/+8 01' ' +O#1\$/ 6#4// " #38A 3/12' C 01#=1%++" #=# #6/20/: /" ' (.) #67/+ 24. : %/ 1/- #+/" , . /\$2(#S01%34(\$; ' 201%34/" ' ("%01(+ . < 3/" , #1.. M201%34/" ' (+#=. \$ 68\$; 2"%: %4% ?%5' -2' 1#3%" 8 3 FreeBSD 2 1%?1/G/" ' (2#01#3#9, %< 7/=#.

>1' : ' " 8 ' ?+/" /" ' (2\$#1#" "/=# 01#=1%++" #=# #6/20/: /" ' (3%1; ' 1. <\$2(#S 9/4%" ' (2\$1#=# -# \$1#4' 1#3%\$; \$/2" # 23(?%" " . < ?%3' 2' + #2\$; , # #2. \$2\$3' (0/1/" #2' + #2\$' 3 -%" # " : /2- #+ 1/O#?' \$#1' ' 2 ' A -#, #+. B/?%3' 2' + # #S 01' : ' " 8, .2' 4' (O# + ' " ' + ' ?%&' ' "%=1. ?- ' "% 0#, , /19- . 5#1-% 0#4/?" 8 , 4(, 1. = ' A 2#01#3#9, %< 7' A. M?6/=C\$/ 3" /2/" ' (\$1' 3' %4; " 8A ' 4' -#2+/\$' : /2- ' A ' ?+/" /" ' C 3 5%48, \$%- -%- *\$# . 24#9" (/ \$ -%9, #/ 0#24/, . < 7// 24' (" /: \$%- ' / 0%\$: ' " /#6A#, ' + # 31. : " . < 0/1/01#3/1(\$; 01' -%9, #+ ' +O#1\$/.

Q24' -#" -1/\$" #/ 01#=1%++" #/ #6/20/: /" ' / " / ' +// \$ 2#01#3#9, %< 7/=#, 3%+ 01/, 4%=%/\$2(3?(\$; "% 2/6(#S3/\$2\$3/" " #2\$; ?% " /=#. Q24' 38 " / .3/1/" 8 3 \$/- . 7/+ 2#01#3#9, /" ' ' , "%0' G' \$/ "% LO' 2#- 1%2284-', O#23(7D)" 8C %1A' \$/- \$. 1/ ' 3". \$1/" /+ . 2\$1#C2\$3. FreeBSD ' . \$#: " ' \$/.

20.2. <\$1* (* #- 9\$&&+, D#* /+' # \$1: #* > -, >* (+#(" ,

) 0#08\$- / .01#2\$' \$; 0# , /19- . 0/1/" #2' + #2\$' FreeBSD "% 04%\$5#1+8, -# \$#18/ +8 0# , /19' 3%/+, (, 1# 2' 2\$/+8 1%?1%6#\$%4# 24/ , . < 7 // 01/, 0' 2%" ' /:

@2" #3" 8/ 01#/- \$" 8/ 1%6#\$8 (3-4<: %(?" %: ' \$/4; " 8/ ' ?+/" /"' (API ' ABI) , #49" 8 0# , \$3/1, ' \$; 23#< 1%6#\$20#2#6" #2\$; -% - + ' "' +. + "% #, " #C 04%\$5#1+ / K1#3" (1 0/1/, \$/+, -% - #"' + #=. \$ 68\$; 3-4<: /" 8 3 , /1/3# ' 2A#, " #=# - #, %.

J%?1%6#\$: ' - ' \$%- 9/ , #49" 8 .: ' \$83\$; "%G. 0#4' \$' - . . 1#3" /C 0# , /19- ' %00%1%" 8A %1A' \$/- \$. 1 3 , #4=#21#: " #C 0/120/- \$' 3/. FS' 01%3' 4% 01/, "%?%" %: /" 8 , 4(01/, #2\$%34/" ' (1/- #+/" , %&' C 3 01#&/22/ 1%?1%6#\$- ' ' # \$4' : %< \$2(# \$ \$1/6#3%" ' C - 5. "- &' (+ ' %1A' \$/- \$. 1%+, . - %?%" " 8+ 3 *\$#+ 1%?, /4/. >1%3' 4% . 1#3" /C 0# , /19- ' 5. "- &' C , 4(%1A' \$/- \$. 1 " % + #+/" \$ 380. 2- % 6#4// 2\$1#=# / , : /+ 01%3' 4% , 4(' ?+/" /"' C 3 01#&/22/ 1%?1%6#\$- ' .

20.3. <\$1* (* #- 9\$ * ' 9\$1: 7\$%- /* 3 /+' # \$1: #* > # \$) 9* 15(\$, \$%

T%?#3%(2' 2\$/+% FreeBSD 2#6' 1%/ \$2(-% - 2 Clang, \$%- ' 2 GCC. >1#/- \$, /4%/\$ *\$# \$7%\$/4; " # ' - # " \$1#4' 1. /+ # , : \$#68 +%- 2' + ' ?' 1#3\$; 01/' +. 7/2\$3% # \$ *\$#C , #0#4"' \$/4; " #C 1%6#\$8, 23#, (*\$. 1%6#\$. - + ' "' +. +.. ># , , /19- % #6# ' A - #+0' 4(\$#1#3 0#38G%/\$ = ' 6- #2\$; , 4("%G' A 0#4; ?#3%\$/4/C. K *\$' A - #+0' 4(\$#1#3 1%?" 8/ 2' 4; " 8/ ' 24%68/ 2\$#1# " 8, ' ' A 2#3+/2\$%" (0# , /19- % 0#?3#4(/\$ 0#4; ?#3%\$/4(+ 386' 1%\$; "%' 6#4// 0# , A#, (7' C , 4(' A ?%, %: . Clang ' GCC 0# , /19' 3%<\$ 2A#9' / , ' %4/- \$8 C ' C++, : \$# \$1/6. /\$ # \$" #2' \$/4; " # "/6#4; G#=# - #4' : /2\$3% . 24#3" #=# - #, % . >1#/- \$ 0#4. : %/\$. 4. : G/" " #/ 0#- 18\$' / - #, % ' 0#38G%/\$ /=# -%: /2\$3#, ' 20#4; ? . (3#?+#9" #2\$' #6# ' A - #+0' 4(\$#1#3. ># , , /19- % *\$#=# , ' %0%?#" % 0#?3#4(/\$ 01#/- \$. 2#6' 1%\$; 2(3 6#4; G/+ - #4' : /2\$3/ 0#4; ?#3%\$/4; 2- ' A # - 1. 9/" ' C ' ?%, /C2\$3#3%\$; 6#4; G/ CI-# 1. 9/" ' C, . 3/4' : ' 3%(. , #62\$3# , 4(0#4; ?#3%\$/4/C ' 01/, #2\$%34((' + 6#4; G/ ' " 2\$1. +/" \$#3 , 4(\$/2\$' 1#3%" ' (. N7%\$/4; " # # = 1%" ' : ' 3%(, ' %0%?#" 0# , /19' 3%/+8A 3/12' C 2#31/+/" " 8+ ' 3/12' (+ ' *\$' A - #+0' 4(\$#1#3, 01#/- \$ ' ?6/=/%\$: 1/?+/1" #=# . 3/4' : /" ' (+% \$1' &8 \$/2\$' 1#3%" ' (. K2\$%1/3G' / ' + #4# ' ?3/2\$" 8/ - #+0' 4(\$#18, % \$%- 9/ 2\$%18/ , ' %4/- \$8 (?8- #3, ' + /<\$ - 1% C" / # = 1%" ' : /" " . < 0# , , /19- . , 0#?3#4(< 7. < 2#6' 1%\$; 0#4; ?#3%\$/4; 2- ' / 01# = 1%++8, " # 6/? # = 1%" ' : /" ' C "% 26#1- . 6%?#3#C 2' 2\$/+8 2 ' A 0#+#7; < . N#: " 8C 6%4%" 2 01#, #49%/\$ 1%?3' 3%\$; 2(, : \$#68 =%1%" \$' 1#3\$; , : \$# 01/' +. 7/2\$3% , #0#4"' \$/4; " #C 1%6#\$8 #2\$%<\$2(38G/ "%- 4%, 83%/+8A /< ?%\$1%\$. J%" ; G/ 01#/- \$ 0# , /19' 3%4 # : /" ; 2\$%18/ - #+0' 4(\$#18 Intel ' 4' 2\$%18/ 3/12' ' GCC, " # + 8 ?%+/" ' 4' 0# , /19- . *\$' A . 2\$%1/3G' A - #+0' 4(\$#1#3 "% \$7%\$/4; " # 3861%" " 8C , ' %0%?#" 2#31/+/" " 8A - #+0' 4(\$#1#3.) *\$#+ 1%?, /4/ #0' 2%" # , = , /+ 8 ' 20#4; ? . /+ 1%?" 8/ - #+0' 4(\$#18 ' -% - / #9' , %" ' (2 *\$' + 23(?%" 8.

T%?#3%(2' 2\$/+% FreeBSD 3-4<: %/\$ 3 2/6(- #+0' 4(\$#1 Clang, 3A#, (7' C 3 , /1/3# ' 2A#, " #=# - #, % . >#2- #4; - . # " (34(/\$2(: %2\$; < , /1/3%, *\$#\$ - #+0' 4(\$#1 #64%, %/\$ "%' 6#4; G/C 0# , /19- #C.) 2/ ' ?+/" /"' (, #49" 8 - #+0' 4' 1#3\$; 2(2 " ' + 0/1/, - #++' \$#+. >#4" #/ \$/2\$' 1#3%" ' / , 2##\$3/\$2\$3. < 7 // ' ?+/" /"' (+ , , #49" # 01#3#, ' \$; 2(2 *\$' + - #+0' 4(\$#1#+.

T%?#3%(2' 2\$/+% FreeBSD \$%- 9/ 0# , /19' 3%/\$ 1%?4' : " 8/ 3/12' ' Clang ' GCC 3 -%: /2\$3/

-#+' 4(\$#1#3, " / 3A#, (7' A 3 ,/1/3# ' 2A#, "#=# -#, %. E4(-1.0" 8A ' 4' 1' 2-#3%" " 8A ' ?+/" /" ' C -#++' \$\$/18 , #49" 8 380#4" ' \$; \$/2\$#3. < 26#1- . 2 0#, ,/19' 3%/+#C 3/12' /C GCC. I#++' 4(\$#18, " / 3A#, (7' / 3 ,/1/3# ' 2A#, "#=# -#, %, , #2\$.0" 8 3 3' , / 0%-/\$#3. I#++' 4(\$#18 GCC , #2\$.0" 8 3 3' , / 0%-/\$#3 \$\${TARGET_ARCH}-gcc\$\${VERSION}, "%01' +/1 aarch64-gcc14. I#++' 4(\$#18 Clang , #2\$.0" 8 3 3' , / 0%-/\$#3 I lvm\$\${VERSION}, "%01' +/1 llvm18. >1#/- \$?%0.2- %/\$ %3\$#++\$' ?' 1#3%" " 8/ ?%, %: ' CI , 4(26#1- ' 32/=# 2 ' 20#4; ?#3%" ' /+ *\$' A -#++' 4(\$#1#3. @9' , %/\$2(, : \$# -#++' \$\$/18 ' 201%3(\$?%, %: ' , -#\$#18/ #' ' 24#+%4' 23#' + ' ?+/" /" ' (+ . I#++' \$\$/18 +#= . \$ \$/2\$' 1#3%; 26#1- ' 0#4; ?#3\$/\$4; 2-#=# 01#2\$1%" 2\$3%' 4' #\$, /4; " 8A (, /1, . 2\$%" #3' 3 0/1/+/" " . < CROSS_TOOLCHAIN 3 ' + (0%-/\$%, "%01' +/1 CROSS_TOOLCHAIN=aarch64-gcc14 ' 4' CROSS_TOOLCHAIN=I lvm18. E4(26#1- ' universe ' 4' tinderbox, USE_GCC_TOOLCHAINS=gcc\$\${VERSION} 2#6' 1%/\$ 32/ %1A' \$/-\$. 18 2 ' 20#4; ?#3%" ' /+ 2##\$3/\$2\$3. < 7' A 0%-/\$#3 -#++' 4(\$#1#3 GCC. E4(26#1- ' universe ' 4' tinderbox 2 ' 20#4; ?#3%" ' /+ Clang, " / 3A#, (7/=# 3 ,/1/3# ' 2A#, "#=# -#, %, 0/1/, %C\$/ CROSS_TOOLCHAIN=I lvm\$\${VERSION}. @61%\$' \$/ 3" ' +%" ' /, : \$# A#\$ (32/ %1A' \$/-\$. 18 3 6?#3#C 2' 2\$+/ +#= . \$ 68\$; 2-#++' 4' 1#3%" 8 2 0#+#7; < Clang, \$#4; -# "/2-#4; -# %1A' \$/-\$. 1 +#= . \$ 68\$; 0#4" #2\$; < 2#61%" 8 2 0#+#7; < GCC.

>1#/- \$ FreeBSD \$%- 9/ ' +//\$ " /2-#4; -# CI-0%CO4%C" #3 "% GitHub. E4(?%01#2#3 "% 01' " (\$' / ' ?+/" /" ' C (pull request) "% GitHub ' "/-#\$#18A 3/\$#-, #S01%34/" " 8A 3 5#1- ' "% GitHub, 380#4" (/ \$2(1(, ?%, %: -1#22--#++' 4(&' ' .@'" '\$/2\$' 1. < \$ 26#1- . FreeBSD 2 ' 20#4; ?#3%" ' /+ 3/12' C Clang, -#\$#18/ #2\$%<\$ # \$ 32\$1#/" "#=# -#++' 4(\$#1% "% #, ". ' 4' "/2-#4; -# #2" #3" 8A 3/12' C.

>1#/- \$ FreeBSD \$%- 9/ #6" #34(/\$ -#++' 4(\$#18. M Clang, ' GCC 682\$1# 1%?3' 3%<\$2(. B/-#\$#18/ ' ?+/" /" ' (, \$%- ' / -%- ., %4/" ' / . 2\$%1/3G' A #6W(34/" ' C ' #01/, /4/" ' C 5. "- &' C 3 2\$' 4/ K&R, 6. . . \$ 3' /2/" 8 3 ,/1/3# , # 0#(34/" ' ("#3#=# -#++' 4(\$#1%. I#++' \$\$/1%+ 24/, . /\$. : '\$83%; *\$# ' 68\$; =#\$#38+' - 01#3/1- / 01#64/+ 3 23#D+ -#, /' 4' ' ?+/" /" ' (A 2 *\$' + ' "#38+' -#++' 4(\$#1%+' . I 1#+/ \$#=#, 21%?. 0#24/ 0#(34/" ' ("#3#C 3/12' ' -#++' 4(\$#1% 3 ,/1/3/, +#9/\$ 0#S1/6#3%; 2(-#++' 4(&' (2 ' 20#4; ?#3%" ' /+ 2\$%1#C 3/12' ' , /24' /2\$; 0#, #?1/" ' / "% " /#6"%1. 9/" " . < 1/=1/22' < .

) , #0#4" /" ' / - -#++' 4(\$#1., LLD # \$ LLVM ' binutils # \$ GNU ' 20#4; ?. < \$2(-#++' 4(\$#1#+ -#23/" "#. I#++' \$\$/18 , #49" 8 . : '\$83%; 1%?4' : ' (3 2' "\$%-2' 2/ %22/+64/1% ' #2#6/" "#2\$(A -#++' #37' -#3, % \$%- 9/ #6/20/: ' 3%; 1%6#\$#20#2#6" #2\$; #6#' A 3%1' "% #3. FS' -#++' #/" \$8 6. . . \$ \$/2\$' 1#3%; 2(3 1%+-%A CI-%, %: FreeBSD , 4(Clang ' 4' GCC.

>1#/- \$ FreeBSD 01/, #2\$%34(/\$?%=#4#3#: " 8/ 5%C48 ' 6' 64' #\$/-' , -#\$#18/ 0#?3#4(<\$ ' 20#4; ?#3%; , 1. = ' / -#++' 4(\$#18 , 4(26#1- ' 01#=#1++ "#=# #6/20/: /" ' (, " / 3A#, (7/=# 3 6%?#3. < 2' 2\$+/+.. FS' ?%=#4#3#: " 8/ 5%C48 0#, ,/19' 3%<\$ 2#?, %"' / 21/, 8, 2##\$3/\$2\$3. < 7/C 2\$%", %1\$%+, 3-4<: %(6#4// 1%" "' / , ' %4/- \$8 ANSI-C, "%: ' "%(2 C89, % \$%- 9/ , 1. = ' / 20/&' 5' : " 8/ 24. : %' , 38(34/" " 8/ "%G/C #6G' 1" #C -#44/- &' /C 0#1\$#3. FS% 0#, ,/19-% #=#1%" : ' 3%/ \$ \$%-? # \$ 2\$%18A 2\$%", %1\$#3 3 \$%- ' A +/2\$%A, -%- ?%=#4#3#: " 8/ 5%C48, " # " / +/G%/\$ #6" #34/" ' < 6%?#3#C 2' 2\$+/+8 , # 6#4// " #38A , ' %4/- \$#3. N%- 9/ #' % " / \$1/6. /\$, : \$#68 6%?#3%(2' 2\$+/+ % &/4' -#+- -#++' 4' 1#3%4%2; 2 ' 20#4; ?#3%" ' /+ *\$' A 2\$%18A 2\$%", %1\$#3. B%1. G/" ' / *\$#C 0#, ,/19- ' 01' 3/, DS - 26#(+ 3 26#1- / 0%-/\$#3 ' ? -#44/- &' ' 0#1\$#3, 0#*\$#+. 0# 3#?+#9" #2\$' *\$#=# 24/, . /\$ ' ?6/=%; , % 01' #6" %1. 9/" "' 01#64/+ Ñ #0/1\$' 3" # ' A ' 201%34(\$; .

L' 2\$+/+ % 26#1- ' FreeBSD 3 "%2\$#(7// 31/+ (0#, ,/19' 3%/ \$ *\$' 1%?4' : " 8/ 21/, 8. ># +/1/

, #6%34/"' ("#38A 01/, .01/9, /"' C 3 -#+0' 4(\$#18 01#/- \$ 2\$%1%/2(' A ' 201%34(\$; . @, "%- # ' " #=#, % *\$' 01/, .01/9, /"' (\$1/6. <\$?" %: ' \$/4; "#C O/1/1%6#\$-' , O#*\$#+. #' ' 0#, %34(<\$2(-%- ' +4' 6# #61%?#+ 2 ' 20#4; ?#3%" ' /+ O/1/+/" " 8A make, - #3#18/ 38: ' 24(<\$ 01%3' 4; "#/ ?" %: /"' / 3 ?%3' 2' +#2\$' # \$ 3/12' ' -#+0' 4(\$#1. J?1%6# \$: ' - ' , #49" 8 .: ' \$83%\$; *\$# ' #6/20/: ' 3%\$; 01%3' 4; ". < .24#3". < #61%6#\$-. 4<68A 54=#3, 20/&' 5' : " 8A, 4(-#+0' 4(\$#1%.

20.3.1. ; +#"H* + %, ' * * # \$) 9* 15(\$, \$%

) /12' ' 0#, , /19' 3%/+8A -#+0' 4(\$#1#3 , 4(-#" - 1/\$" #C 3/\$-' , \$%- #C -%- main' 4' stable/X, 2# 31/+/" /+ +/" (<\$2(. !3\$#1' \$/\$" 8+ ' 2\$#: " ' -#+ ' ' 5#1+%&' ' # 0#, , /19' 3%/+8A 3/12' (A -#+0' 4(\$#1#3 (34(<\$2(%3\$#+%\$' ?' 1#3%" " 8/ ?%, %: ' CI, \$/2\$' 1. /+8/ 3 -1#22-26#1-%A GitHub Actions ' Jenkins.

C+(-#- 2\$) 9 * 15(\$, %+(#*	llvm12	llvm13	llvm14	llvm15	llvm18	amd64 -gcc12	amd64 -gcc13	amd64 -gcc14	amd64 -gcc15	riscv64-gcc15
main	llvm19			Y	Y	Y	Y	Y	Y	Y
stable/15	llvm19		Y		Y	Y	Y	Y		
stable/14	llvm19	Y	Y	Y		Y		Y		
stable/13	llvm19	Y	Y	Y		Y		Y		

B%6#1 ' " 2\$1. +/" \$#3 1%?1%6#\$-' GCC \$/2\$' 1. /\$2(, 4(amd64 ' riscv64 : /1/? ?%, %"' (CI 3 Jenkins. B%6#1 ' " 2\$1. +/" \$#3 1%?1%6#\$-' LLVM \$/2\$' 1. /\$2(, 4(aarch64 ' arm64 3 -1#22-26#1-%A GitHub.

20.4. 0, "=* + 9, +&1\$D+/* 5

>1' 3" /2/" ' ' ' ?+/" /"' C 3 , #- . +/" \$%&' < O/1/, -#++' \$#+ 01#3/1(C\$/ #15#=1%5' <. E4(32/A XML-, #- . +/" \$#3 . 6/, ' \$/2; 3 -#11/- \$" #2\$' , ' 1/- \$" 3 5#1+%\$' 1#3%" ' (, 380#4"' 3 make lint' textproc/igor.

E4(2\$1%" ' & 1. -#3#, 2\$3% ?%O. 2\$' \$/ sysutils/manck ' textproc/igor "% 2\$1%" ' &/ 1. -#3#, 2\$3%, : \$#68 01#3/1' \$; , : \$# 32/ O/1/- 1/2\$" 8/ 2284-' ' 2284-' " % 5% C48 -#11/- \$" 8, % \$%- 9/ : \$# 2\$1%" ' &% 1. -#3#, 2\$3% ' +// \$ 32/ " /#6A#, ' +8/ MLINKS.

B/ 2+/G' 3%CS/ ' 201%34/"' (2\$' 4(2 " #3#C 5. " -&' #"%4; "#2\$; <. M201%34/"' / 2\$' 4(Ñ *\$# 4<6#/ ' ?+/" /"' /, -#3#1#/ " / +/" (/ \$ 5. " -&' #"%4; "#2\$; -#, %. L+/G' 3%" ' / ' ?+/" /"' C ?%\$1. , " (/ \$ O#" ' +%" ' / ' ?+/" /"' C 5. " -&' #"%4; "#2\$' 01' ?%01#2/ 1%?4' : ' C +/9, . 3/12' (+ , : \$# +#9/\$ 2- 18\$; "#38/ #G' 6-' . B/ 3-4<: %CS/ ' ?+/" /"' (01#6/4#3 3+/2\$ / 2 ' ?+/" /"' (+ 2#, /19' +#=# 3 -#++' \$%A , 4(doc/. U' G" ' C G. + 3 1%?4' : ' (A ?" %: ' \$/4; "#

.24#9" (/ \$ 1%6#\$. 0/1/3#, : ' - #3.) + /2\$# *\$#=# 3" #2' \$/ ' 201%34/" ' (2\$' 4(' 4' 01#6/4#3 3 #\$, /4; " 8A - #+++' \$%A, (3" # #6#?" %: /" " 8A - % - \$% - #38/ 3 2##67/" ' ' - #+++' \$%.

20.5. J' (-, +% - 3H* + R" /#@* *

I #=, % " /#6A#, ' + # ., %4' \$; 5. " - &' #"%4; " #2\$; ' ? 01#=1%++" #=# #6/20/: /" ' (3 6#?#3#C 2' 2\$/+/, 0# 3#?+#9" #2\$' 24/, . CS/ *\$' + 1/- #+/" , %&' (+:

1. KO#+' "%'' / # \$#+, : \$# #0&' (, . \$' 4' \$% ' 4' ' "\$/15/C2 .2\$%1/4', 2#, /19' \$2(3 1. - #3#, 2\$3/ ' , 3#?+#9" #, 3 01' +/: %'' (A - 380.2-.. M20#4; ?#3%" ' / .2\$%1/3G/C 5. " - &' ' 38?83%/\$ 01/, . 01/9, /" ' /.
2. @0&' (, . \$' 4' \$% ' 4' ' "\$/15/C2 2#A1%" (<\$2(, # 24/, . <7/=# +%9#1" #=# (\$#: -%" #4;) 1/4' ?%.
3. @0&' (, . \$' 4' \$% ' 4' ' "\$/15/C2 ., %4/" 8' 6#4; G/ "/ , #- . +/" \$' 1. <\$2(. @" ' 2: ' \$%<\$2(.2\$%1/3G' +'. N%- 9/ #68: " # 1/- #+/" , ./ \$2(. - %?%\$; ' A ., %4/" ' / 3 01' +/: %'' (A - 380.2-..

20.6. 2\$/R* &+/@* - 1: /\$' (: * 9, *%- (/ \$' (:

1. T#4; G% (: %2\$; 1%6#8 "%, FreeBSD 380#4" (/ \$2(0.64' : " #.

FreeBSD Ñ *\$# #049- O-. 01#/- \$. F\$# #?" %: %/\$, : \$# " / \$#4; - # 4<6#C + #9/\$ ' 20#4; ?#3#\$; ' 2A#, " 8C - #, , " # ' 6#4; G% (: %2\$; 01#&/22% 1%?1%6#\$- ' # \$- 18\$% , 4(0.64' : " #=# ' ?.: /" ' (.

2. B/- # \$ #18/ - # " 5' , /" &' %4; " 8/ 3#01#28 , #49" 8 #2\$%3#\$; 2(3 \$%C" / ' 4' 68\$; 0#, ?%01/\$#+ "% 1%?4%G/" ' /.

I 2#9%4/" ' <, 0#4" #C 01#?1%: " #2\$' 68\$; "/ + #9/\$. I %- 1%?1%6#\$: ' - FreeBSD, 38 6. , /\$ / +/\$; #01/, /4D" " . < 2\$/0/"; 01' 3' 4/= ' 1#3%" "#=# , #2\$.0% - ' " 5#1+%&' ' . L4/, #3%\$/4; " #, # \$ 3%2 #9', %/\$2(2#64<, /" ' / #01/, /4D" " 8A \$1/6#3%" ' C - # " 5' , /" &' %4; " #2\$' . M" #=, % " /#6A#, ' + #2\$; - # " 5' , /" &' %4; " #2\$' ' 2A#, ' \$ # \$ 3" /G" ' A 2# \$1. , " ' - #3 ' 4' ' + /\$ - # " - 1/\$" 8C 31/+/" " #C 4' + ' \$. @, "% - # 3 6#4; G' " 2\$3/ 24. : %/3 *\$# 3#01#2 " /1%?4%G/" ' (: %2\$" 8A 0/1/0' 2#-.

3. @\$3/\$2\$3/" " 8C ?% 6/?#0%2" #2\$; #64%, %/\$ ' 2-4<: ' \$/4; " 8+ 01%3#+ 0.64' - %&' ' . 3/, #+4/" ' C # 6/?#0%2" #2\$' .

V, / /2\$; 01#64/+ 8 6/?#0%2" #2\$' , ?%\$1%=' 3%<7' / + " #9/2\$3# 1%?4' : " 8A #0/1%&' # " 8A 2' 2\$/+, FreeBSD : %2\$# ?%3' 2' \$ # \$ 1%" " /=# , #2\$.0%, : \$#68 ' +/\$; 3#?+#9" #2\$; 0#, =#\$#3' \$; . 3/, #+4/" ' (, 4(2#4%2#3%" "#=# 380.2-%. Q24' 1%?1%6#\$: ' - ' FreeBSD " / + # =. \$ 68\$; , #3/1/" 8 3 3#01#2%A 0#, , /19%" ' (6/?#0%2" #2\$' , \$% - #C 1%" " ' C , #2\$.0 01/, #2\$%34/" " / 6. , /\$. @\$3/\$2\$3/" " 8C ?% 6/?#0%2" #2\$; - # " \$1#4' 1. /\$, #2\$.0 - ' " 5#1+%&' ' #6 . (?3' + #2\$(A , # ' A 0.64' - %&' ' ' #01/, /4(/\$ 31/(380.2-% 32/A . 3/, #+4/" ' C . @" + #9/\$?%01#2' \$; 0# + #7; 01' .24#3' ' - # " 5' , /" &' %4; " #2\$' . 4<6#=# 1%?1%6#\$: ' - % 2 2##\$3/\$2\$3. <7' + ' ?" %'' (+ ' , 4(0#, =#\$#3- ' ' 201%34/" ' C 6/?#0%2" #2\$' .

4. I #+++. "' - %&' ' 2 @2" #3" #C - #+%" , #C (Core Team) 2#A1%" (< \$2(3 - # " 5' , /" &' %4; " #2\$' 2\$#4; - # 31/+/" ' , 2- #4; - # " /#6A#, ' + #.

I #+++. "' - %&' ' 2 @2" #3" #C - #+%" , #C ' ?" %: %4; " # 6. , . \$ 1%22+%\$1' 3%\$; 2(- % - # " 5' , /" &' %4; " 8/. @, "%- # 3 - # " /: " #+ ' \$#=/ 6#4; G% (: %2\$; , /(\$/4; " #2\$' @2" #3" #C - #+%" , 8 6. , /\$ #6#67/" % 3 /9/+ /2(: " 8A ' 4' - 3%1\$%4; " 8A #\$: D\$%A (, 1%. T. , /\$. , /4/" # 3"' +%" ' / \$#+. , : \$#68 ' ?6/9%\$; 1%?=4%G/" ' (- %- ' A-4' 6# : . 32\$3' \$/4; " 8A , /\$%4/C. P%0' 2' 0# " /- # \$#18+ #2#6# : . 32\$3' \$/4; " 8+ \$/+%+ + #=. \$ 3##67/ " / 0#0%, %\$; 3 #\$: D\$8 ' 6. , . \$ A1%" ' \$; 2(\$#4; - # 3: %2\$" 8A %1A' 3%A @2" #3" #C - #+%" , 8.

5. L#=#4%G/" ' (# " /1%?=4%G/" ' ' ' + #=. \$ 0#\$1/6#3%\$; 2(, 4(, #2\$. 0% - #01/, /4D" " #C - #+++/1: /2- ' : . 32\$3' \$/4; " #C ' " 5#1+%&' ' .

E#2\$. 0 - #01/, /4D" " 8+ - #+++/1: /2- ' : . 32\$3' \$/4; " 8+ , %" " 8+ + #9/\$ 68\$; 01/, #2\$%34/" \$#4; - # 01' 0#, 0' 2%" ' ' L#=#4%G/" ' (# " /1%?=4%G/" ' ' ' . >/1/, ?%- 4<: /" ' /+ - %- ' A-4' 6# < 1' , ' : /2- ' #6(?83%< 7' A 2#=#4%G/" ' ' C " /#6A#, ' + # 01#- # " 2. 4; \$' 1#3%\$; 2(2 < 1' , ' : /2- ' + # \$, /4## R# " , %FreeBSD.

6. > 1' 3%\$" 8/ 2##67/" ' (" / , #49" 8 2\$%" #3' \$; 2(0. 64' : " 8+ ' 6/? 1%?1/G/" ' (.

> #+ ' + # . - %?%" " 8A 38G/ - # " - 1/\$" 8A \$1/6#3%" ' C, 2. 7/2\$3. /\$ #67// 01%3' 4# " / 0. 64' - #3%\$; 4' : " . < 0/1/0' 2- . + /9, . 1%?1%6#\$: ' - %+ ' 6/? 2#=#4%2' (32/A 3#34/: /" " 8A 2\$#1#". >/1/, 0/1/284- #C 2##67/" ' (3 0. 64' : " . < 1%2284- . , 1%?+/7/" ' /+ " % 5#1. + / ' 4' 3/6-2%CS/, , #2\$. 0" #+ " / \$#4; - # , 4(' 2A#, " 8A - #11/20#" , /" \$#3, " /#6A#, ' + # ?%01#2' \$; 1%?1/G/" ' /.

7. @67/" ' / 3 - %%" %4%A, 01/, "%?" %: /" " 8A \$#4; - # , 4(01#/- \$% ' 4' 2 #=#1%" ' : /" " 8+ , #2\$. 0#+, , #49" # #2\$%3%\$; 2(- # " 5' , /" &' %4; " 8+.

! "%4#=: " # 4' : " 8+ 2##67/" ' (+, " /- # \$#18/ 3". \$1/" ' ' / - %%" %48 23(? , 3- 4<: %(0#: \$#38/ 1%2284- ' \$#4; - # , 4(- #+++' \$\$/1#3 FreeBSD ' IRC-- %%" %48 2 #=#1%" ' : /" " 8+ , #2\$. 0#+, 2: ' \$%< \$2(: %2\$" #C 0/1/0' 2- #C. E4(0. 64' - %&' ' + %\$/1' %4#3 ' ? *\$' A ' 2\$#: " ' - #3 \$1/6. /\$2(1%?1/G/" ' /.

8. @2" #3" % (- #+%" , % + #9/\$ #, #61' \$; 0. 64' - %&' <.

) 24. : %(A, - #, % 0#4. : /" ' / 1%?1/G/" ' (" /01%- \$' : " # ' ?-?% - #4' : /2\$3% - #11/20#" , /" \$#3 ' 4' - #, % 1%?1/G/" ' / " % 0. 64' - %&' < " /#6#2" #3%" " # #S- 4#" (/ \$2(, @2" #3" % (- #+%" , % + #9/\$ #, #61' \$; 1%2- 18\$' / \$%- ' A : %2\$" 8A 3#01#2#3, - # \$#18/ ?%24. 9' 3%< \$ 6#4// G' 1#- #C 0. 64' - %&' ' .

21. < \$&&+, D#-) / \$D+' (%+//O>

- , >* (+#(" ,

FreeBSD \tilde{N} *\$# 382#- #0#1\$%\$' 3" % (#0/1%&' # " " % (2' 2\$/+%, 01/, "%?" %: /" " % (, 4(1%6#S8 " % + " #9/2\$3/ 1%?4' : " 8A \$' 0#3 %00%1%\$" 8A %1A' \$/- \$. 1. > #, , /19%" ' / : /\$- #=# 1%?, /4/" ' (+ /9, . + %G' " #?%3' 2' + 8+ (MD) ' + %G' " # " /?%3' 2' + 8+ (MI) - #, #+, % \$%- 9/ + ' ' ' + ' ?%&' (MD-- #, % (34(< \$2(3%9" #C : %2\$; < " %G/C 2\$1%\$/' ' 0# 2#A1%" /" ' < = ' 6- #2\$' 3 # \$" #G/" ' ' .

\$/- . 7' A \$/" , /" &' C 3 %00%1%\$"#+ #6/20/: /" ' ' . I %9, % ("#3% (%00%1%\$"% (%1A' \$/- \$. 1%,
0#, , /19' 3%/+% (FreeBSD, 2. 7/2\$3/" "# . 3/4' : ' 3%/ \$?%\$1%\$8 "% 0#, , /19- . - #, %,
' " 2\$1. +/" \$%4; " 8A 21/, 2\$3 ' . 01%34/" / 380. 2- %+' . F\$# \$%- 9/ ?" %: ' \$/4; " # 0#38G%/ \$
2\$#' + #2\$; *55/- \$' 3" #=# \$/2\$' 1#3%" (' ?+/" /" ' C 3 (, 1/. N%- ' + #61%?#+, 2. 7/2\$3. /\$
2/1; /? "% (+\$' 3%&' (, 4(1%?=1%" : /" ' (. 1#3"/ C 0#, , /19- ' 1%?4' : " 8A %1A' \$/- \$. 1,
#2\$%3%(2; 01' *\$#+ 2' 4; " 8+ ' 3 " /2- #4; - ' A - 4< : /38A %1A' \$/- \$. 1A, - # \$#18/
1%22+%\$1' 3%<\$2(- % - Ç&/4/3%(% . , ' \$#1' (È FreeBSD).

21.1. T- 5%1+/* + \$8 \$8H* > /-) +, +/* 5>

>1#/- \$ FreeBSD #1' /" \$' 1#3%" "% "-#++/1: /2- ' / =#\$#38/ 1%6#: ' / 2\$%" &' ' , 2/13/18 ' 382#- #01# ' ?3#, ' \$/4; " 8/ 32\$1% ' 3%/+8/ 2' 2\$/+8 01# ' ?3#, 2\$3/" "#=# . 1#3" (" L#A1%" ((
5#- . 2 "% . ?- #+ "%6#1/ %1A' \$/- \$. 1, %- \$. %4; " 8A , 4(*\$' A 21/, , 01#/- \$ FreeBSD 20#2#6/"
0#, , /19' 3%\$; 382#- ' C . 1#3/" ; - %: /2\$3%, 2\$%6' 4; " #2\$' ' 01# ' ?3#, ' \$/4; " #2\$' , % \$%- 9/
+ ' " ' + ' ?' 1#3%\$; "%=1. ?- . "% 1%?4' : " 8/ - #+%" , 8 0#, , /19- ' 01#/- \$%, \$%- ' / - % - #+%" , %
0#1\$#3, - #+%" , % , #- . +/" \$%&' ' , #5' &/1 6/?#0%2" #2\$' ' - #+%" , 8 1%?1%6#\$- ' 1/4' ?#3.
J?" ##61%? / 3 0#, , /19- / #6#1. , #3%" (1%2G' 1(/\$ 3#?+#9" #2\$' 0#\$1/6' \$/4/C FreeBSD,
01/, 4%=("#38/ 5. " - &' ' ' 3%1' "% \$8 ' 20#4; ?#3%" (, #, "%- # *\$' 01/' + . 7/2\$3% 32/=, %
, #49" 8 \$7%\$4; " # #&/" ' 3%\$; 2(2. : D\$#+ 1/%4; " 8A ?%\$1%\$ "% 0#, , /19- . , #0#4" ' \$/4; " 8A
04%\$5#1+.

>1#/- \$ FreeBSD 1%?, /4(/\$ &/4/38/ 04%\$5#1+8 "% :/\$81/ . 1#3" (" I %9, 8C . 1#3/" ;
3- 4< : %/\$ 20' 2#- =%1%" \$' C, "% - # \$#18/ +#=# \$ 1%22: ' \$83%\$; 0#4; ?#3%\$4' , % \$%- 9/
#6(?%\$4; 2\$3% 01#/- \$% ' 1%?1%6#\$: ' - #3 0# 380#4/" /" < *\$' A =%1%" \$' C. F\$' 20' 2- '
#01/, /4(<\$ + ' " ' +%4; " 8/ =%1%" \$' ' , 4(- %9, #=# . 1#3" (. >1#/- \$ ' 1%?1%6#\$: ' - ' +#=# \$
01/, #2\$%34(\$; , #0#4" ' \$/4; " 8/ . 1#3" ' 0#, , /19- ' , 01/38G%<7' / + ' " ' +%4; " 8/
=%1%" \$' ' , 4(, % " "#=# . 1#3" (, "# \$%- % (, #0#4" ' \$/4; "% (0#, , /19- % " / =%1%" \$' 1. /\$2(
I %9, % (&/4/3%(04%\$5#1+% "%?" %: %/\$2("% #01/, /4D" " 8C . 1#3/" ; , 4(- %9, #C 2\$%6' 4; " #C
3/\$3' .) 1/? . 4; \$%\$/, &/4/3%(04%\$5#1+% + #9/\$ 68\$; "%?" %: /" % "% 1%?" 8/ . 1#3" ' 3
0%1%44/4; " 8A 2\$%6' 4; " 8A 3/\$- %A.

21.2. U+1+%O+ 91- (R\$,) O

>#, , /19- % %00%1%\$"#C 04%\$5#1+8 2#2\$#' \$ ' ? , 3. A - #+0#" /" \$#3: 0#, , /19- ' (, 1% ' 0#4; ?#3%\$4; 2- ' A , 3# ' : " 8A ' '\$/15/C2#3 01' 4#9/" ' C (ABI). >#, , /19- % 04%\$5#1+8 "% . 1#3" / (, 1% 3- 4< : %/\$ 3 2/6(32D "/#6A#, ' +#/ , 4(?%0. 2- % (, 1% FreeBSD "% %00%1%\$"#C 04%\$5#1+/, "%01' +/1, ?%3' 2(7// # \$ +%G" ' 8 . 01%34/" / 3' 1\$. %4; " #C 0#+ (\$; < ' , 1%C3/18 . 2\$1#C2\$3. >#4; ?#3%\$4; 2- ' C ABI #01/, /4(/\$ ' '\$/15/C2 , 4(3?' + #, /C2\$3' (0#4; ?#3%\$4; 2- ' A 01#&/22#3 2 (, 1#+ FreeBSD ' 6%?#38+' 2' 2\$/+" 8+' 6' 64' #\$/- %+' . >#4; ?#3%\$4; 2- ' C ABI 3- 4< : %/\$ ' '\$/15/C28 2' 2\$/+" 8A 38?#3#3, 1%20#4#9/" / ' 2/+%" \$' - . 0. 64' : " 8A 2\$1. - \$. 1 , "% " 8A, % \$%- 9/ 1%20#4#9/" / ' 2/+%" \$' - . %1= . +/" \$#3, 0/1/, %3%/+8A 0#, 01#=#1++%+. B/- # \$#18/ - #+0#" /" \$8 ABI +#=# \$ 68\$; #01/, /4/" 8 20/&' 5' - %&' (+ ' , \$%- ' + ' - % - 1%20#4#9/" / #6W/- #3' 2- 4< : /" ' C ++ ' 4' 2#=#4G/" (# 38?#3%A , 4(5. " - &' C C.

[, 1# FreeBSD \$%- 9/ ' 20#4; ? . /\$ ABI (" #=#, % "%?83%/+8C Kernel Binary Interface (KBI)), - # \$#18C 3- 4< : %/\$ 2/+%" \$' - . ' 1%20#4#9/" / 0. 64' : " 8A 2\$1. - \$. 1 , "% " 8A, % \$%- 9/

1%20#4#9/" ' / ' 2/+%" \$' -. %1=. +/" \$#3 0. 64' : " 8A 5. " - &' C 3" . \$1' 2%+## (, 1%.

[, 1# FreeBSD +#9/\$ 0# , /19' 3%; " /2- #4; -# 0#4; ?#3%\$/4; 2- ' A ABI. B%01' +/1, (, 1# FreeBSD amd64 0# , /19' 3%/\$ 0#4; ?#3%\$/4; 2- ' / ABI FreeBSD amd64 ' i386, % \$%- 9/ 0#4; ?#3%\$/4; 2- ' / ABI Linux x86_64 ' i386. [, 1# FreeBSD , #49" # 0# , /19' 3%; " 1#, " #C" ABI 3 -%: /2\$3/ ABI 0# . +#4: %" ' < . "J#, " #C" ABI, -%- 01%3' 4#, 1%?, /4(/\$ #01/, /4D" " 8/ 23#C2\$3% 2 ABI (, 1%, \$%- ' / -%- 2#=#4G/" ' / # 38?#3%A 3 C, 1%?+/18 6%?#38A \$' 0#3 ' \$., .

K1#3" ' #01/, /4/" 8 -%- , 4((, /1, \$%- ' , 4(0#4; ?#3%\$/4; 2- ' A ABI.) #67/+ 24. : %/ (, 1# 04%\$5#1+8 ' ABI FreeBSD "%?" %: %< \$2("% #, ' " ' \$#\$ 9/ . 1#3/" ; .

21.2.1. J, \$%+/: 1: <\$1/\$' (: 3 9\$&&+, D*%- +) O+ - , >* (+#(" , O

K1#3/" ; 1 3- 4< : %/\$ " %' 6#4// ?1/48/ 04%\$5#1+8 FreeBSD. @" ' 0# , /19' 3%< \$2(#5' &/1#+ 6/?#0%2" #2\$' , ' " 9/" /1%+' 380. 2- % ' -#+% , #C . 01%34/" ' (0#1\$%+' . @9' , %/\$2(, : \$# %1A' \$/- \$. 18 K1#3" (1 2##\$3/\$2\$3. <\$ 01# ' ?3#, 2\$3/" " #+. -%: /2\$3. 3# 32/A %20/- \$%A #0/1%&' # " #C 2' 2\$/+8 FreeBSD, 3- 4< : %(21/, 8 . 2\$%" #3- ' ' 1%?1%6#\$- ' .

>1#/- \$ FreeBSD 01/, #2\$%34(/\$ 24/, . < 7' / =%1%" \$' ' 0#4; ?#3%\$/4(+ 04%\$5#1+ K1#3" (1:

¥ @5' &' %4; " 8/ #61%?8 1/4' ?#3 FreeBSD 6. . \$ 01/, #2\$%34/" 8 -#+% , #C 1%?1%6#\$- ' 1/4' ?#3.

¥ E3# ' : " 8/ #6" #34/" ' (' ' 201%34/" ' (' 2A#, "#=# -#, % , 4(Security Advisories ' Errata Notices 6. . \$ 01/, #2\$%34(\$; 2(, 4(0# , /19' 3%/+8A 380. 2- #3.

¥ M2A#, " 8/ 0%\$: ' , 4(6< 44/\$/" /C 6/?#0%2" #2\$' 6. . \$ 01/, #2\$%34/" 8 , 4(0# , /19' 3%/+8A 3/\$#- .

¥ E3# ' : " 8/ #6" #34/" ' (' ' 201%34/" ' (' 2A#, "#=# -#, % , 4(- 1#22-04%\$5#1+/" " 8A 380. 2- #3 Security Advisories #68: " # 01/, #2\$%34(< \$2(3# 31/+ (#6W(34/" ' (.

¥ M?+/" /" ' (3 0#4; ?#3%\$/4; 2- ' A ABI, -%- 01%3' 4#, 3- 4< : %<\$ 01#24#C- ' 2#3+/2\$' +#2\$' (shim) , 4(#6/20/: /" ' (-#11/- \$" #C 1%6#\$8 6' " %1" 8A 5%C4#3, 2- #+0' 4' 1#3%" " 8A , 4(4< 6#C 2\$%6' 4; " #C 3/\$- ' , =, / 04%\$5#1+% # \$" #2' \$2(- K1#3" < 1. F\$' 01#24#C- ' +#=. \$ 68\$; # \$- 4< : /" 8 3 2\$%" , %1\$" #C . 2\$%" #3- / . Q24' 01#24#C- ' 2#3+/2\$' +#2\$' " / 01/, #2\$%34(< \$2(, 4(' ?+/" /" ' (ABI, ' A #2. 2\$3\$' / 6. , /\$ (3" #. - %?%" # 3 01' +/: %" ' (A - 380. 2- . .

¥ M?+/" /" ' (3 #01/, /4D" " 8A : %2\$(A ABI (, 1% 6. . \$ 3- 4< : %\$; 01#24#C- ' 2#3+/2\$' +#2\$' , 4(#6/20/: /" ' (-#11/- \$" #C 1%6#\$8 +#, . 4/C (, 1%, 2- #+0' 4' 1#3%" " 8A , 4(2%+ #C 2\$%1#C 0# , /19' 3%/+ #C 3/12' ' 3 3/\$- / . @61%\$' \$/ 3" ' +%" ' / , : \$# " / 32/ : %2\$' ABI (, 1% ?%7' 7/" 8.

¥ @5' &' %4; " 8/ 6' "%1" 8/ 0%- /\$8 , 4(2\$#1#" "/=# 01#=1%++ "#=# #6/20/: /" ' (6. . \$ 01/, #2\$%34/" 8 -#+% , #C 0#1\$#3. E4(32\$1% 3%/+8A %1A' \$/- \$. 1 *\$' 0%- /\$8 +#=. \$ 68\$; - 1#22-2#61%" " 8+ ' "% %1A' \$/- \$. 1/ , 1. =#=# \$' 0%.

¥ B% 6#4// 0#, A#, (7' / 0#1\$8 , #49" 8 4' 6# 2#6' 1%\$; 2(, 4' 6# ' +/\$; 2##\$3/\$2\$3. < 7' / 5' 4; \$18, : \$#68 01/, #S31%\$' \$; 26#1- . " /O#, A#, (7' A.

¥ B#38/ 5. " - &' ' , - # \$#18/ " / (34(< \$2(20/&' 5' : " 8+ ' , 4(04%\$5#1+8, 6. . \$ 0#4" #2\$; < 1%6#\$20#2#6" 8 " % 32/A %1A' \$/- \$. 1%A K1#3" (1.

¥ R. "- &' ' 01#24#C-' 2#3+/2\$' + #2\$' , ' 20#4; ?. /+8/ 01#=1%++%+' ,
2-#+0' 4' 1#3%" " 8+' , 4(2\$%18A 2\$%6' 4; " 8A 3/\$#-, +#=.\$ 68\$; . , %4/" 8 3 " #38A
#2" #3" 8A 3/12' (A. N%- / ' ?+/" /"' (6. , . \$: /\$- # , #- . +/" \$' 1#3%" 8 3 01' +/: %"' (A -
380. 2- . .

¥ K1#3/" ; 1 04%\$5#1+ , #49/" 68\$; 0#4" #2\$; < , #- . +/" \$' 1#3%" . @2" #3" 8/ #0/1%&' '
6. , . \$ #0' 2%" 8 3 J. - #3# , 2\$3/ FreeBSD.

¥ K1#3/" ; 1 04%\$5#1+ 6. , /\$ 3-4<: /" 3 , /1/3# ' 2A# , " 8A - # , #3.

¥ >4%\$5#1+8 K1#3" (1 , #49" 8 68\$; 2%+# , #2\$%\$#: " 8+' , ' 20#4; ?. (4' 6# 32\$1#/" " 8C
' " 2\$1. +/" \$%1' C , 4' 6# 3"/G"' C ' " 2\$1. +/" \$%1' C. Q24' \$1/6. /\$2(3"/G"' C
' " 2\$1. +/" \$%1' C , 6. , . \$ 01/ , #2\$%34/" 8 #5' &' %4; " 8/ 6' " %1" 8/ 0%- /\$8 , 4(" /=#.

E4(#6/20/: /"' (?1/4#2\$' 04%\$5#1+ K1#3" (1 01#/- \$ FreeBSD 6. , /\$ 0# , , /19' 3%\$;
24/ , . < 7' / 1/2. 128 , 4(1%?1%6#-\$- ' :

¥ L6#1-% ' %3\$#+\$' ?%&' (\$/2\$' 1#3%"' (0# , , /19' 3%<\$2(4' 6# 3 -4%2\$/1/ FreeBSD.org,
4' 6# 3 , 1. =#+ +/2\$/, 4/=- # , #2\$. 0" #+ , 4(32/A 1%?1%6#-\$: ' - #3. E4(32\$1%' 3%/+8A
04%\$5#1+ + #9" # ' 20#4; ?#3\$; * . 4(\$#1 , #2\$. 0" 8C 3 -4%2\$/1/ FreeBSD.org, 3+ /2\$#
1/%4; " #=# #6#1. , #3%"' (.

¥) - 4<: /"' / 3 & /4' make universe ' make tinderbox.

¥) 8 , /4/" " #/ #6#1. , #3%"' / 3 # , " #+ ' ? -4%2\$/1#3 FreeBSD , 4(26#1-' 0%- /\$#3 (" %\$' 3" #
' 4' : /1/? qemu-user).

L#3#-. 0" # , 1%?1%6#-\$: ' - ' , #49" 8 #6/20/: ' \$; 24/ , . < 7// , 4(0# , , /19%"' (2\$%\$. 2%
04%\$5#1+8 K1#3" (1:

¥ M?+/" /"' (3 , /1/3/ ' 2A# , "#=# - # , % " / , #49" 8 ?%3/ , #++ "%1. G%\$; 26#1-. 04%\$5#1+8
K1#3" (1.

¥ K1#3/" ; 1 %1A' \$/- \$. 1 , #49/" #64% , %\$; ?1/4#C , ? , #1#3#C *- #2' 2\$/+ #C 0#4; ?#3\$%/4/C '
%- \$' 3" 8A 1%?1%6#-\$: ' - #3.

¥ J%?1%6#-\$: ' - ' , #49" 8 ' +/\$; 3#?+ #9" #2\$; 2#6' 1%\$; 0%- /\$8 " % G' 1#- # , #2\$. 0" 8A,
" /32\$1%' 3%/+8A 2' 2\$/+ #A K1#3" (1. F\$# + #9/\$ #?" %: %\$; -% - "%\$' 3" 8/ 26#1-' , /24'
" /32\$1%' 3%/+8/ 2' 2\$/+8 G' 1#- # , #2\$. 0" 8 , 4(1%22+%\$1' 3%/+ #C 04%\$5#1+8 , \$%- '
- 1#22-26#1-' , 380#4" (/+8/ "% , 1. =#C %1A' \$/- \$. 1/ K1#3" (1.

¥ M?+/" /"' (" / , #49" 8 "%1. G%\$; ABI 0#4; ?#3\$%/4; 2- #=# 01#2\$1%" 2\$3%. Q24' ' ?+/" /"' /
ABI " /#6A# , ' + # , 2#3+/2\$' + #2\$; ABI , 4(2. 7/2\$3. < 7' A 6' "%1" 8A 5% C4#3 , #49" %
#6/20/: ' 3%\$; 2(2 0#++ #7; < 3/12' #"' 1#3%"' (2' +3#4#3 ' 4' . 3/4' : /"' (3/12' C
1%? , /4(/+8A 6' 64' #\$/- .

¥ M?+/" /"' (, - # \$ #18+ 2 , /4%" # 24' (" ' / 3 2\$%6' 4; " 8/ 3/\$- ' , " / , #49" 8 "%1. G%\$;
?%7' 7/" " 8/ : %2\$' ABI (, 1%. Q24' \$1/6. /\$2(' ?+/" /"' / ABI (, 1% , ' ?+/" /"' / , #49" #
68\$; + # , ' 5' &' 1#3%" # , 4(2#A1%" /"' (5. " - &' # "%4; " #2\$' 2. 7/2\$3. < 7' A + # , . 4/C (, 1%.

21.2.2. J, \$%+/: 2: ! - 7%*%- 3H*+' 5 * / * L +%O+ - , > * (+# (" , O

K1#3/" ; 2 3-4<: %/\$ 3 2/6(5. " - &' # "%4; " 8/ , " # +/" // 1%?3' \$8/ 04%\$5#1+8 FreeBSD. @"' '
" / 0# , , /19' 3%<\$2(#5' &/1#+ 6/?#0%2" #2\$' , ' " 9/" /1#+ ' 380. 2-% ' - #+% , #C . 01%34/"' (

O#1\$%+' .

>4%\$5#1+8 K1#3" (2 +#=. \$ 68\$; -" , ' , %\$%+' 3 04%\$5#1+8 K1#3" (1, -#\$#18/ 32D /7D
"%A#, (\$2(3%- '\$ 3" #C 1%?1%6#\$/- .! 1A' \$/- \$. 18, , #2\$' =G' / - # " &% 9' ?' / " "#=# &' - 4%, \$%- 9/
+ #=. \$ 68\$; 0/1/3/, /" 8 ' ? 2\$\$. 2% K1#3" (1 "% K1#3/" ; 2 0# +/1/ 2#- 1%7/" ' (, #2\$. 0" #2\$'
1/2. 12#3 , 4(0#, , /19%" ' (2' 2\$/+8 3 2#2\$#(" ' ' 01# ' ?3#, 2\$3/" "#=# -%: /2\$3%. H#1#G#
0#, , /19' 3%/+8/ " ' G/38/ %1A' \$/- \$. 18 \$%- 9/ + #=. \$ # \$" #2' \$; 2(- K1#3" < 2.

>1#/- \$ FreeBSD 01/, #2\$%34(/\$ 24/, . < 7' / =%1%" \$' ' 0#4; ?#3%\$/4(+ 04%\$5#1+ K1#3" (2:

¥ M" 51%2\$1. - \$. 1% 0#1\$#3 , #49" % 3- 4<: %\$; 6%?#3. < 0#, , /19-. %1A' \$/- \$. 1 K1#3" (2,
 , #2\$%# #: " . < , 4(26#1- ' 0#1\$#3 ' 0%- /\$#3. F\$# 3- 4<: %/ \$ 0#, , /19-. 6%?#38A 0%- /\$#3,
\$%- ' A -% ports-mgmt/pkg, " # " /\$ =%1%" \$' ' , : \$# 01# ' ?3#4; " 8/ 0#1\$8 6. , . \$ 2#6' 1%/+8+'
' 4' 1%6#\$\$#20#2#6" 8+' .

¥ B#38/ 5. "- &' ' , -#\$#18/ " / (34(<\$2(20/&' 5' : " 8+' , 4(04%\$5#1+8, , #49" 8 68\$;
1/%4' ? . /+8 " % 32/A %1A' \$/- \$. 1%A. 1#3" (K1#3/" ; 2, /24' # " ' " / 1/%4' ?#3%" 8.

¥ K1#3/" ; 2 04%\$5#1+ 6. , /\$ 3- 4<: /" 3, /1/3# ' 2A#, " 8A - #, #3.

¥ >4%\$5#1+8 K1#3" (2 , #49" 8 68\$; 2%+ #, #2\$%# #: " 8+' , ' 20#4; ? . (4' 6# 32\$1#/" " 8C
' " 2\$1. +/" \$%1' C, 4' 6# 3"/G" ' C ' " 2\$1. +/" \$%1' C. Q24' \$1/6. /\$2(3"/G" ' C
' " 2\$1. +/" \$%1' C, 6. , . \$ 01/, #2\$%34/" 8 #5' &' %4; " 8/ 6' " %1" 8/ 0%- /\$8 , 4("/=#.

¥ K1#3/" ; 2 04%\$5#1+ , #49/" #6/20/: ' 3%\$; 5. "- &' # " %4; " 8/ (, 1% ' 0#4; ?#3%\$/4; 2- ' /
21/, 8, , %9/ /24' #5' &' %4; " 8C , ' 2\$1' 6. \$' 3 " / 01/, #2\$%34(/\$2(.

E4(0#, , /19%" ' (?1/4#2\$' 04%\$5#1+ K1#3" (2 01#/- \$ FreeBSD 6. , /\$ 0#, , /19' 3%\$;
24/, . < 7' / 1/2. 128 , 4(1%?1%6#\$/- ' :

¥) - 4<: /" ' / 3 &/4' make universe ' make tinderbox.

L#3+/2\$" # 1%?1%6#\$/- ' - ' , #49" 8 #6/20/: ' \$; 24/, . < 7// , 4(0#, , /19%" ' (2\$%\$. 2%
04%\$5#1+8 K1#3" (2:

¥ M?+/" /" ' (3 , /1/3/ ' 2A#, " #=# - #, % " / , #49" 8 ?%3/, #++ " %1. G%\$; 26#1-. 04%\$5#1+8
K1#3" (2.

¥ K1#3/" ; 2 %1A' \$/- \$. 1 , #49/" ' +/\$; %- '\$ 3" . < *- #2' 2\$/+. 0#4; ?#3%\$/4/C '
1%?1%6#\$/- #3.

¥ H#\$ (' ?+/" /" ' (, "%1. G%< 7' / ABI 0#4; ?#3%\$/4; 2- #=# 01#2\$1%" 2\$3% , #0. 2\$' +8, " /
24/, . /\$, /4%\$; *\$# 6/? 3/2- #C 01' : ' " 8. P" %: ' \$/4; " 8/ ' ?+/" /" ' (ABI
0#4; ?#3%\$/4; 2- #=# 01#2\$1%" 2\$3% , #49" 8 #=1%" ' : ' 3%\$; 2(#2" #3" 8+' 3/12' (+' .

¥ B#38/ 5. "- &' ' , -#\$#18/ /7D " / 1/%4' ?#3%" 8 3 %1A' \$/- \$. 1%A K1#3" (2, , #49" 8
01/, #2\$%34(\$; 3#?+#9" #2\$; ' A # \$- 4<: /" ' ("% *\$' A %1A' \$/- \$. 1%A.

21.2.3. J, \$%+/: 3: V# ' 9+, *) +/(- 1: /O+ -, >* (+#(" , O

K1#3/" ; 3 3- 4<: %/\$ 04%\$5#1+8 2 : %2\$' : "#C 0#, , /19- #C FreeBSD. @ " ') 70#, , /19' 3%<\$2(
#5' &/1#+ 6/?#0%2" #2\$' , ' " 9/" /1%+' 380. 2- % 1/4' ?#3' - #+% , #C . 01%34/" ' (0#1\$%+' .

K1#3/" ; 3 3- 4<: %/\$ %1A' \$/- \$. 18 " % 1%" ' ' A 2\$%, ' (A 1%?1%6#\$/- , 01/, "%?" %: /" " 8/ , 4(

"/#2"#3" 8A %00%1%" 8A 04%\$5#1+ ' 4' 2: ' \$%< 7' /2(. 2\$%1/3G' + ' 2' 2\$/+#+', -#\$#18/
31(, 4' 0#4. : %\$ G' 1#- #/ 01' +/" /" / 3 6. , . 7/+ . >/13#" %: %4; "%(0#, , /19-% 04%\$5#1+
K1#3" (3 + #9/\$ " %A#, ' \$; 2(3 #\$, /4; "#+ 1/0#?' \$#1' ' , % " / 3 #2"#3" #+ 1/0#?' \$#1' '
' 2A#, "#=# - #, %.

>1#/- \$ FreeBSD " / 01/, #2\$%34(/\$ " ' -%- ' A =%1%" \$' C 0#4; ?#3\$%/4(+ 04%\$5#1+ K1#3" (3' " /
#6(? . /\$2(38, /4(\$; 1/2. 128 , 4(0#, , /19-' 1%?1%6\$-\$' . >4%\$5#1+8 K1#3" (3 + #=. \$ " /
32/=, % 2#6' 1%\$; 2(, ' " ' #, "# ABI (, 1% ' 4' 0#4; ?#3\$%/4; 2- #=# 01#2\$1%" 2\$3% " / 2: ' \$%/2(
2\$%6' 4; " 8+.

21.2.4. ?+9\$&&+, D*%-+) O+ -, >* (+#(" , O

E1. = ' / 04%\$5#1+8 " / 0#, , /19' 3%<\$2(01#/- \$#+ 3 -%- #C-4' 6# 5#1+/. J%" // 01#/- \$
#0' 283%4' A -%- 2' 2\$/+8 K1#3" (4.

>#24/ 0/1/A#, % 04%\$5#1+8 3 2\$%\$. 2 " /0#, , /19' 3%/+#C, 32(0#, , /19-% 04%\$5#1+8
. , %4(/\$2(' ?' 2A#, "#=# - #, %, 0#1\$#3' , #- . +/" \$%&' ' . @61%\$' \$/ 3" ' +%" ' /, : \$# 0#, , /19-% 3
0#1\$%A , #49" % 2#A1%" (\$; 2(, # \$/A 0#1, 0#- % 04%\$5#1+ % 0#, , /19' 3%/2(3 3/\$- /,
0#, , /19' 3%/+#C 0#1\$%+ ' .

21.3. <\$1* (* #- * 7) +/+/* 5 " , \$%/5 - , >* (+#(" , O

L' 2\$/+8 +#=. \$ 68\$; 0/1+/7/" 8 2 #, "#=# . 1#3" ("% , 1. =#C \$#4; - # 2 #, #61/" ' (@2"#3" #C
- #+%" , 8 FreeBSD, -#\$#1%(01' " ' +%/ \$ *\$# 1/G/" ' / 2#3+/2\$" # 2 Security Officer, Release
Engineering ' - #+%" , %+' . 01%34/" ' (0#1\$%+ ' . E4(0/1/3#, % 04%\$5#1+8 "% 6#4// 382#- ' C
. 1#3/" ; 32/ " /, #2\$%< 7' / =%1%" \$' ' 0#, , /19-' , #49" 8 68\$; 380#4" /" 8 , # ?%3/1G/" ' (0#38G/" ' (.

22. 69+@* R* 4/O+ FAQ 9\$ 9\$, (-)

22.1. 0\$8- %1+/* + /\$%\$=\$ 9\$, (-

22.1.1. 2- # &\$8- %* (: /\$%OE 9\$, (?)

E#6%34/" ' / 0#1\$% 3 , /1/3# #S" #2' \$/4; "# 01#2\$#. I %- \$#4; - # 0#1\$ =#\$#3 - , #6%34/" ' < , - %-
#0' 2%" # , %4// ? , /2; , " /#6A#, ' + # , #6%3' \$; ?%0' 2; - %\$%4#=% 0#1\$% 3 Makefile
2##\$3/\$2\$3. < 7/C - %\$/=#1' ' .) *\$#+ Makefile 0#1\$8 0/1/: ' 24/" 8 3 %45%3' \$" #+ 0#1(, - / '
, #6%34/" 8 3 0/1+//" " . < SUBDIR, "%01' +/1:

```
É SUBDIR += newport
```

>#24/ \$#=# -%- 0#1\$' Makefile /=# - %\$/=#1' ' =#\$#38, "#38C 0#1\$ + #9" # ?%- #++' \$' \$; :

```
% git add category/Makefile category/newport  
% git commit
```

```
% git push
```

!

```
B/ ?%6. , ; $/ "%2$1# ' $; git-A. - ' , 4( , /1/3% O#1$#3; 20/&' %4; " 8C A. - 684
1%?1%6#S%" , 4( O1#3/1- ' Makefile - %9, #C - %$/=#1' ' .
```

22.1.2. S' (: 1* 4(\$-(\$ +HW, 4(\$) /+ /"D/\$ 7/- (: 9, * &\$8- %1+/* * /\$%\$=\$
9\$, (- ?

```
>1#3/1; $/ O#1$, 9/4%$/4; "# .6/, ' $; 2(, : $# # " -#+O' 4' 1. /$2( ' 2#6' 1%/$2( 3 O%- /$8
O1%3' 4; "#.
```

```
) =4%3/ J. -#3#, 2$3% O#1$' 1#37' -% O# $/2$' 1#3%" ' < 2#, /19%$2( 6#4// O#, 1#6" 8/
' " 2$1. - &' ' .L+. 1%?, /48 Portclippy / Portfmt ' poudriere.
```

```
)%+ " / #6(?%$/4; "# .2$1%" ($; 32/ O1/, . O1/9, /" ' (, "# .6/, ' $/2; , : $# ' 2O1%3' 4' O1#2$8/.
```

```
Q24' O#1$ O#2$. O' 4 # $ # $O1%3' $/4(, -#$#18C 1%" // " / . : %2$3#3%4 3 >1#/- $/, , #6%3; $/ ' + (
*$#=# : /4#3/- % 3 1%?, /4 E#O#4" ' $/4; " 8/ . : %2$" ' - ' 2O' 2- % . : %2$" ' - #3 FreeBSD.
```

P%- 1#CS/ PR, /24' O#1\$ 684 # \$O1%34/" -%- PR. Z\$#68 ?%- 18\$; PR, ' ?+/" ' \$/ 2#2\$#(" / "%
Issue Resolved' . 2\$%" #3' \$/ 1/G/" ' / -%- Fixed.

!

```
Q24' O# -%- #C-$# O1' : ' " / ' 2O#4; ?#3%" ' / poudriere , 4( $/2$' 1#3%" ' (
"#3#=# O#1$% " /3#?+#9" #, + ' "' +%4; " 8C "%6#1 $/2$' 1#3%" ' ( 3- 4< : %/$
24/, . < 7. < O#24/, #3%$/4; " #2$; :
```

```
# make install
# make package
# make deinstall
# pkg add package you built above
# make deinstall
# make reinstall
# make package
```

```
@61%$' $/ 3" ' +%" ' /, : $# poudriere (34(/$2( *$%4#" #+ , 4( 26#1- ' O%- /$#3.
Q24' O#1$ " / 2#6' 1%/$2( 3 poudriere, #" 6. , /$ . , %4D".
```

22.2. J&- 1+/* + ' "H+' (% " 3H+= \$ 9\$, (-

22.2.1. 2- # "&- 1* (: ' "H+' (% " 3H* E 9\$, (?

```
L" : %4% O1#: ' $%CS/ 1%?, /4 # -#O' (A 1/O#?' $#1' /3. >/1/, . , %4/" ' /+ O#1$% " /#6A#, ' + #
.6/, ' $; 2(, : $# # $ " /=# " / ?%3' 2($ , 1. = ' / O#1$8.
```

```
¥ K6/, ' $/2; , : $# " /$ ?%3' 2' + #2$/C # $ O#1$% 3 - #44/- &' ' O#1$#3:
```

```
\ M+ ( O%- /$% O#1$% (PKGNAME) O#(34(/$2( 1#3" # 3 #, "#C 2$1#- / 3 O#24/, " /+ 5%C4/
```

INDEX.

```
\ B' #, ' " , 1. =#C O#1$ " / 2#, /19' $ 2284#- "% -%$4#= O#1$% ' 4' PKGNAME 3 23# ' A
Makefiles
```

!

```
>1' ' 20#4; ?#3%" ' ' Git 1%22+#$1' $/ 3#?+#9" #2$; ' 20#4; ?#3%" ' ( git-
grep(1), $%- -%- # " ?" %: ' $/4; " # 682$1//, : /+ grep -r.
```

¥ P%\$/+ . , %4' \$/ O#1\$:

```
\ K, %4' $/ 5%C48 ' -%$4#= O#1$% 2 O#+#7; < git rm.
\ K, %4' $/ . -%?" ' / SUBDIR , 4( O#1$% 3 Makefile 1#, ' $/4; 2- #=# -%$4#=#.
\ E#6%3; $/ ?%O' 2; 3 ports/MOVED.
\ K, %4' $/ O#1$ ' ? ports/LEGAL, /24' # " $%+ O1' 2. $2$3. /$.
```

M4' 38 + #9/\$/ ' 20#4; ?#3\$; 2- 1' O\$ rmpport ' ? ports/Tools/scripts. F\$#\$ 2- 1' O\$ 684 "%O' 2%"
 Vasil Dimov <vd@FreeBSD.org>. >1' #S01%3- / 3#01#2#3 #6 *\$##+ 2- 1' O\$/ 3 LO' 2#- 1%2284- ',
 O#23(7D" " 8C >#1\$%+ FreeBSD, O#9%4. C2\$, \$%- 9/ -#O' 1. C\$/ Chris Rees <
 crees@FreeBSD.org>, \$/- . 7 /=# 2#01#3#9, %< 7 /=#.

22.3. 2- # 9+, +) +' (* (: 9\$, (% /\$%\$+) +' (\$?

1.) 80#4" ' \$/ \$7%\$/4; " . < O1#3/1- . -#44/- &' ' O#1\$#3 "% "%4' : ' / ?%3' 2' + #2\$/C #S
 2\$%1#=# 1%20#4#9/" ' (' 4' ' +/" ' O#1\$% ' #6" #3' \$/ ' A. P%O. 2- grep O# 5%C4. INDEX
 "/, #2\$%\$#: /", O#2- #4; - . " /- # \$#18/ O#1\$8 ' +/<\$?%3' 2' + #2\$' , 3- 4<: D" " 8/ : /1/?
 O%1%+/\$18 -#+O' 4(&' ' . J/- #+/" , ./ \$2(380#4" ' \$; O#4" 8C O# 2- 2 O#+#7; < git-
 grep(1) O# - #44/- &' ' O#1\$#3.
2. K, %4' \$/ ?%O' 2; SUBDIR ' ? Makefile 2\$%1#C -%\$/#1' ' ' , #6%3; \$/ ?%O' 2; SUBDIR 3
 Makefile " #3#C -%\$/#1' ' .
3. E#6%3; \$/ ?%O' 2; 3 ports/MOVED.
4. ># ' 7' \$/ ?%O' 2' 3 xml-5%C4%A 3" . \$1' ports/security/vuxml ' 2- #11/- \$' 1. C\$/ ' A
 2##\$3/\$2\$3. < 7' + #61%?#+.) : %2\$" #2\$' , O1#3/1; \$/ O1/, 8, . 7' / O%- /\$8 2 " #38+
 ' +/" /+, 3/12' (-#\$#18A + #9/\$ 3- 4<: %\$; " #38C O#1\$.
5. >/1/+ /2\$' \$/ O#1\$ 2 O#+#7; < git mv.
6. P%5' - 2' 1. C\$/ ' ?+/" /" ' (.

22.4. 2- # ' #S9*, \$%- (: 9\$, (% /\$%\$+) +' (\$?

1. L- #O' 1. C\$/ O#1\$ 2 O#+#7; < cp -R old-cat/old-port new-cat/new-port.
2. E#6%3; \$/ " #38C O#1\$ 3 5%C4 new-cat/Makefile.

3. M?+/' ' \$/ 2#, /19' +#/ 3 new-cat/new-port.

4. P%5' -2' 1. C\$/ ' ?+/' /' ' (.

22.5. T-) \$, \$7#- 9\$, (\$%

22.5.1. F(\$ (- #S+ Ç7-) \$, \$7#- 9\$, (\$%È?

ÇP%+#1#?- % 0#1\$#3È (ports freeze) Ñ *\$# #="'' : /" "#/ 2#2\$#(" ' /, 3 -#\$#1#/ , /1/3# 0#1\$#3 0/1/3#, ' 4#2; 0/1/, 380. 2-#+ 1/4' ?%. @" # ' 20#4; ?#3#4#2; , 4(#6/20/: /" ' (6#4// 382#- #=# -%: /2\$3% 0%- /\$#3, 0#2\$%34(/+8A 2 1/4' ?#+. @68: " # *\$# , 4' 4#2; " /2- #4; -# " /, /4; .) \$/: /" ' / *\$#=# 31/+/' ' ' 201%34(4' 2; 01#64/+8 2# 26#1- #C, % \$%- 9/ 2\$1# ' 4' 2; 0%- /\$8 , 4(1/4' ?%. F\$% 01%- \$' -% 6#4; G/ " / 01' +/' (/S2(, \$%- -% 0%- /\$8 , 4(1/4' ?#3 \$/0/1; 2#6' 1%< \$2(' ? \$/- . 7/C 2\$%6' 4; " #C - 3%1\$%4; " #C 3/\$- ' .

E4(0#4. : /" ' (, #0#4" ' \$/4; " #C ' ' 5#1+%&' ' # \$#+, -%- , /4%\$; 24' (" ' / -#++' \$#3 3 -3%1\$%4; " . < 3/\$- ., 2+. I%- #3% 01#&/, . 1% 0#4. : /" ' (1%?1/G/" ' ("% 24' (" ' / -#++' \$% 2 -3%1\$%4; " #C 3/\$- #C?.

22.6. 2%- , (- 1: /O+ %+(#*

22.6.1. 2- #S%- 9, \$@+&", - 9\$1" 4+/*5 , -7, +L +/*5 /- ' 1*5/*+ #S)) * (- ' #%- , (- 1: /SE %+(#SE?

># 2#2\$#(" < "% 30 " # (61(2020 =#, % (3" #/ #, #61/" ' / , 4(3" /2/" ' (' ?+/' /" ' C 3 -3%1\$%4; " . < 3/\$- . " / \$1/6. /\$2(.

22.6.2. 2- #S%- 9, \$@+&", - ' 1*5/*5 #S)) * (\$% % #%- , (- 1: /" 3 %+(#"?

L4' (" ' / -#++' \$#3 3 -3%1\$%4; " . < 3/\$- . (01#&/22, -#\$#18C +8 0# ' 2\$#1' : /2- ' + 01' : ' "%+ "%?83%/+ MFH) #: /" ; 0#A#9/ "% MFC -#++' \$#3 3 1/O#?' \$#1' ' src, 0#*\$#+. 3 #2" #3" #+:

```
% git checkout 202102
% git cherry-pick -x $HASH
(verify everything is OK, for example by doing a build test)
% git push
```

=, / \$HASH Ñ *\$# A*G -#++' \$%, -#\$#18C 38 A#\$' \$/ 2-#0' 1#3%; 3 -3%1\$%4; " . < 3/\$- .. >%1%+/\$1 -x =%1%" \$' 1./\$, : \$# A*G \$HASH ' ? 3/\$- ' main 6. , /\$ 3-4<: D" 3 " #3#/ 2##67/" ' / -#++' \$% 3 -3%1\$%4; " #C 3/\$- /.

22.7. 6\$7&- /*+ /\$%\$E #- (+=\$, **

22.7.1. 2- #S%- 9, \$@+&", - ' \$7&- /*5 /\$%\$E #- (+=\$, **?

>#9%4. C2\$%, #?" %- #+; \$/2; 2 >1/, 4#9/" ' / " #3#C -%\$/#1' ' 3 J. -#3#, 2\$3/ FreeBSD 0#

2#?, %" ' < 0#1\$#3. >#24/ 380#4" /" ' (*\$#C 01#&/, . 18 ' "%?"%: /" ' (PR 3 =1. 00/ Ñ V1. 00% O/" /, 9/1#3 E/1/3% >#1\$#3 FreeBSD <portmgr@FreeBSD.org>, 1/G/" ' / #6 #, #61/" ' ' 01' ' ' +%/S2(' + ' . Q24' 1/G/" ' / O#4#9' S/4; "#/, ' A #6(?%" " #2S; < (34(/S2(:

1.) 80#4" ' \$/ 32/ " /#6A#, ' +8/ 0/1/+ /7/" ' (. (F\$# 01' +/" ' +# \$#4; -# - 5' ?' : /2- ' + -%\$/=#1' (+.)
2. @6" #3' \$/ #01/, /4/" ' / VALID_CATEGORIES 3 5%C4/ ports/Mk/bsd.port.mk.
3. B%?"%: ' \$; PR #61%\$" # "% 3%2.

22.7.2. F(\$) /+ /"D/\$ ' &+1- (: &15 ' \$7&- /* 5 /\$%\$E R*7* 4+' #SE #- (+=\$, **?

1. @6" #3' \$/ Makefile -%9, #=# 0/1/+ /7/" " #=# 0#1\$%. >#- % " / O#, -4< : %CS/ " #3. < -%\$/=#1' < - 26#1- /.

E4(*\$#=# 3%+ O#S1/6. /S2(:

1. M?+/" ' \$/ CATEGORIES O#1\$% (*\$# 684% &/4; . 01%9" /" ' (, O#+ " ' \$/?). B#3%(-%\$/=#1' (. -%?"% O/13#C. F\$# O#+#9/\$. 6/, ' \$; 2(, : \$# PKGORIGIN . -%?" O1%3' 4; " #.
2.) 80#4" ' \$/ -#+%" , . make describe. >#2- #4; - . -#+%" , % make index 3/1A" /=# . 1#3" (, -#\$#1. < 38 ?%O. 2\$' \$/ : /1/? " /2- #4; -# G%=#3, (34(/S2(' \$/1%&' /C make describe , 4(32/C ' /1%1A' ' O#1\$#3, #6"%1. 9/" ' / #G' 6#- "% *\$#+ *\$%O/ 2*- # " #+ ' \$ 31/+ (, ' ?6%3' 3 # \$ " /#6A#, ' + #2\$' O/1/?%O. 2- %\$; *\$# \$ G%= 0#?9/.
3. Q24' 38 A#\$' \$/ 68\$; , /C2\$3' \$/4; " # \$7%\$/4; " 8+, 2/C: %2 + #9/\$ 68\$; O#, A#, (7 // 31/+ (?%O. 2\$' \$; portlint(1).

2. >1#3/1; \$/, : \$# ?" %: /" ' (PKGORIGIN . -%?" 8 3/1" #. L' 2\$/+% O#1\$#3 ' 20#4; ? . /\$?%O' 2; CATEGORIES -%9, #=# 0#1\$% , 4(2#?, %" ' (/=# PKGORIGIN , -#\$#18C 24. 9' \$, 4(23(? ' . 2\$%" #34/" " 8A 0%- /\$#3 2 - %\$%4#=#+ O#1\$%, ' ? -#\$#1#=# " ' 684' 2#61%" 8. Q24' *\$% ?%O' 2; " /3/1"% , \$%- ' / 1%201#2\$1%" D" " 8/ ' " 2\$1. +/" \$8 , 4(1%6#\$8 2 O#1\$%+ ' , -% pkg-version(8) ' portupgrade(1), " / 6. , . \$ 1%6#\$%\$; .

E4(*\$#=# ' 20#4; ? . CS/ ' " 2\$1. +/" \$ chkorigin.sh: env PORTSDIR=/path/to/ports sh -e /path/to/ports/Tools/scripts/chkorigin.sh. F\$# 01#3/1' \$ -%9, 8C 0#1\$ 3 , /1/3/ O#1\$#3, , %9/ \$/, -#\$#18/ " / 23(?%" 8 2# 26#1- #C, O#*\$#+. 38 + #9/\$/ ?%O. 2\$' \$; /=# 21%?. O#24/ #O/1%&' ' O/1/+ /7/" ' (. >#, 2- %?-%: " / ?%6. , ; \$/ O1#3/1' \$; PKGORIGIN , 4(32/A O#, : ' " D" " 8A O#1\$#3 (slave ports) \$/A O#1\$#3, -#\$#18/ 38 \$#4; -# : \$# O/1/+ /2\$' 4' !

3. B% 3%G/C 4#- %4; " #C 2' 2\$/+ / O1#\$/2\$' 1. CS/ O1/, 4%=%/+ 8/ ' ?+/" /" ' (: 2" %: %4% ?%- #++/" \$' 1. CS/ ?%O' 2' SUBDIR 3 5%C4%A Makefile 2\$%18A -%\$/=#1' C O#1\$#3; ?%\$/+ 3- 4< : ' \$/ 26#1- . " #3#C -%\$/=#1' ' 3 ports/Makefile. P%O. 2\$' \$/ make checksubdirs 3 ?%\$1#". \$8A -%\$%4#=#A -%\$/=#1' C, : \$#68 O1#3/1' \$; ?%O' 2' SUBDIR. P%\$/+ 3 -%\$%4#=#/ ports/ 380#4" ' \$/ make index. F\$# + #9/\$?%" (\$; 6#4// 40 + ' " . \$, %9/ " % 2#31/+ /" " 8A

2' 2\$/+A; #, "%-# *\$# "/#6A#, ' +8C G%= , 4(01/, #S31%7/"' (01#64/+ . , 1. =' A
O#4; ?#3%\$/4/C.

4. >#24/ *\$#=# +#9" # ?%5' -2' 1#3%; #6" #34D" " 8C 5%C4 ports/Makefile, :\$#68
O#, -4<:' \$; " #3. < -%\$/=#1' < - 26#1-/, % \$%-9/ 2, /4%; -#++' \$ '?+/"'/' (+ 3
5%C4/ Makefile , 4(2\$%1#C -%\$/=#1' ' ' 4' -%\$/=#1' C.

5. E#6%3; \$/ 2##\$3/\$2\$3. < 7' / ?%0' 2' 3 ports/MOVED.

6. @6" #3' \$/ , #- . +/" \$%&' < , ' ?+/"' ' 3:

\ 20' 2#- -%\$/=#1' C 3 J. -#3#, 2\$3/ FreeBSD O# 2#?, %" ' < O#1\$#3

7. N#4; -# O#24/ \$#=#, -%- 32/ 38G/O/1/: ' 24/" "#/ 6. , /\$ 380#4" /" # ' 6#4; G/ "' - \$# "/
2##67%/\$ # O1#64/+%A 2 " #38+' O#1\$%+', 2\$%18/ O#1\$8 24/, ./ \$., %4' \$; ' ? ' A
O1/9" ' A +/2\$ 3 1/O#?' \$#1' ' .

22.7.3. F(\$) /+ /"D/\$ ' &+1- (: &15 ' \$7&- /*5 /\$%\$E %*, (" - 1: /\$E #- (+=\$, **?

FS# "%+ " #=# O1#7 /, : /+ 5' ?' : /2-%(-%\$/=#1' (. N1/6. /\$2(32/=# " /2- #4; -# ' ?+/"' /" ' C:

¥ 20' 2#- -%\$/=#1' C 3 J. -#3#, 2\$3/ FreeBSD O# 2#?, %" ' < O#1\$#3

22.8. ! - 7/O+ %\$9, \$' O

22.8.1. 6"H+' (% " 3 (1* * 7) +/+/*5, #\$(\$, O+) \$D/\$ 7-R* #' * , \$%- (: 8+7 7-9, \$' - \$&\$8, +/*5 " ' \$9, %\$D&- 3H+= \$?

@67// #, #61/"' / , 4(6#4; G' " 2\$3% O#1\$#3 O1' +/" (/ \$2(- 24/, . < 7' + \$' O#+ ' 201%34/"' C:

¥ T#4; G' " 2\$3# ' ?+/"' /" ' C ' " 51%2\$1. - \$. 18 O#1\$% (\$# /2\$; +#, /1" ' ?%&' (6/? ' ?+/"' /" ' (
5. "- &' #"%4; "#2\$'). B#O1' +/1, *\$# 3-4<: %/\$ O/1/A#, "% " #38/ +%- 1#28 USES,
3-4<: /" ' / O#, 1#6" 8A 26#1#- ' O/1/A#, "% " #38/ 2' " \$%-2' 28 2' 2\$/+8 O#1\$#3.

¥ N1' 3' %4; " 8/ ' " 9#, 797) - 7' 201%34/"' (, 4(26#1- ' ' 380#4" /" ' (.

¥ E#- . +/" \$%&' (' 4' ' ?+/"' /" ' (+/\$%, %" " 8A , 4(O#1\$#3, \$%- ' / -%- pkg-descr ' 4' COMMENT.

#

M2-4<: /" ' (+ ' (34(< \$2(4<68/ -#+0#" /" \$8, O#, , /19' 3%/+8/ V1.00%
O/" /, 9/1#3 E/1/3% >#1\$#3 FreeBSD <portmgr@FreeBSD.org> ' 4' I#+%, %
&1% T/?#O%2" #2\$' <security-officer@FreeBSD.org>.
B/2%" - &' #"' 1#3%" " 8/ -#++' \$8 3 O#1\$8, -# \$#18/ O#, , /19' 3%< \$2(*\$' +'
=1.00%+', " /, #0. 2\$' +8.

22.8.2. 2- # "7/- (: ,) \$E 9\$, (' \$8*, - +(' 5 9, - %* 1: /\$ * 1* /+ (?

>%- /\$8 2#6' 1%< \$2(" /2- #4; -# 1%? 3 " /, /4<. Q24' 26#1-% O#1\$% ?%3/1G%/ \$2(" / ., %: "#,
2#O1#3#9, %< 7' C O#4. : ' \$ O' 2; +# # \$ pkg-fallout@FreeBSD.org.

@\$: D\$8 O# 32/+ 26#1-%+ O%- /\$#3 (#5' &' %4; " 8/, *- 20/1' +/" \$%4; " 8/ ' 6/? 1/=1/22' ')

%=1/= ' 1. < \$2(" % pkg-status.FreeBSD.org.

22.8.3. N &\$8- %* 1 /\$%OE 9\$, (. ? "D/\$ 1* &\$8- %15(: += \$ % INDEX?

B/\$. R%#4 + #9/\$ 68\$; 2#?, %" 380#4" /" ' /+ - #+%", 8 make index, ' 4' + #9" # ?%=1. ?' \$; 01/, 3%1' \$/4; " # 2="/ /1' 1#3% " . < 3/12' < 2 0#++#7; < make fetchindex.

22.8.4. S' (: 1* &, "=* + R- E1O, #\$((\$, O+) /+ /+1: 75 * 7) +/5(: ?

U< 6#C 5%#4 " /O#21/, 2\$3/" " # 3 ports/ ' 4' 4< 6#C 5%#4 3 0#, - %\$%4#=#, "%?3%" ' / - # \$#1#=# "%: ' " %/\$2(2 ?%=4%3" #C 6. - 38 (Mk/, Tools/ ' \$., .)) : %2\$" #2\$' , V1.00% O/" /, 9/1#3 E/1/3% > #1\$#3 FreeBSD <portmgr@FreeBSD.org> #: /"; 1/3" #2\$" # # \$" #2' \$2(- ports/Mk/bsd.port*.mk, O#*\$#+. " / 3" #2' \$/ ' ?+/" /" ' (3 *\$' 5%#48, /24' " / A#\$' \$/ " %34/: ; " % 2/6(' A = " /3.

22.8.5. 2- # 9, - %* 1: /\$ \$8/\$%* (: #\$/ (, \$1: /" 3 ' ")) " &15 distfile 9\$, (-, + ' 1* R- E1 * 7) +/* 1' 5 8+7 * 7) +/+/* 5 %+, ' * * ?

I #=, % - #" \$1#4; "% (2. + + % 5%#4% , ' 2\$1' 6. \$' 3% #6" #34(/\$2(' ?-?% \$#=#, : \$# %3\$#1 #6" #3' 4 5%#4 6/? ' ?+/" /" ' (1/3' ?' ' O#1\$, 2##67/" ' / - #++' \$% 3- 4< : %/\$ 23#, - . 2##\$3/\$2\$3. < 7' A 1%?4' : ' C +/9, . #1' = " %4; " 8+ ' " #38+ 5%#4#+, ' 2\$1' 6. \$' 3%, : \$#68 . 6/, ' \$; 2(, : \$# 5%#4 , ' 2\$1' 6. \$' 3% " / 684 O#31/9, D" ' 4' ?4#" %+ /1/" " # ' ?+/" D". Q24' \$/-. 7%(3/12' (O#1\$% "%A#, ' \$2(3, /1/3/ O#1\$#3 . 9/ " /- # \$#1# / 31/+ (, - #0' (2\$%1#=# 5%#4% , ' 2\$1' 6. \$' 3% #68: " # , #2\$. 0" % " % FTP-2/13/1%A; 3 O1#\$' 3" #+ 24. : %/ 24/, . /\$ 23(?%\$; 2(2 %3\$#1#+ ' 4' 2#01#3#9, %< 7' +, : \$#68 38(2" ' \$; , 0#: /+. 5%#4, ' 2\$1' 6. \$' 3% ' ?+/" ' 42(.

22.8.6. 2- #) \$D/\$ 7-9, \$' * (: K# ' 9+, *) +/(- 1: /" 3 (+' (\$%" 3 ' 8\$, # " &+, +% - 9\$, (\$% (exp-run)?

>/1/, - #++' \$#+ ' ?+/" /" ' C, #- %?83%< 7' A ?" %: ' \$/4; " #/ 34' (" ' / " % O#1\$8, " /#6A#, ' + # 380#4" ' \$; \$/2\$#38C O1#=#" (exp-run). M201%34/" ' / + #9/\$ # \$" #2' \$; 2(- % - , /1/3. O#1\$#3, \$%- ' - 6%?#3#C 2' 2\$/+.

>#4" 8/ 26#1- ' 0%- /\$#3 6. . \$ 380#4" /" 8 2 0%\$: %+, , 01/, #2\$%34/" " 8+ ' # \$01%3' \$/4+, ' # \$01%3' \$/4; #6(?% " ' 201%3' \$; #6" %1. 9/" " 8/ O1#64/+8 (" *17) (2 \$%#94((O.) O/1/, - #++' \$#+.

1. >/1/C, ' \$/ O# 2284- / LS1%" ' &% 2#?, %" ' (" #3#C PR 3 Bugzilla.
2.) 86/1' \$/ O1#, . - \$, - - # \$#1#+. # \$" #2' \$2(3%G 0%\$: .
3. P%O#4" ' \$/ # \$: D\$ #6 #G' 6- / - % - #68: " #. B/ ?%6. , ; \$/ O1' 4#9' \$; ' 201%34/" ' /.
4. Q24' 33/1A. " %O' 2%" # Ç>#- %?%\$; , #O#4" ' \$/4; " 8/ O#4((Show Advanced Fields)È, "%9+' \$/ " % *\$#. N/O/1; 6. , /\$ " %O' 2%" # ÇL- 18\$; , #O#4" ' \$/4; " 8/ O#4((Hide Advanced Fields)È. LS%" . \$, #2\$. 0" 8 + " #=' / " #38/ O#4(. Q24' . 9/ " %O' 2%" # ÇL- 18\$; , #O#4" ' \$/4; " 8/ O#4(È, " ' : /=# , /4%\$; " / " . 9" #.
5.) 1%?, /4/ ÇFlagsÈ . 2\$%" #3' \$/ 54%= Çexp-runÈ 3 ?" %: /" ' / ? . E4(32/A #2\$%4; " 8A O#4/C O1' " %3/, /" ' ' - . 12#1% " % 4< 6#/ O#4/ # \$#61%9%< \$2(, #O#4" ' \$/4; " 8/ 23/, /" ' (.
6. @ \$01%3; \$/. E#9, ' \$/2; ?%3/1G/" ' (26#1- ' .

7. VI. 00% O/" /, 9/1#3 E/1/3% >#1\$#3 FreeBSD <portmgr@FreeBSD.org> #S3/\$' \$ 2
 ' " 5#1+%&' /C 3#?+#9" 8A 0%, /" ' (A.
8.) ?%3' 2' + #2\$' # \$ 0#24/, 2\$3' C:
- \ Q24' 0#24/, 2\$3' C " /\$, 01#&/, . 1% #2\$%" %34' 3%/\$2(?, /2;, ' ' ?+/" /" ' / + #9/\$
 68\$; ?%- #++' : /" #, #9' , %(4< 68A , 1. = ' A " /#6A#, ' + 8A . \$3/19, /" ' C.
- i. Q24' 3#?' ' - ". \$ 01#64/+8, ' A) 7#%/#1(: # ' 201%3' \$; , 4' 6# "%01(+. < 3
 , /1/3/ 0#1\$#3, 4' 6# , #6%3' 3 ' ?+/" /" ' (3 01/, #2\$%34/" " 8C 0%\$: .
- ii. >#24/ *\$#=# 3/1" ' \$/2; - G%=. 6, . - %?%3, : \$# 01#64/+%. 2\$1%" /" %, ' , #9, ' \$/2;
 0#3\$#1" #=# ?%0. 2- % exp-run. >#3\$#1(CS/, 0#- % #2\$%< \$2(" /' 201%3" 8/ 0#1\$8.

23. <, \$81+) O, >- , - #(+, /O+ &15 , - 7, - 8\$(4* #S%, /+ 5%153H* >' 5 #S)) * ((+, -) *

B/2- #4; - # 4<, /C, ' +/< 7' A , #2\$. 0 - +%G' "%+ FreeBSD, " / #64%, %< \$ 01%3%+' "% - #++' \$8.
 >#: \$' 32/ 0#4#9/" ' (*\$#=# , #- . +/" \$% 01' +/" ' + 8 ' - \$%- ' + 1%?1%6#S: ' -%+ (?%
 ' 2- 4<: /" ' /+ %20/- \$#3, 20/&' 5' : " 8A , 4(- #++' \$#3 ' 23(?%" "#=# 2 " ' + ' : 4/" 2\$3% 3
 1%2284- %A.) : %2\$" #2\$' , + 8 1/- #+/" , . /+ #?" %- #++' \$; 2(2# 24/, . < 7' +:

¥ !, + ' " ' 2\$1%\$' 3" 8/ , /\$%4'

¥ E4(32/A

!

>#01#2' \$/ 3%G/=# "%2\$%3" ' -% , #6%3' \$; 3%2 3 20' 2#- "E#0#4" ' \$/4; " 8/
 . : %2\$" ' - ' " (doc/shared/contrib-additional.adoc), /24' 3%2 \$%+ /7D " /\$.

¥ @\$" #G/" ' (2 1%?1%6#S: ' -%+'

¥ J. - #3#, 2\$3# 0# 682\$1#+. "%: %4. 1%6#\$8 2 SSH

¥ T#4; G#C 20' 2#- 01%3' 4 - #++' \$\$/1#3 FreeBSD

24. M/R\$,) - @* 5 \$ Google Analytics

># 2#2\$#(" ' < "% 12 , /-%61(2012 =#, % "% 2%CS/ 01#/- \$% FreeBSD 684 3- 4<: /" Google
 Analytics , 4(26#1% "% # ' + " #C 2\$%\$' 2\$' - ' ' 20#4; ?#3%" ' (2%CS%.

!

># 2#2\$#(" ' < "% 3 + %1\$% 2022 =#, % Google Analytics 684 . , %4D" ' ? 01#/- \$%
 FreeBSD.

25. ! - 7/O+ %\$9, \$' O

25.1. 2- # 9\$1" 4* (: &\$' (" 9 # people.FreeBSD.org &15
, - 7) +H+/* 5 1* 4/\$E * 1* 9, \$+#(/\$E * /R\$,) - @* * ?

people.FreeBSD.org Ñ *\$# \$# 9/ 2%+ #/, : \$# ' freefall.FreeBSD.org. >1#2\$# 2#?, %CS/ - %\$%4#=
public_html.) 2D, : \$# 38 0#+/2\$' \$/ 3 *\$#\$ - %\$%4#=#, 6. , /\$ %3\$#+%\$' : /2- ' , #2\$. 0" # 0# %, 1/2.
<https://people.FreeBSD.org/>.

25.2. X&+ >, - /5(' 5 - , >*%O ' 9*' #\$\$, - ' ' O1#* ?

L0' 2- ' 1%2284- ' %1A' 3' 1. <\$2(3 /local/mail " % freefall.FreeBSD.org.

25.3. N >\$4" ' (- (: /- ' (- %/* #)\$) /\$%\$=\$ #)\$) * ((+, - .
2- #SE 9, \$@+' ') /+ /"D/\$ 9, \$E(* ?

L+., #- . +/" \$ >1#&/, . 1% 2#?, %" ' ("#3#C. : DS" #C ?%O' 2' "% 3" . \$1/" "' A 2\$1%" ' &%A.

26. <, +*) "H+' (%- * 9, *%* 1+=* * &15
#\$)) * ((+, \$% FreeBSD

26.1. <, * 7/- / * +

>1' ?" %" ' / 3 -%: /2\$3/ -3%4' 5' &' 1#3%" "#=# ' " 9/" /1%-01#=1%++' 2\$% Ñ *\$# 2%+(
, #4=#3/: "%(&/" "#2\$;. I 1#+/ \$#=#, 3#?+#9" #2\$; 1%6#\$%\$; 2 #, "' + ' ' ? 4. : G' A
20/&' %4' 2\$#3, # 32\$1/: / 2 -# \$#18+ ' +/: \$%/ \$ 4<6#C ' " 9/" /1, Ñ *\$# #4' : " 8C 6#" . 2!

26.2. FreeBSD Mall

I #++' \$\$/18 FreeBSD +#=. \$ 6/204%\$ " # 0#4. : ' \$; "%6#1 ' ? 4 CD ' 4' DVD "% -#" 5/1/" &' (A
: /1/? FreeBSD Mall, Inc..

26.3. Gandi.net

[Gandi](https://Gandi.net) 01/, #2\$%34(/\$.24.= ' A#2\$' "=% 3/6-2%CS#3, #64%: " 8A 38: ' 24/" ' C, 1/'= ' 2\$1%&' '
, #+/" #3' 2/1\$' 5' - %\$#3 X.509.

[Gandi](https://Gandi.net) 01/, #2\$%34(/\$ 2- ' , - . E-rate 32/+ 1%?1%6#\$: ' -%+ FreeBSD. Z\$#68 . 01#2\$' \$; 01#&/22
0#4. : /" ' (2- ' , - ' , 2" %: %4% 2#?, %CS/ . : DS" . < ?%O' 2; [Gandi](https://Gandi.net), ?%O#4" ' \$/ 04%\$/9" 8/ , %" " 8/ '
386/1' \$/ 3%4<\$.. P%\$/+ #S01%3; \$/ O' 2; + # 0# %, 1/2. non-profit@gandi.net 2 3%G/=# %, 1/2%
[@freebsd.org](https://freebsd.org), . - %?%3 3%G ' , /" \$' 5' - %\$#1 [Gandi](https://Gandi.net).

26.4. rsync.net

rsync.net 01/, #2\$%34(/\$ #64%: " #/ A1%" ' 4' 7/ , 4(1/?/13" #=# -#O' 1#3%" ' (3" / #5' 2%,

#OS' +' ?' 1#3%" "#/ , 4(0#4; ?#3%\$/4/C UNIX. MA 2/13' 2 0#4" #2\$; < 1%6#\$/ \$ "% FreeBSD ' ZFS.

rsync.net 01/, #2\$%34(/\$ 6/204%" 8C %- -%. " \$ "% 500 VT "%32/=, % 1%?1%6#\$: ' -%+ FreeBSD.
>1#2\$# ?%1/= ' 2\$1' 1. C\$/2; 0# %, 1/2. <https://www.rsync.net/freebsd.html>, ' 20#4; ?. (3%G %, 1/2
[@freebsd.org](https://www.freebsd.org), : \$#68 0#4. : ' \$; *\$#\$ 6/204%" 8C %- -%. " \$.