GNU Mes – Reduced Binary Seed bootstrap

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Outline

1. Reduced Binary Seed bootstrap: Introduction.
2. Reduced Binary Seed bootstrap: Why?
3. Reduced Binary Seed bootstrap: How?
4. Reduced Binary Seed bootstrap: Future.
5. Thanks
6. Legalese
7. Extra: Maxwell Equations of Software
8. Extra: History
9. Extra: Timeline
10. Extra: Metrics
GNU Mes

- A Scheme interpreter written in ~5,000LOC of simple C.
- A C compiler written in Scheme.
- Built on eval/apply, the Maxwell Equations of Software.
What is a Compiler?

A compiler takes source code and produces executable object code

```plaintext
$ gcc hello.c -o hello
$ ./hello => "Hello, Mes!"
$ gcc hello.c -S -o hello.s
```

```plaintext
hello.c

void main()
{
    puts("Hello, Mes!");
}
```

```plaintext
hello.s

main:  push %ebp
       mov %esp,%ebp
       push _string_0
       call puts
       add $4,%esp
       leave
       ret

_string_0:  .string "Hello, Mes!"
```

```plaintext
janneke@gnu.org (FOSDEM'19) GNU Mes – Reduced Binary Seed bootstrap 2019-02-02 4 / 64
```
What is a Compiler?

A compiler takes source code and produces executable object code

```bash
$ gcc -c hello.s -o hello.o
$ gcc hello.o -o hello
$ ./hello => "Hello, Mes!"
```

**hello.o object code**

5589e5689b020001e8dc00000083c404c9c3

**hello executable code**

7f454c460101...5589e5689b020001e8dc00000083c404c9c3
What is a Binary Seed?

1. A binary (program) that was not build from source.
2. A binary (program) that was injected from a previous generation.
   - Think: Binutils, GCC, Glibc, Go, Haskel, Java, Perl, Rust, ...
What is a Bootstrap Seed?

In Guix 0.16 ~250MB

- "bootstrap-binaries": bash, binutils, bzip2, coreutils, gawk, gcc, glibc, grep, gzip, patch, sed, tar, and xz.

In Debian ~ 450MB

- "debootstrap" + "build-essential":
  - adduser, apt, base-files, base-passwd, bash, binutils, bsdutils, bzip2, coreutils, cpp, cpp-6, dash, debconf, debian-archive-keyring, debianutils, diffutils, dpkg, dpkg-dev, e2fslibs, e2fsprogs, findutils, g++, g++-6, gcc, gcc-6, gcc-6-base, gpgv, grep, gzip...
What is a Bootstrap?

Impossible task: pull yourself up on your boot straps

Software: to create your first: kernel, shell, C compiler, ...

source + ?? = binary
How to Bootstrap: An Old Recipe... 

Recipe for yoghurt: Add yoghurt to milk – Anonymous
How to Bootstrap: Create your first GCC

Traditional recipe: like yoghurt

source + binary - 1 = binary

... and done!
GNU Mes: Reduced Binary Seed bootstrap

GNU Mes v0.19 (dec 2018)

- mes.c: small Scheme interpreter written in a simple C subset
  - 5000LOC
  - mostly Guile-compatible
- mescc.scm: A C compiler written in mes-compatible Guile Scheme
  - Nyacc C99 parser
- Mes C Library
  - libc.c: small C library for mes.c (25 functions, 1000LOC)
  - libc+tcc.c (80 functions, 3000LOC)
  - libc+gnu.c: bootstrap support libraries (160 functions, 6000LOC)

Reduced Binary Seed bootstrap (unreleased: @core-updates)

- Bootstrap GNU without binutils, GCC, or C Library
- Halves the size of the trusted set of binaries
  - Debian: 450MB, Guix: 250MB, RBSb-Guix: 130MB
Reduced Binary Seed bootstrap: Why?

Safety/Security
- Ken Thompson’s "Reflections on trusting trust" attack.

Moral duty
- James Comey: ought to take responsibility for safety and security.

We like source
- Everything in Guix is built from source, except the bootstrap binaries.

Tradition
- This is how we used to do it.

Pragmatism
- Support new hardware architecture
## Legality

- Is it even legal to distribute a GCC binary in DisneyWorld?

## Inspiration

- Stage0’s hex0 Monitor/Assembler.
It’s interesting: the "trusting trust" attack has actually gotten easier over time, because compilers have gotten increasingly complex, giving attackers more places to hide their attacks.

Here’s how you can use a simpler compiler – that you can trust more – to act as a watchdog on the more sophisticated and more complex compiler. – Bruce Schneier, 2006
Reflecting on 'Reflections on Trusting Trust’

Enterprises appear to be overlooking or bypassing robust software assurance processes and procedures.

Thompsons essay is probably more fitting today than it was when it was written.

The moral of this article is that you still cannot trust any software. – Peter Herdman, 2014
Bootstrappable builds focuses on minimizing the amount of bootstrap binaries. They’re not just interested in the direct "bootstrap" code to boot a computer, but also what is necessary to generate the direct bootstrap code.

The problem bootstrappable builds is trying to address is a real one, namely, they are worried about subverted bootstrap code. – David A. Wheeler, 2016
I put a piece of tape [...] over the camera [of my personal laptop ..] so that people who don’t have authority don’t look at you. I think that’s a good thing. I think people ought to take responsibility for their own safety and security. – US FBI director James Comey, 2016

That probably also applies to downloading binaries from the internet and running them; paraphrasing

The FBI thinks that we ought to bootstrap our computers from source.
These big chunks of binary code are practically non-auditable which breaks the source to binary transparency that we get in the rest of the package dependency graph.

Every unauditable binary leaves us vulnerable to compiler backdoors as described by Ken Thompson in the 1984 paper Reflections on Trusting Trust.

Thus, our goal is to reduce the set of bootstrap binaries to the bare minimum. – Ludovic Courtès (GNU Guix documentation, December 2017)
Is it legal to distribute a GCC binary in DisneyWorld?

Only if you distribute, or give access to the ‘Corresponding Source’

The "Corresponding Source" for a work in object code form means all the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities. However, it does not include the work’s System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. – GNU GPL version 3

Let’s assume GCC was built using GCC-1

- Is GCC-1 a ‘System Library’? or
- Is GCC-1 a ‘general-purpose tool’? or
- Was GCC-1 a ‘generally available free program’?
As time goes on we will expire the binary packages for old releases. Currently we have binaries for squeeze, lenny, etch, sarge, woody, potato, slink, hamm and bo available, and only source code for the other releases. –

www.debian.org/distrib/archive
Inspiration: Stage0’s 500 byte hex0 Monitor

## ELF Header
7F 45 4C 46 ## e_ident[EI_MAG0-3] ELF’s magic number
02 ## e_ident[EI_CLASS] Indicating 64 bit
01 ## e_ident[EI_DATA] Indicating little endianness
...

## ascii other
48 c7 c0 ff ff ff ff # mov $0xffffffffffffffff,%rax
c3 # retq

## start
49 c7 c7 ff ff ff ff # mov $0xffffffffffffffff,%r15
49 c7 c6 00 00 00 00 # mov $0x0,%r14

## Loop
48 c7 c2 01 00 00 00 # mov $0x1,%rdx
48 c7 c6 99 01 60 00 # mov $0x600199,%rsi
How: Remove Yoghurt-software!
How: Remove Yoghurt-software!
Is GNU GCC Yoghurt-software?
From boot-strap to boot-strip
Is TCC Yoghurt-software?
Is Mes+MesCC Yoghurt-software?
MesCC: Compile to M1

mescc -S scaffold/hello.c -o hello.M1
mescc scaffold/hello.c -o a.out

```c
void main () {
    puts ("Hello, Mes!");
}
```

```assembly
hello.M1
:main
    push___%ebp
    mov____%esp,%ebp
    sub____$i32,%esp %0x1054
    push___$i32 &_string_0
    call32 %puts
    add____$i8,%esp !0x4
    leave
    ret
```
MesCC [M1-macro]: Assemble to hex2

```
mescc -c scaffold/hello.c -o hello.hex2

hello.hex2
  :main
  55
  89e5
  81ec
  54100000
  68
  &_string_0
  e8
  %puts
  83c4
  04
  c9
  c3
```
## MesCC [hex2-linker]: Link to ELF

### M1-Macros

<table>
<thead>
<tr>
<th>Macro</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINE push__%ebp</td>
<td>55</td>
</tr>
<tr>
<td>DEFINE mov__%esp,%ebp</td>
<td>89e5</td>
</tr>
<tr>
<td>DEFINE sub__%esp</td>
<td>81ec</td>
</tr>
<tr>
<td>DEFINE push__$i32</td>
<td>68</td>
</tr>
</tbody>
</table>

### ...continued

<table>
<thead>
<tr>
<th>Macro</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINE call32</td>
<td>e8</td>
</tr>
<tr>
<td>DEFINE sub__$i32,%esp</td>
<td>81ec</td>
</tr>
<tr>
<td>DEFINE leave</td>
<td>c9</td>
</tr>
<tr>
<td>DEFINE ret</td>
<td>c3</td>
</tr>
</tbody>
</table>

### a.out

```asm
0100026d <main>:
  100026d: 55                  push  %ebp
  100026e: 89 e5               mov  %esp,%ebp
  1000270: 81 ec 54 10 00 00   sub  $0x1054,%esp
  1000276: 68 9b 02 00 01      push  $0x100029b
  100027b: e8 dc 00 00 00      call  100035c <puts>
  1000280: 83 c4 04           add  $0x4,%esp
  1000283: c9                  leave
  1000284: c3                  ret
```
Future: Aim for the Stars: Full Source Bootstrap
Aim for the Stars: Stage 0

hex1-assembler

black done, essential

cyano done, optional

hex0 Assembler

SET editor

hex0 Monitor
Aim for the Stars: Stage 1

M2-PLanet

- **black**: done, essential
- **cyan**: done, optional
- **green**: done, undecided
- **orange**: in progress, undecided

- cat
- Slow Lisp
- Stage0 FORTH
- cc_x86
- M2-Moon

M1 Macro assembler

- hex2 Assembler
- hex1 Assembler
Aim for the Stars: Stage 2

- **mescc**
- **mes.M2**
- **Mes C Lib.M2**
- **mescc-tools**
- **M2-PLanet**
- **M2-Moon**
- **cc_x86**
- **M1-Macro**

**Labels:**
- **black**: done, essential
- **red**: in progress, essential
- **orange**: in progress, undecided
Aim for the Stars: Stage mes

- gcc-core 2.95.3
- Mes C Lib + GNU
- tcc
- mescc
- Mes C Lib + tcc
- mes.M2
- bootstrap-binaries
- mescc-tools
- Mes C Lib.M2
- M2-Planet

black done, essential
red in progress, essential
Aim for the Stars: Stage mesboot

black done, essential
red in progress, essential

gcc 4.7.4

black done, essential
red in progress, essential

gcc 2.95.3

glibc 2.16

glibc 2.2.5

gcc-core 2.95.3

make

binutils

bootstrap-binaries

Mes C Lib +GNU

tcc
Aim for the Stars: Further reductions

**In progress**

- Gash: Scheme-only Bootstrap (Guix @wip-bootstrap)
  - Bootstrap Guix from only mescc-tools, mes, gash, guile.
- Mes v0.20: Mes C Lib support for awk, bash, sed, tar.
- Bootstrap Mes.M2 using M2-Planet.
- A Reduced Binary Seed bootstrap for Nix.
- Skip gcc-2.95.3 stage, build gcc-4.x directly?

**Later**

- Inspire the GCC developers to write their own bootstrap story.
- Remove bootstrap-mescc-tools, bootstrap-mes.
- Fully replace bootstrap-guile with bootstrap-mes.
- Other Architectures (ARM).
- Non-functional distributions (Debian, a *BSD?).
Aim for the Stars: Gash

Recent merger between historical Gash and Geesh

- **Gash**: experimental PEG parser for Bash
  - focus on converting shell to Guile
  - shelly Guile scripting and interactive use
- **Geesh**: LALR parser for POSIX sh
  - focus on sh compliance and bootstrap

Current focus

- Scheme-only bootstrap
- 0.1 release

Features

- Bootstraps Bash 4.4: configure script, make shell snippets
- awk lexer parser basename cat chmod cmp compress cp cut diff
dirname expr find grep ln ls mkdir mv printf reboot rm rmdir sed
reader sleep sort tar test testb touch tr uname uniq wc which
Thanks

- John McCarthy
- Eelco Dolstra
- Ludovic Courtès
- Matt Wette
- Jeremiah Orians
- Rutger van Beusekom

Thanks everyone else

- LISP-1.5
- GNU/Linux
- Nix
- Debian
- Reproducible builds
- Guix

Connect

- irc freenode.net #bootstrappable #guix
- mail guix-devel@gnu.org, bug-mes@gnu.org
- git https://git.savannah.gnu.org/git/mes.git
- web bootstrappable.org
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That was the big revelation to me when I [...] finally understood that the half page of code on the bottom of page 13 of the Lisp 1.5 manual was Lisp in itself. These were “Maxwell’s Equations of Software!” – Alan Kay
apply[fn;x;a] =
    [atom[fn] \rightarrow [eq[fn;CAR] \rightarrow caar[x];
            eq[fn;CDR] \rightarrow cdar[x];
            eq[fn;CONS] \rightarrow cons[car[x];cadr[x]];]
    eq[fn;ATOM] \rightarrow atom[car[x]];  
    eq[fn;EQ] \rightarrow eq[car[x];cadr[x]];  
    T \rightarrow apply[eval[fn;a];x;a]]

  eq[car[fn];LAMBDA] \rightarrow eval[caddr[fn];pairlis[cadr[fn];x;a]]; 
  eq[car[fn];LABEL] \rightarrow apply[  caddr[fn];x;  cons[cons[cadr[fn];
                                           caddr[fn]];a]]]

eval[e;a] = [atom[e] \rightarrow cdr[assoc[e;a]];  
             atom[car[e]] \rightarrow  
             [eq[car[e];QUOTE] \rightarrow cdr[e];  
              eq[car[e];COND] \rightarrow evcon[cdr[e];a];  
              T \rightarrow apply[car[e];evlis[cdr[e];a];a]];  
             T \rightarrow apply[car[e];evlis[cdr[e];a];a]]
(define (apply fn x a)
  (cond
    ((atom fn)
      (cond
        ((eq fn CAR) (caar x))
        ((eq fn CDR) (cdar x))
        ((eq fn CONS) (cons (car x) (cadr x)))
        ((eq fn ATOM) (atom (car x)))
        ((eq fn EQ) (eq (car x) (cadr x)))
        (#t (apply (eval fn a) x a)))))
    ((eq (car fn) LAMBDA)
      (eval (caddr fn) (pairlis (cadr fn) x a)))
    ((eq (car fn) LABEL)
      (apply (caddr fn) x (cons (cons (cadr fn)
                                  (caddr fn))
                            a)))))
(define (eval e a)
  (cond
   ((atom e) (cdr (assoc e a)))
   ((atom (car e))
     (cond ((eq (car e) QUOTE) (cadr e))
           ((eq (car e) COND) (evcon (cdr e) a))
           (#t (apply (car e) (evlis (cdr e) a) a))))
   (#t (apply (car e) (evlis (cdr e) a) a)))))
(define (assoc x a)
  (cond ((eq (caar a) x) (car a))
        (#t (assoc x (cdr a)))))

(define (pairlis x y a)
  (cond ((null x) a)
        (#t (cons (cons (car x) (car y))
                 (pairlis (cdr x) (cdr y) a)))))

(define (evcon c a)
  (cond ((eval (caar c) a) (eval (cadar c) a))
        (#t (evcon (cdr c) a)))))

(define (evlis m a)
  (cond ((null m) NIL)
        (#t (cons (eval (car m) a) (evlis (cdr m) a)))))
The freedom to

0. run the program as you wish, for any purpose
1. study how the program works, and change it if you wish
2. redistribute copies so you can help your neighbor
3. share copies of your modified versions with others

– Richard M. Stallman
1990s Reproducible GNU Tools @Cygnus

We made the GNU tools that we were shipping and supporting – and all of our test cases compiled by them – reproducible. That includes gcc, gdb, gas, binutils, gnu make, and a few other things. – John Gilmore
1984 Four Software Freedoms: GNU GPL
1990s Reproducible GNU Tools @Cygnus

2006 Nix: Purely Functional Software Deployment

- functional package management
- isolated builds
- Nix (and GNU Guix) are designed for reproducibility

Installation of a component can lead to the failure of previously installed components; a component might require other components that are not present; and it is difficult to undo deployment actions.

This thesis describes a better approach based on a purely functional deployment model, implemented in a deployment system called Nix. – Eelco Dolstra
1984 Four Software Freedoms: GNU GPL
1990s Reproducible GNU Tools @Cygnus
2006 Nix: Functional package management

I think it would be really cool if the Debian policy required that packages could be rebuild bit-identical from source.

At the moment, it is impossible to independly verify the integrity of binary packages. – Martin Uecker
1984 Four Software Freedoms: GNU GPL
1990s Reproducible GNU Tools @Cygnus
2006 Nix: Functional package management
2007 debian-devel: Reproducibility

We view “reproducible builds” as a technical means to an end: that of guaranteeing user autonomy and safety. – Ludovic Courtès
1984 Four Software Freedoms: GNU GPL
1990s Reproducible GNU Tools @Cygnus
2006 Nix: Functional package management
2007 debian-devel: Reproducibility
2012 GNU Guix: user autonomy and safety

Lunar organizes reproducible-builds.org

A build is reproducible if given the same source code, build environment and build instructions, any party can recreate bit-by-bit identical copies of all specified artifacts. – reproducible-builds.org
1984 Four Software Freedoms: GNU GPL
1990s Reproducible GNU Tools @Cygnus
2006 Nix: Functional package management
2007 debian-devel: Reproducibility
2012 GNU Guix: user autonomy and safety
2013 DebConf13: reproducible-builds.org

2016 R-B Summit II: bootstrappable.org

reproducible builds summit II

session: Writing a statement about what it means to do bootstrappable compilers II

host: Ludovic Courtès

result: Following up on the first session focusing on this effort, the group drafted a first version of the bootstrappable.org website.
History – 2016 Initial release of Stage0 and Mes

- 1984 Four Software Freedoms: GNU GPL
- 1990s Reproducible GNU Tools @Cygnus
- 2006 Nix: Functional package management
- 2007 debian-devel: Reproducibility
- 2012 GNU Guix: user autonomy and safety
- 2013 DebConf13: reproducible-builds.org
- 2016 R-B Summit II: bootstrappable.org

2016 Initial release of Stage0 and Mes

Release of Stage0 and Mes
History – 2018 Reduced Binary Seed bootstrap

- 1984 Four Software Freedoms: GNU GPL
- 1990s Reproducible GNU Tools @Cygnus
- 2006 Nix: Functional package management
- 2007 debian-devel: Reproducibility
- 2012 GNU Guix: user autonomy and safety
- 2013 DebConf13: reproducible-builds.org
- 2016 R-B Summit II: bootstrappable.org
- 2016 Initial release of Stage0 and Mes

2018 Reduced Binary Seed bootstrap

This talk!
## Timeline 2016

### October 23: 0.1 [not announced]
- let-syntax, match
- compile main.c in 2s (was 1’20")
- add REPL

### November 21: 0.2 [not announced]
- psyntax integration, syntax-case, load

### December 12: on bootstrapping: first Mes 0.3 released
- Garbage Collector/Jam Scraper

### December 25: Mes 0.4 released
- run Nyacc, PEG, reduced core
## Timeline 2017

### April 27: Mes 0.5 released
- mutual self-hosting
  - mes.c runs mescc.scm
  - mescc.scm compiles mes.c

### May 14: Mes 0.6 released
- MesCC runs on unpatched Nyacc
- MesCC compiles 33/55 of tinycc/tests/test2

### June 3: Mes 0.7 released
- Mes C Library headers and stubs support working on compiling tcc.c

### June 25: Mes 0.8 released
- MesCC compiles to stage0’s hex2 format
July 26: Mes 0.9 released
- MesCC compiles mes-tcc, to a mostly segfaulting executable

September 10: Mes 0.10 released
- mes-tcc can compile a working trivial C program "int main () {return 42;}"

November 18: Mes 0.11 released
- MesCC: test suite with 69 tests
- less-heavily patched mes-tcc passes 41/69 MesCC C tests
Timeline 2018

April 8: Mes 0.12 released
- performance work: MesCC compiles mes-tcc in ~2h30’ (was: ~1day)

April 28: Mes 0.13 released
- MesCC builds functional mes-tcc
- Patches offered to tcc community, rejected

May 24: Mes 0.14 released
- MesCC builds functional, only slightly patched mes-tcc

June 12: Mes 0.15 released
- Experimental Guix integration
- Mes C Library supports building binutils-2.14, gcc-2.95.3, glibc-2.2.5.
### Timeline 2018-2

**June 26: GNU Mes 0.16 released**
- Fix ELF header bug: all Mes binaries segfault on Linux 4.17
- Guix integration: build gcc-4.1.0

**August 10: GNU Mes 0.17 released**
- Mes is an official GNU package
- Guix integration: build gcc-4.7.4

**Ocotber 7: GNU Mes 0.18 released**
- Guix integration: Reduced Binary Seed bootstrap (cheat using Guile)
- Introduce embarrassing bug: MesCC only runs on Guile

**December 16: GNU Mes 0.19 released**
- Compile mes-tcc in ~8’ (was: ~1h30).
- Guix integration: Remove MesCC-on-Guile shortcut
Metrics: Mes since Fosdem’17

- 14 releases: 0.5..0.19
- 1174 commits
Metrics: simplifying-tcc patches

135 0001-bootstrappable-Outline-elf-unions.patch
41 0002-bootstrappable-Outline-CValue_str.patch
44 0003-bootstrappable-Outline-enum-TCCState_pflag.patch
162 0005-bootstrappable-Heterogeneous-initializer-list.patch
51 0006-bootstrappable-Simple-initializer-lists.patch
496 0007-bootstrappable-Heterogeneous-switch-case.patch
26 0008-bootstrappable-(foo--)->bar.baz.patch
47 0010-bootstrappable-foo (bar (), baz ()).patch
176 0011-bootstrappable-foo ()->bar.patch
39 0012-bootstrappable-char foo[][][].patch
94 0013-bootstrappable-Multi-line-strings.patch
187 0014-bootstrappable-sizeof-type.patch
36 0015-bootstrappable-str-r-chr-str-0.patch
30 0016-bootstrappable-uint16_t-in-struct-on-heap.patch
64 0017-bootstrappable-constant-pointer-arithmetic.patch
1704 total
Metrics: remaining tcc patches

35 0001-bootstrappable-Work-around-Nyacc-0.80.42-bug.patch
47 0002-bootstrappable-HAVE_LONG_LONG.patch
47 0003-bootstrappable-HAVE_BITFIELD.patch
94 0004-bootstrappable-HAVE_FLOAT.patch
27 0005-bootstrappable-Skip-tidy_section_headers.patch
26 0006-bootstrappable-Handle-libtcc1.a.patch
30 0007-bootstrappable-uint16_t-in-struct-on-heap.patch
193 0008-bootstrappable-add-tcc.h-include-guards-to-include-l.patch
33 0009-bootstrappable-Work-around-MesCC-bug.patch
26 0010-bootstrappable-Force-static-link.patch
558 total
Metrics: GNU patches

26  tcc-boot-0.9.27.patch
157  binutils-boot-2.20.1a.patch
137  gcc-boot-2.95.3.patch
251  glibc-boot-2.2.5.patch
   68  gcc-boot-4.7.4.patch
352  glibc-boot-2.16.0.patch
  991 total
Metrics: GNU Guix patches

gnu: Use i686-linux bootstrap binaries on x86_64-linux.
bootstrap: Merge mes-minimal into mes-minimal-stripped.
doc: Update mesboot graph without bootstrap-guile.
bootstrap: Do not fake, use Mes instead of Guile.
bootstrap: mes-minimal-stripped: Do not strip bin.
bootstrap: Switch to official bootstrap urls.
bootstrap: mes-boot: Use mes-boot0 version.
doc: Update for bootstrap-mescc-tools change.
bootstrap: Force i686-linux for bootstrap-tarballs.
bootstrap: Update %bootstrap-tarballs.
bootstrap: Replace %mescc-tools-seed with %bootstrap-mescc-tools.
bootstrap: Update %bootstrap-mes.
bootstrap: Add %bootstrap-mescc-tools.
bootstrap: Add %mes-minimal.
bootstrap: Add mescc-tools-static, mescc-tools-static-tarball.