

PORT DEBIAN 13 TRIXIE TO LOONGARCH64

Wencey Wang



QUESTIONS



- What is loongarch64? Why a new arch?
- Why port Debian to loongarch64?
- How to port Debian to a new arch?
- What did we do to port Debian to a new arch?

WHY
LOONGARCH64?



**Telecommunications industry**

This article is more than 8 years old

China's ZTE to pay US \$1bn fine in new deal to save company

Deal comes after Trump said he was working with Xi Jinping to save jobs. He later tweeted the talks were 'part of a larger trade deal'



The ZTE logo on an office building in Shanghai, China. Photograph: Johannes Eisele/AFP/Getty Images

The United States and **China** have reached a deal that allows the Chinese

Guardian staff and agencies

Fri 8 Jun 2018 02:16 AEST

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NEW GOV PROCUREMENT :

DOMESTIC

&

CONTROLLABLE



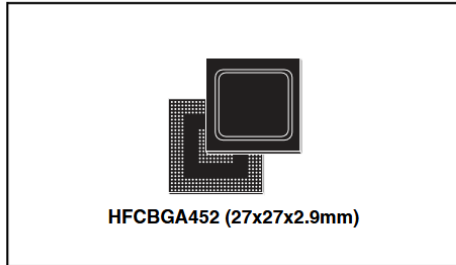
Features

- 64-bit superscalar architecture
- 900 MHz clock frequency
- Single/double precision floating-point units
- New streaming multimedia instruction set support (SIMD)
- 64 Kbyte instruction cache, 64 Kbyte data cache, on-chip 512 Kbyte unified L2 cache
- On chip DDR2-667 and PCI-X controller
- 4 W @ 900 MHz power consumption:
 - Best in class for power management
 - Voltage/frequency scaling
 - Standby mode support
 - L2 cache disable/enable option
- Leading edge 90 nm process technology
- 27x27 heat spreader flip-chip BGA package
- MIPS based (compatible with MIPSIII) instruction set

Description

The STLS2F02 is a MIPS based 64-bit superscalar microprocessor, able to issue four instructions per clock cycle among six functional units: two integer, two single/double-precision floating-point, one 64-bit SIMD and one load/store unit.

The micro architecture is organized with nine stages of pipeline and support of dynamic branch prediction.



The memory hierarchy is composed by the first level of 64 Kbyte 4-way set associative caches for instructions and data, the second level of 512 Kbyte unified 4-way set associative cache and the memory management unit with table lookside buffer.

The Loongson microprocessor family is the outcome of a successful collaboration started in 2004 between STMicroelectronics and the Institute of Computing Technology, part of the Chinese Academy of Science. Loongson microprocessors were co-developed by STMicroelectronics and the Institute of Computing Technology to address all the applications requiring high level of performance and low power dissipation.

Compared to the STLS2E02 processor, the STLS2F02 has an enhanced architecture providing higher performances, reduced power consumption, integrated DDR2 memory controller and PCI-X bus interface.

Table 1. Device summary

Order code	Package	Packing
STLS2F02	HFCBGA452 (27x27x2.9 mm)	Tray

FROM MIPS TO LOONGARCH

● **2000s**

Loongson use MIPS instructions
without authorization
Partner with ST to made chip

● **2019**

CIP United, a Chinese company, bought
exclusive rights of MIPS in China, sued
Loongson for violation

● **2010s**

Loongson acquired a license from MIPS
in 2011



Already
made IP
core uses
MIPS

Loongson can't
maintain software
stack themselves

Using MIPS
exposes legal
risk



2000s

Loongson planned a new arch to wipeout MIPS dependence



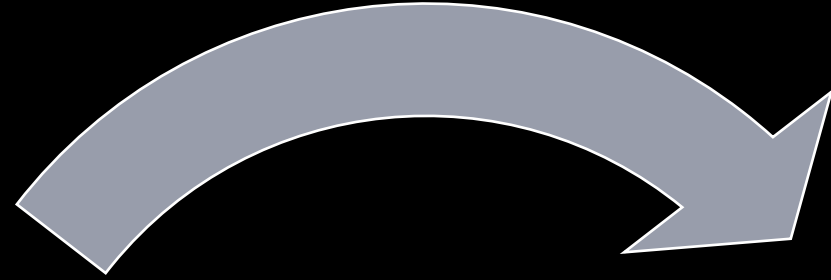
2017~

Several Chinese startup company started selling Linux as domestic OS

2017

Chinese Government required new procurement being domestic and controllable





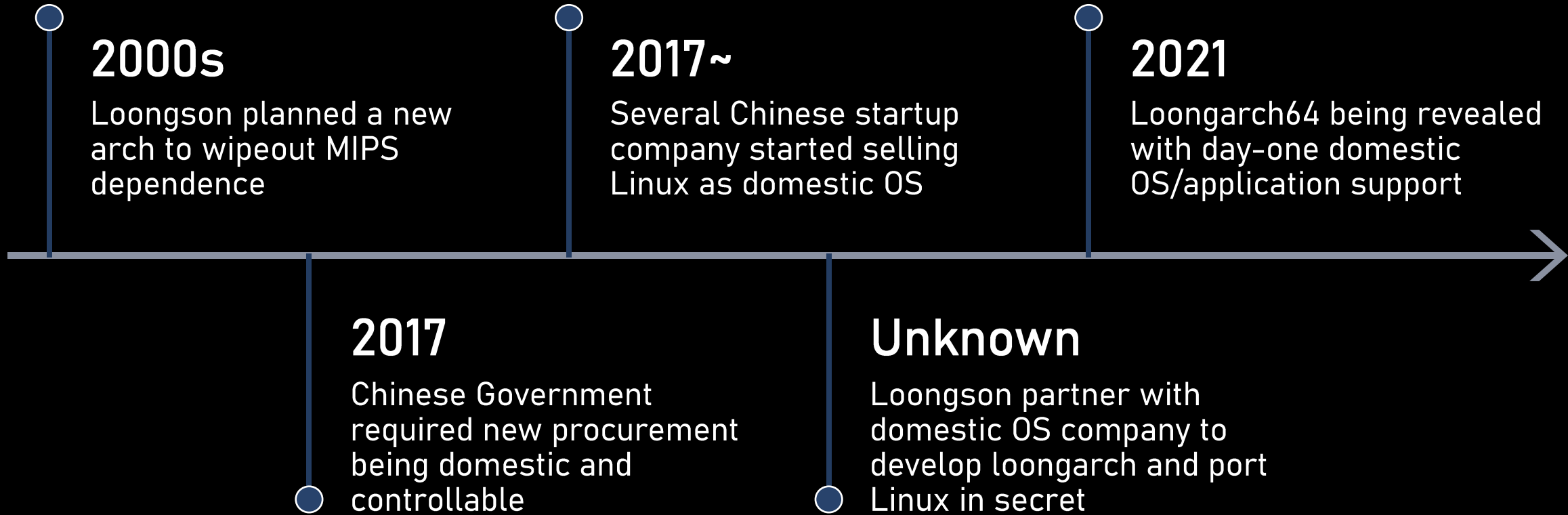
Domestic OS

Loongson

- Promised monopoly

- Promised software





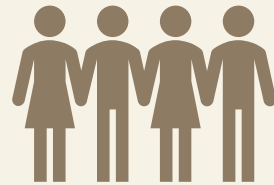
WHY PORTING DEBIAN TO LOONGARCH64?



WHERE DOES LOONGARCH MACHINES GO?



Government



Public Service



Schools

AVAILABLE OS BEFORE

UnionTech Tong Xin UOS (Pre-installed)

Deepin OS

Loongson Loongnix (off-tree fork)

This crappy TongXin OS perfectly abandoned all the advantages of Linux-like systems and learned all the disadvantages of closed systems ...

Our own people are the best at it, accomplishing what the USA has always wanted to do but couldn't.



TRAP FOR ORDINARY PEOPLE

- Subscription based pricing, pay every year to keep system running.

For ordinary user :

- No root access
- Can only install software from built-in software store
- No build tool
- No command line access

For registered developer :

- Case-by-case reviewed application with PII
- JIT root access
- Another subscription fee



HOW TO PORT DEBIAN TO A NEW ARCH?



PREREQUISITE

Toolchain	binutils
-----------	----------

	gcc
--	-----

	glibc
--	-------

FW /	grub
------	------

Kernel	boot ABI
--------	----------

	driver
--	--------

User Space	JIT Runtime
---------------	-------------

	Interpreter
--	-------------



About Our Community

That Mysterious Community
for Mysterious Processors



[Go Back](#)




LOONGSON HOBBYISTS COMMUNITY

Collaborate / Architect / Forward

The Loongson Hobbyists' Community was founded on October 24, 2024 (Programmers' Day). We are an Internet-based community of Loongson hobbyists, industry workers, and students, dedicated to the construction of Loongson's (LoongArch) software and hardware ecosystem.

[GitHub](#) 
Community projects and discussions

[YouTube](#) 
International mirror of our Bilibili
content?

[Bilibili](#) 
Follow for event videos and more

WHERE DOES THE
FULL INSTRUCTION
SET SPEC GO?



☰ Unofficial LoongArch Intrinsic Guide

Latency and Throughput of Instructions

LoongArch LBT Basics

LoongArch SIMD Basics

Migrating from AVX to LASX

Migrating from SSE to LSX

Browse All Intrinsic

LASX

Bitwise Operations

Branch

Floating Point Comparison

Floating Point Computation

Floating Point Conversion

Floating Point Misc

Fused Multiply-Add

Integer Comparison

Next »

Unofficial LoongArch Intrinsic Guide

DOI [10.5281/zenodo.20406437](https://doi.org/10.5281/zenodo.20406437)

This is the Unofficial LoongArch Intrinsic Guide by Jiajie Chen et al. The documentation is arranged from the following sources:

- QEMU
- GCC
- Observations from real hardware incl. 3C5000(LA464), 3A6000(LA664), 3C6000(LA664), 2K1000LA(LA264) and 2K3000(LA364E)

Beyond SIMD intrinsic, this guide also documents the **LBT** (LoongArch Binary Translation) instruction set, used for emulating x86, ARM, and MIPS ISAs. See the [LBT Basics](#) page for an overview.

The guide provides pseudo code for the SIMD intrinsic. The code assumes that the elements of the LSX/LASX vector registers can be accessed via members of a `union`:

```
union lsx_register {  
    uint8_t byte[16];
```

SOURCE CODE
FROM DOMESTIC
OS COMPANY?



ABI BREAK

&

libLoL



LoongArch architecture added to Debian Ports

- *To:* debian-devel-announce@lists.debian.org
 - *Subject:* LoongArch architecture added to Debian Ports
 - *From:* John Paul Adrian Glaubitz <glaubitz@physik.fu-berlin.de>
 - *Date:* Wed, 16 Aug 2023 10:27:05 +0200
 - *Message-id:* <[📧] c32d3af9f9ebc362431e2f208f75b52ba64779c0.camel@physik.fu-berlin.de>
 - *Mail-followup-to:* debian-devel@lists.debian.org
-

Hello!

I am happy to announce that we have added the LoongArch architecture to Debian Ports meaning that the port has been added to the Debian Ports archive mirrors as well as the wanna-build infrastructure.

After an initial manual bootstrap of roughly 200 packages, two buildds are now building packages for the newly added "loong64" port with the help of qemu-user. After enough packages have been built for the port to be self-hosting, we're planning to replace these two buildds with real hardware hosted at Loongson.

The packages can be found in the "pool-loong64" directory on the primary Debian Ports archive mirror [1] while the current archive build progress can be observed on buildd.debian.org [2].

Developers interested in joining the LoongArch porting efforts, are encouraged to reach out to the Debian Ports team via the #debian-ports IRC channel on Libera.

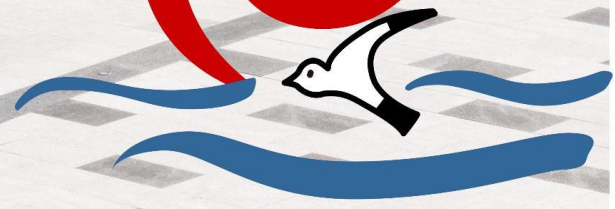
Cheers,
Adrian

- > [1] <http://ftp.ports.debian.org/debian-ports/pool-loong64/>
- > [2] <https://buildd.debian.org/status/architecture.php?a=loong64&suite=sid>

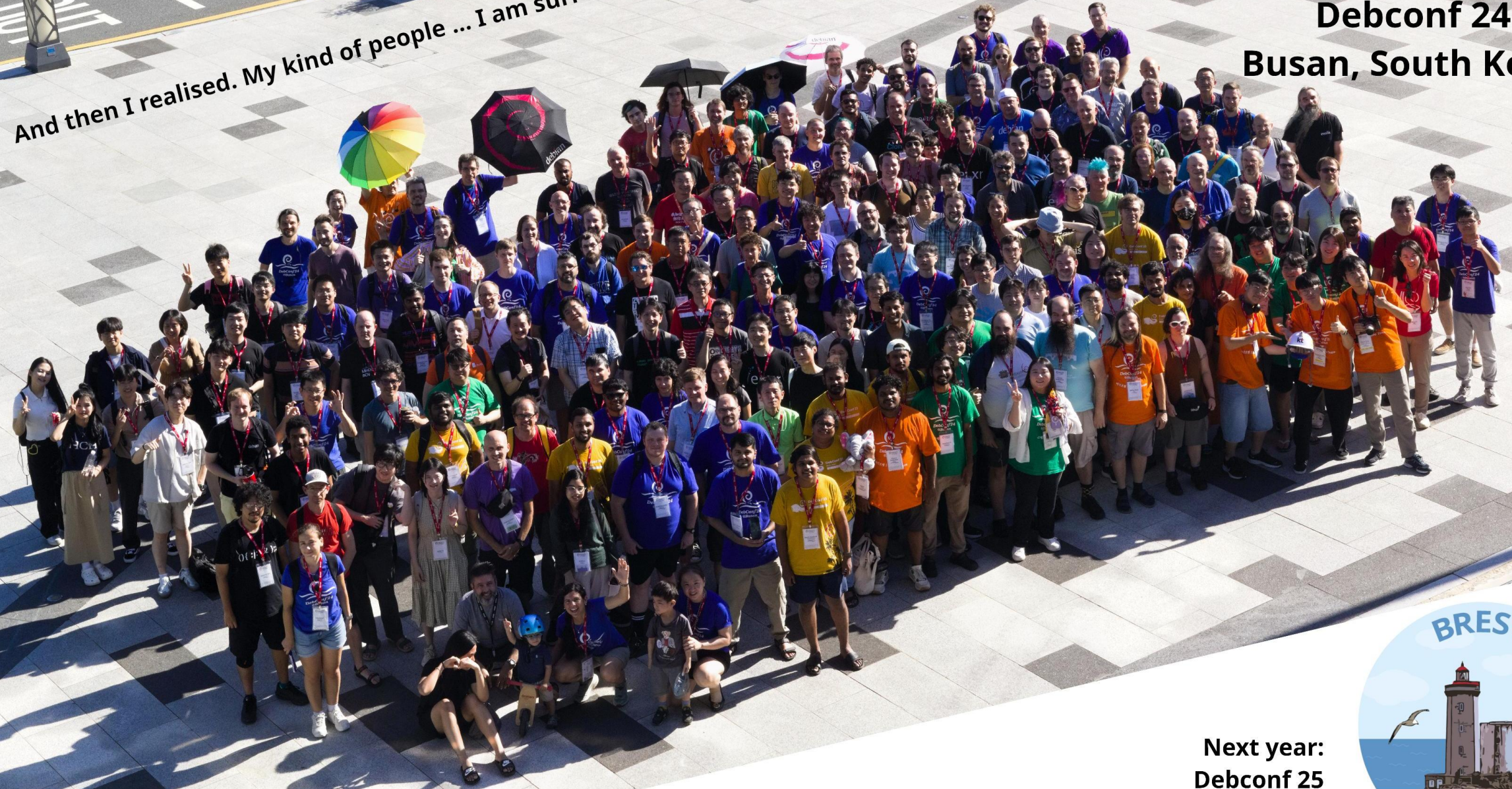
--
`.'`.' John Paul Adrian Glaubitz
: : ' : Debian Developer
'.'`.' Physicist

FROM
PORT TO
OFFICIAL?

And then I realised. My kind of people ... I am surrounded by my kind of people.

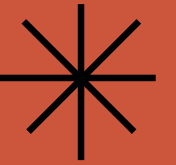


Debconf 24 Busan, South Korea



Next year:
Debconf 25





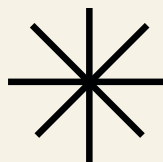
BUT PEOPLE CAN'T WAIT ANYMORE

Miao Wang

SMUGGLING THE MACHINE AND PREPARATION



```
Architecture:                loongarch64
  CPU op-mode(s):            64-bit
  Address sizes:              48 bits physical, 48 bits virtual
  Byte Order:                 Little Endian
CPU(s):                       32
  On-line CPU(s) list:       0-31
Model name:                   Loongson-3C6000/S
  CPU family:                 Loongson-64bit
  Model:                      0x10
  Thread(s) per core:        2
  Core(s) per socket:        16
  Socket(s):                  1
  Bogomips:                   4400.00
  Flags:                      cpucfg lam ual fpu lsx lasx crc32
complex crypto lspw lvz lbt_x86 lbt_arm lbt_mips
Caches (sum of all):
  L1d:                        2 MiB (32 instances)
  L1i:                        2 MiB (32 instances)
  L2:                         8 MiB (32 instances)
  L3:                         32 MiB (1 instance)
NUMA:
  NUMA node(s):               1
  NUMA node0 CPU(s):         0-31
Vulnerabilities:
  Gather data sampling:       Not affected
  Indirect target selection:  Not affected
  Itlb multihit:              Not affected
  L1tf:                       Not affected
  Mds:                        Not affected
  Meltdown:                   Not affected
  Mmio stale data:            Not affected
  Reg file data sampling:     Not affected
  Retbleed:                   Not affected
  Spec rstack overflow:       Not affected
  Spec store bypass:          Not affected
  Spectre v1:                 Mitigation: user pointer
```



FROM SOURCE PACKAGE TO BINARY RELEASE

Source Package

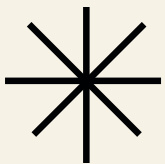
apt source

Binary Package

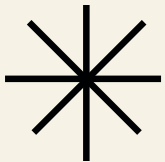
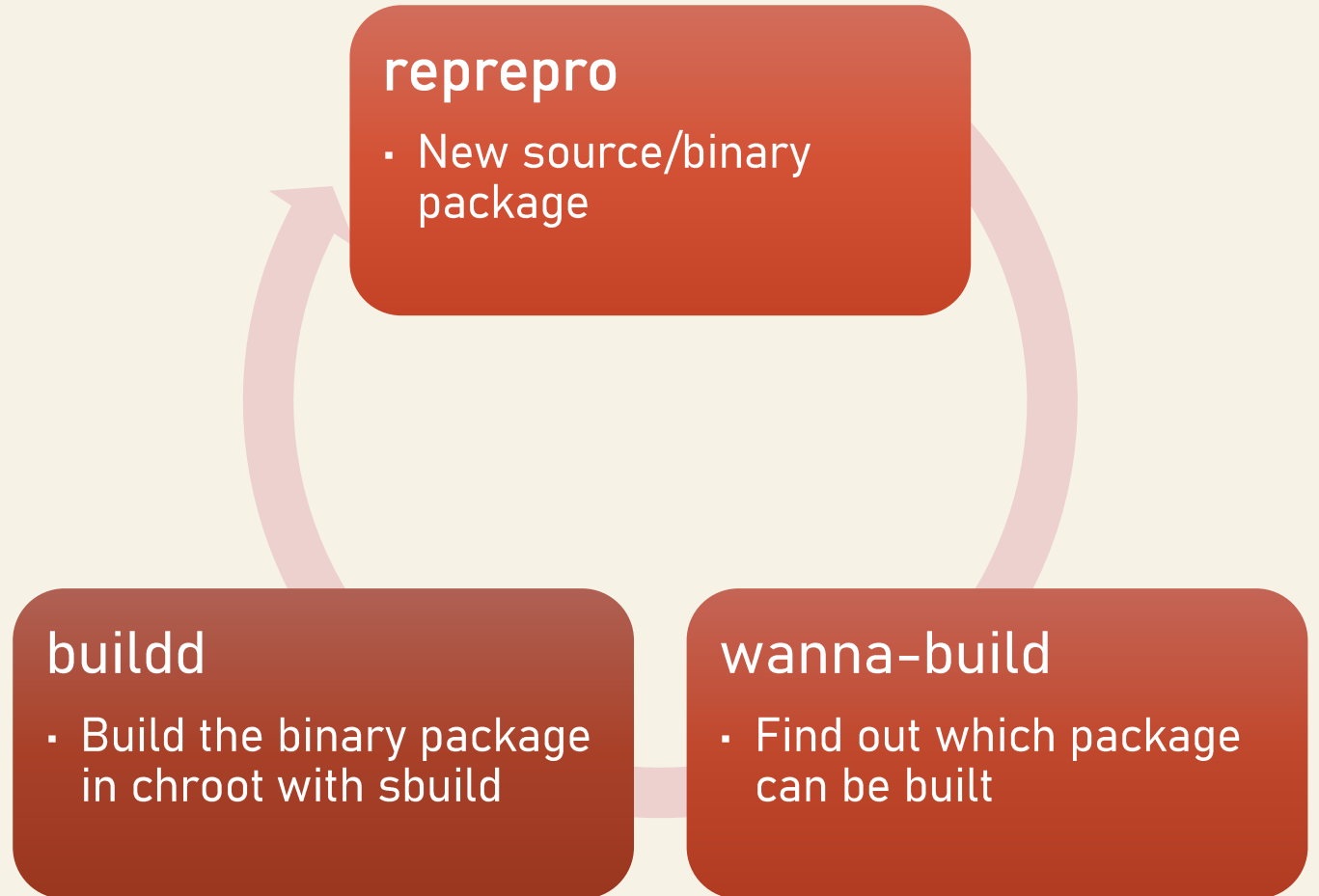
- apt download

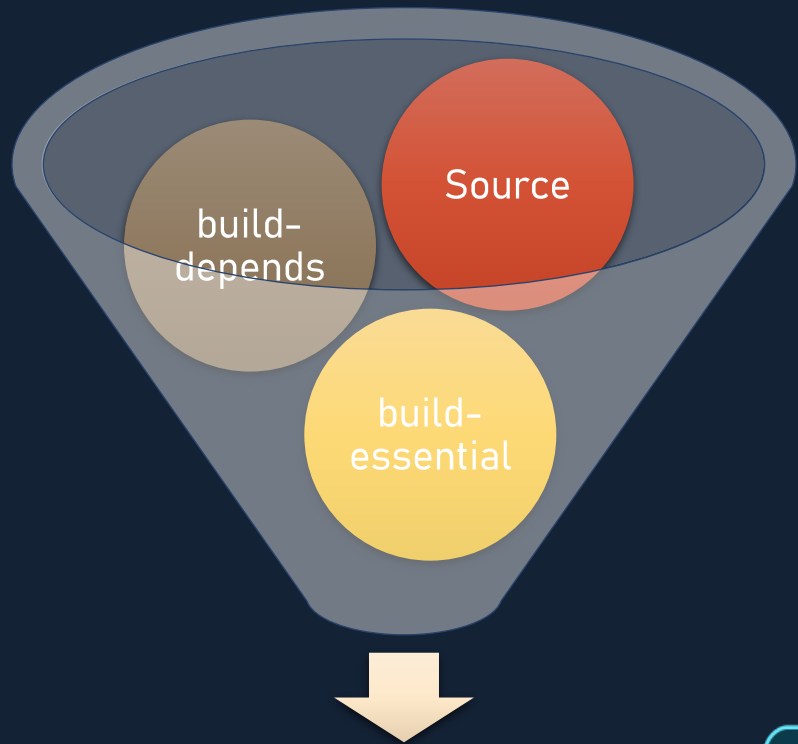
Release File

- Hash of files/packages

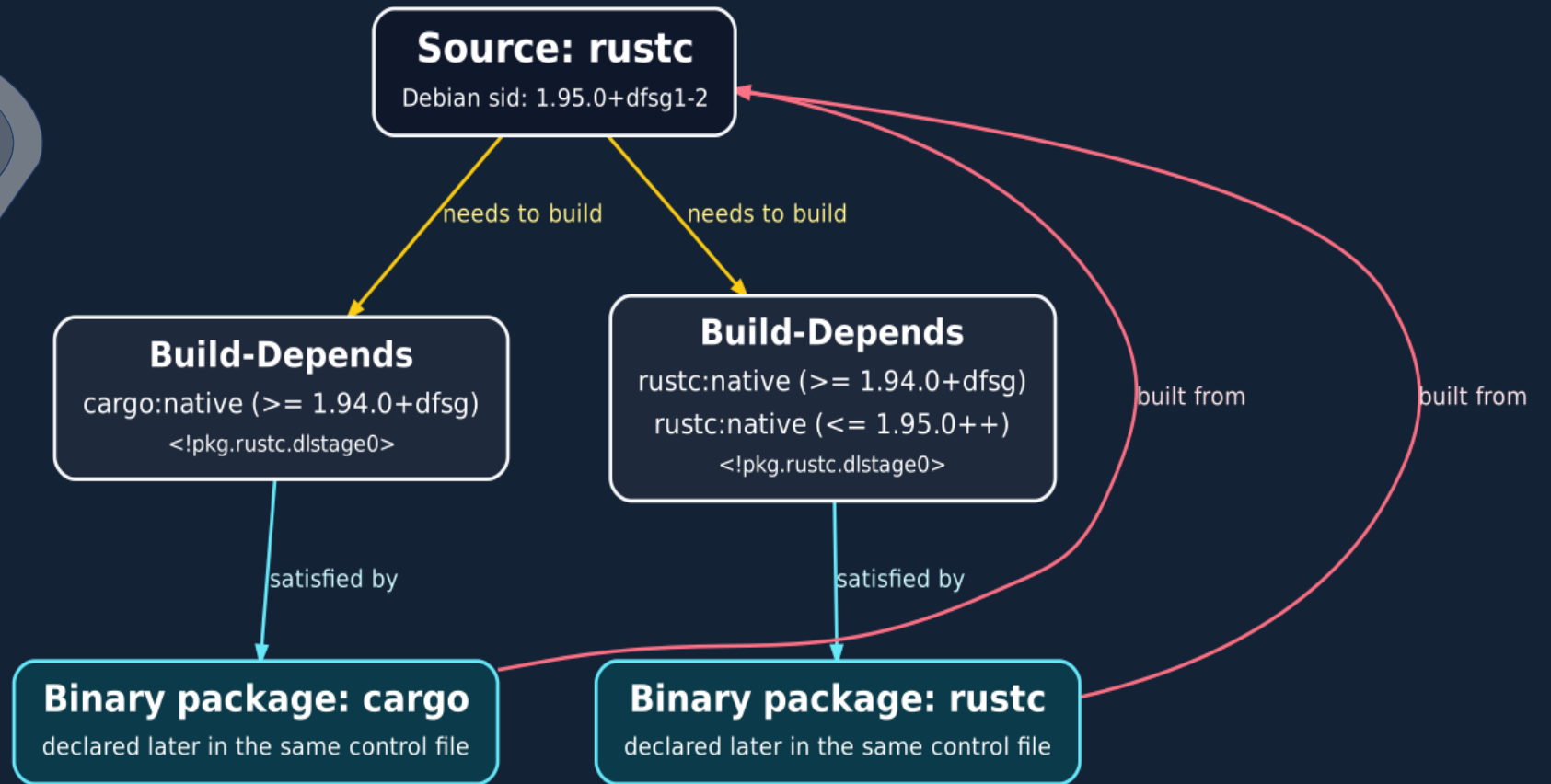


THE BUILD LOOP





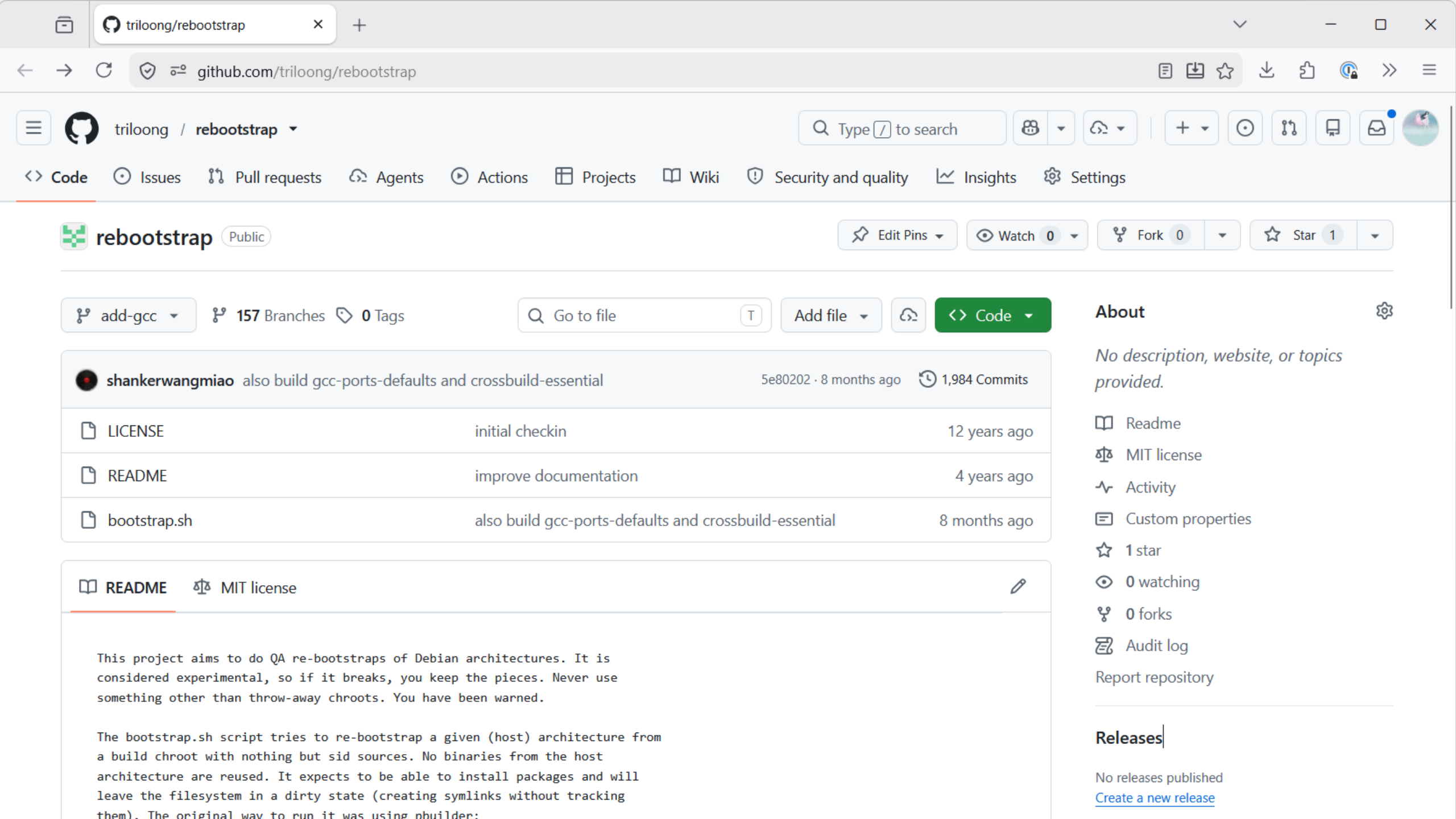
Binary Package



YES, BUT

Bootstrapping refers to building binaries for an architecture from source without using any pre-built binaries for that architecture. In the past 20 years about 20 architectures have been bootstrapped for Debian. At all times this has been a manual and non-repeatable process.





rebootstrap Public

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[add-gcc](#) [157 Branches](#) [0 Tags](#) [Add file](#) [Code](#)

	shankerwangmiao also build gcc-ports-defaults and crossbuild-essential	5e80202 · 8 months ago	🕒 1,984 Commits
	LICENSE	initial checkin	12 years ago
	README	improve documentation	4 years ago
	bootstrap.sh	also build gcc-ports-defaults and crossbuild-essential	8 months ago

[README](#) [MIT license](#)

This project aims to do QA re-bootstraps of Debian architectures. It is considered experimental, so if it breaks, you keep the pieces. Never use something other than throw-away chroots. You have been warned.

The bootstrap.sh script tries to re-bootstrap a given (host) architecture from a build chroot with nothing but sid sources. No binaries from the host architecture are reused. It expects to be able to install packages and will leave the filesystem in a dirty state (creating symlinks without tracking them). The original way to run it was using pbuilder:

About

No description, website, or topics provided.

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Releases

No releases published
[Create a new release](#)

ACTUAL PROCESS

Bootstrap

- Run rebootstrap script on different arch

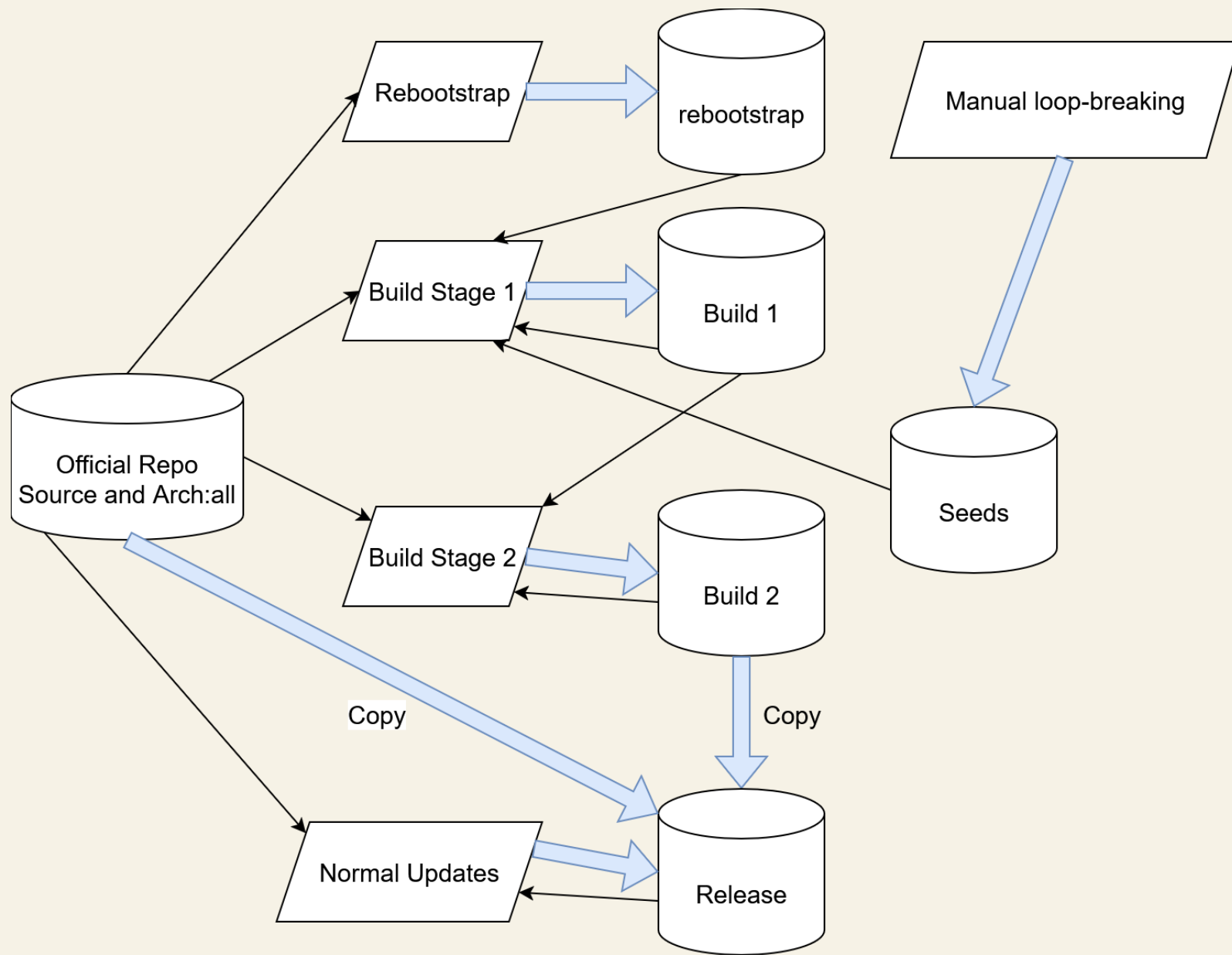
Native round 1

- Mostly automatic build
- Manually loop breaking
 - Custom build profile
 - Cross-compile

Native round 2

- Fully automatic native build

REPO AND BUILD STAGE



24+

Days to build the repo



LOONG13.DEBIAN.NET
GITHUB.COM/TRILOONG

