Rebuilding Debian with LLVM/Clang

Sylvestre Ledru – sylvestre@debian.org

Who am I ?

- Involved in Debian for 7 years
- Maintainer of the LLVM toolchain in Debian/Ubuntu for the last 3 years
- LLVM, Clang and LLDB committer
- Co-organizer of Euro LLVM 2013

Current status in Debian & Ubuntu:

All C, C++, Objective-C sources are being built with gcc for all supported Debian arches and Kernel.

gcc is THE FLOSS compiler for the last 25 years
Used for (pretty much) everywhere or anything

Why a new compiler in Debian ?

As we were able to do with decoupling Linux from Debian with kFreeBSD and the HURD, we are aiming to decouple gcc in Debian.

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- Other compilers can find programming errors that gcc could not find

- Code built by many compilers is more likely to be more strictly correct and more portable then code only built with gcc

- Some compilers can have advantages on some archs (ex : clang on ARM)

- A big ecosystem is being built over LLVM/Clang

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LLVM/Clang

About performances :

Results presented by Google last April at the Euro LLVM conference

clang compared to gcc

Servers: 1.04
Image processing: 1.03
Video codecs: 1.00

Agregate of various internal benchmarks of Google

Source: http://www.irill.org/videos/euro-llvm-2013/carruth-hires

Libraries

OpenSSL: 1.00
Protocol Buffer: 1.12
Snappy : 1.05

Source: http://www.irill.org/videos/euro-llvm-2013/carruth-hires

Some advantages (bis)
More intelligent detections

– foo.c –

```
int main() {
        unsigned int i = 0;
        return i < 0;
}
```

```
$ gcc -Wall -Werror foo.c ; echo $?
0
$ clang -Werror foo.c
foo.c:3:17: error: comparison of unsigned expression < 0 is always false
      [-Werror,-Wtautological-compare]
    return i < 0;
           ~ ^ ~
1 error generated.
```

Rebuild of Debian using Clang

Crappy method :

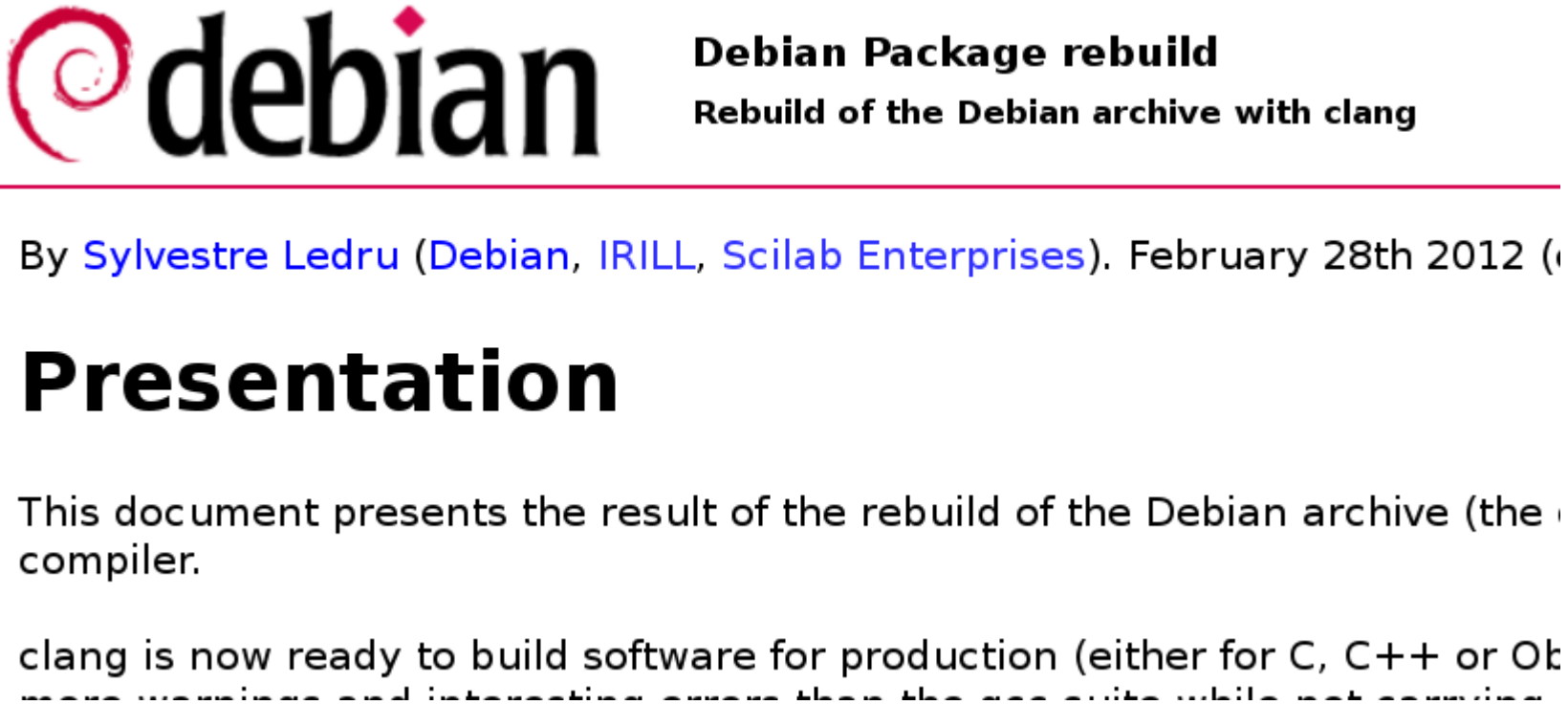
```
VERSIONS="4.8 4.7 4.6"
cd /usr/bin
for VERSION in $VERSIONS; do
 rm g++-$VERSION gcc-$VERSION cpp-$VERSION
 ln -s clang++ g++-$VERSION
 ln -s clang gcc-$VERSION
 ln -s clang cpp-$VERSION
done
```

CC=clang CXX=clang++ dpkg-buildpackage
fails to use clang in too many cases

Testing the rebuild of the package under amd64.

NOT the performances (build time or execution)
nor the execution of the binaries

Full results published:
http://clang.debian.net/



Debian Package rebuild

Rebuild of the Debian archive with clang

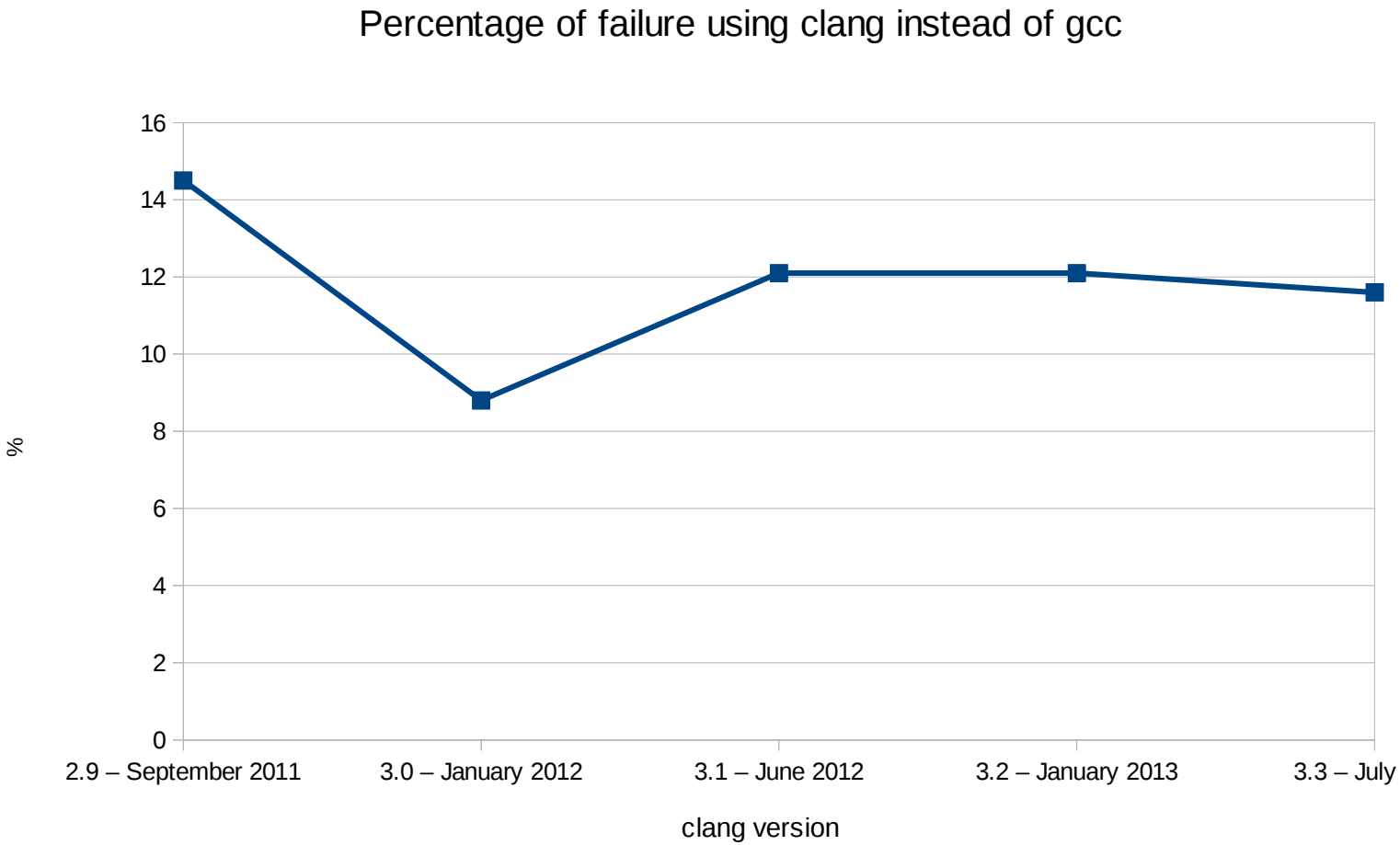
By Sylvestre Ledru (Debian, IRILL, Scilab Enterprises). February 28th 2012 (

Presentation

This document presents the result of the rebuild of the Debian archive (the
compiler.

clang is now ready to build software for production (either for C, C++ or Ob

Done on the cloud-qa - EC2 (Amazon cloud)
Thanks to Lucas Nussbaum and David Suarez



Version	Pkg/Failure
2.9	16398 2372
3.0	15658 1381
3.1	17710 2137
3.2	18264 2204
3.3	18854 2188

Why these differences between 3.0 vs 3.1/3.2/3.3?

Some information about *-Wall* & *-Werror* :

-Wall enables many warnings (and different set from gcc)

-Werror transforms Warning to Error

```
int main() {
    unsigned int i = 0;
    return i < 0;
}
```

```
$ gcc -Wall -Werror foo.c && echo $?
0

$ clang -Wall -Werror foo.c && echo $?
foo.c:3:14: error: comparison of unsigned expression < 0 is always false
      [-Werror,-Wtautological-compare]
    return i < 0;
           ~ ^ ~
1 error generated.
```

Security check introduced in clang 3.1
36 occurences

```
#include <stdio.h>

void foo(void) {
  char buffer[1024];
  sprintf(buffer, "%n", 2);
}
```

```
$ gcc -Werror -c foo.c && echo $?

0
$ clang -Werror -c foo.c && echo $?

foo.c:5:23: error: use of '%n' in format string discouraged
      (potentially insecure) [-Werror,-Wformat-security]
    sprintf(buffer, "%n", 2);
                      ~^

1 error generated.
```

Some of the most common errors

Unsupported options
49 occurrences

$ gcc -O9 foo.c && echo $?

0

$ clang -O9 foo.c

error: invalid value '9' in '-O9'

Record by libdbi-drivers with -O20 \o/

Different default behavior
120 occurrences

– noreturn.c –

```
int foo(void) {
  return;
}
```

```
$ gcc -c noreturn.c; echo $?
0
# -Wall shows it as warning
$ clang -c noreturn.c
noreturn.c:2:2: error: non-void function 'foo' should return a value
      [-Wreturn-type]
  return;
  ^
1 error generated.
```

Different default behavior (bis)
16 occurrences

– returninvoid.c –

```
void foo(void) {
  return 42;
}
```

$ gcc -c returninvoid.c; echo $?

returninvoid.c: In function ‘foo’:

returninvoid.c:2:2: warning: ‘return’ with a value, in function returning void [enabled by default]

0

$ clang -c returninvoid.c

returninvoid.c:2:2: error: void function 'foo' should not return a value

[-Wreturn-type]

return 42;

^ ~~

1 error generated.

Nested functions
33 occurrences

```
void foo() {
    void bar() {
    }
}
```

```
$ gcc -Wall -c foo.c; echo $?
0
$ clang -c foo.c
foo.c:3:17: error: function definition is not allowed here
    void bar() {
                ^
foo.c:5:7: error: expected ';' at end of declaration
    }
     ^
```

gcc extensions which won't be supported
21 occurences

– foo.cpp –

```
#include <vector>
void foo() {
 int N=2;
 std::vector<int> best[2][N];
}
```



```
$ g++ -c foo.cpp; echo $?
0
$ clang++ -c foo.cpp
foo.cpp:4:29: error: variable length array of non-POD element type
      'std::vector<int>'
   std::vector<int> best[2][N];
                            ^
1 error generated.
```

Last rebuilds proved that clang is now ready

Remaining problems are upstream

How to make about 2000 upstreams fix their issues ?

Provide them with an interface which shows clang and other build

Working on debile aka Debuild.me (by Paul Tagliamonte) as part of Léo Cavaillé's Google Summer of Code

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debuild.me

This experimental infrastructure aims to provide a generic rebuild platform.
Normal build, custom builds (clang based) or static analyzers (coccinelle, scan-build, etc) are managed through this infrastructure.

By package		Search
By maintainer		Search

Perhaps you're looking for the last uploads

Active Jobs

Type	Arch	Suite	Assigned	Builder	Source Package
build	amd64	unstable	12 minutes ago	irill4-builder1	openmpi

Builder Status

Name	Last ping	Jobs
irill4-builder1	12 minutes ago	build
irill4-builder2	a day ago	

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debile

Package info

Name eztrace
Version 0.9.1-2
Maintainer Samuel Thibault <sthibault@debian.org>
Uploaded by Fred the autobuilder

9/8
Remain

source jobs

launched on the source package provided

Type	Version	Machine	Results
build/clang-3.3 *(amd64)*	0.9.1-2	irill4-builder1	Failed
build/gcc-4.8 *(amd64)*	0.9.1-2	irill4-builder1	Uploaded
clanganalyzer *(all)*	0.9.1-2	irill4-builder1	✗ Errors found
coccinelle *(all)*	0.9.1-2	irill4-builder1	✓ Nothing found
cppcheck *(all)*	0.9.1-2	irill4-builder1	✗ Errors found
lintian *(all)*	0.9.1-2	irill4-builder1	✓ Nothing found

Provides various workers:

- Normal builds
- scan-build
- Lintian
- Coccinelle
- Cppcheck
- Clang
- ...

With repository of clang-built packages

Ask gcc people to add more default warnings to fix the *-Wall -Werror* issue?

Other ideas ? (besides writing and forwarding upstream 2000 patches)

Any questions ? Remarks ?