Build Debian with another compiler

debian

Current status :
All C, C++, Objective-C sources are being built with GCC for all supported Debian arches.

Why a new compiler ?

Because we can

No other reason ?

Because it is fun

Seriously :
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)

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

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LLVM/Clang

Started as an academic project
Versatile platform for compilation and virtual machine

Designed originally for the investigation of dynamic compilation techniques for static and dynamic languages

Sponsored by Apple since 2005 to replace GCC (GPL vs BSD)

Has now a strong and diverse community (academics, individuals and corporates)

Many universities/research centers are basing their research on LLVM

Clang

C, C++ & Objective-C compiler.
(no Fortran)
Based on LLVM

Default compiler for Mac OS X (Xcode)/iOS [1]
and FreeBSD [2]

Sources:
[1] https://developer.apple.com/technologies/tools/
[2] http://lists.freebsd.org/pipermail/freebsd-stable/2012-May/067486.html

Some advantages :

More recent base code (ie less legacy code)
Strong interest of material manufactors (ARM, MIPS, Nvidia, etc)
Supposed to be faster to build code than gcc

Example
Full build of Scilab (doc, essential tests)
~24 minutes gcc
~22 minutes clang

Some advantages (bis)
More intelligent detections

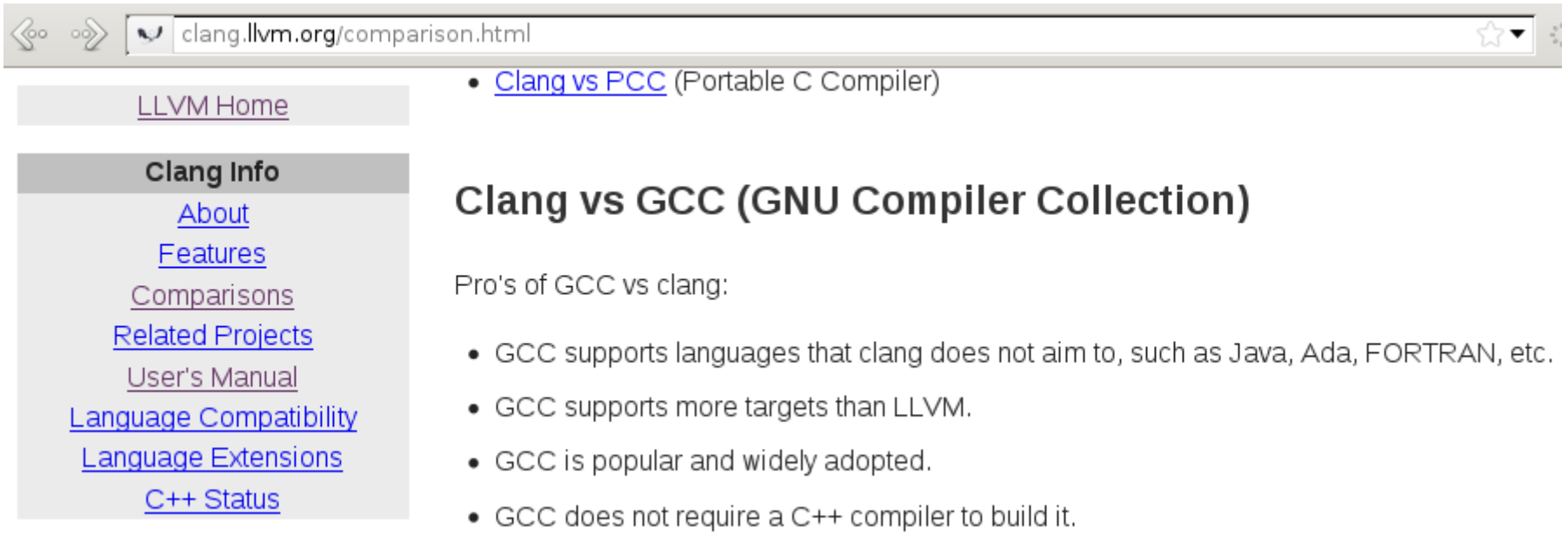
– foo.c --

```
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.
```

Side effect
=> Brings (friendly) competition in the free compiler world.

http://gcc.gnu.org/wiki/ClangDiagnosticsComparison



http://clang.llvm.org/comparison.html#gcc

Rebuild of Debian using Clang

Crappy method :

```
VERSION=4.7
cd /usr/bin
rm g++-$VERSION gcc-$VERSION cpp-$VERSION
ln -s clang++ g++-$VERSION
ln -s clang gcc-$VERSION
ln -s clang cpp-$VERSION
cd -
```

Testing the rebuild of the package.

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

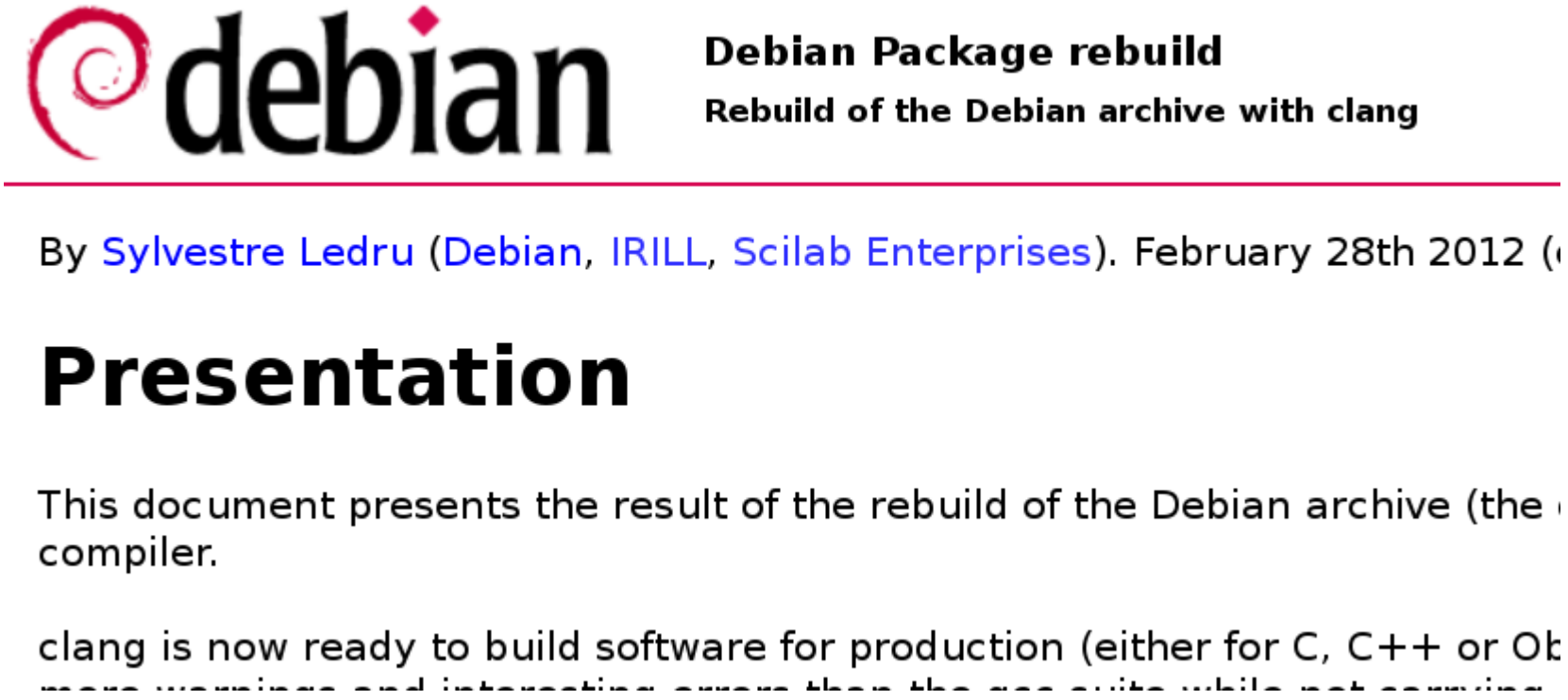
Rebuild with clang 3.0
February 28, 2012

15658 packages built : 1381 (8.8 %) failed.

Rebuild with clang 3.1
June 23, 2012

17710 packages built : 2137 (12.1 %) failed.

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

Why these differences between 3.0 & 3.1?

-Werror & unused args
96 occurrences

Clang detects unused argument.

clang --param ssp-buffer-size=4 -Werror foo.c

clang: error: argument unused during compilation: '--param ssp-buffer-size=4'

And generates a normal warning …

96 occurrences

Which becomes an error with -Werror

Security check introduced in clang 3.1
20 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
48 occurrences

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

0

$ clang -O9 foo.c

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

Different default behavior
132 occurrences

– noreturn.c –

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

```
$ gcc -c noreturn.c; echo $?
0

$ 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)
17 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.
```

Different understanding of the C++ standard

– mailboxField.cpp –

```
class address {
protected:
    static int parseNext(int a);
};
class mailbox : public address {
    friend class mailboxField;
};
class mailboxField {
    void parse(int a)          {
            address::parseNext(a);
            // will work with:
            // mailbox::parseNext(a);
        }
};
```

$ g++ -c mailboxField.cpp && echo $?

0

$ clang++ -c mailboxField.cpp

mailboxField.cpp:17:22: error: 'parseNext' is a protected member of 'address'

```
        address::parseNext(a);
                ^
```

mailboxField.cpp:4:16: note: declared protected here

```
    static int parseNext(int a);
               ^
```

References:
http://llvm.org/bugs/show_bug.cgi?id=6840
http://gcc.gnu.org/bugzilla/show_bug.cgi?id=52136

Different set of warnings with -Wall
Plenty of occurences

– plop.c –

```
void foo() {
    int a=1;
    if ((a == 1)) {
        return;
    }
}
```

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

$ clang -Wall -Werror -c foo.cpp
foo.cpp:3:13: error: equality comparison with extraneous parentheses
    [-Werror,-Wparentheses-equality]
    if ((a == 1)) {
        ~~^~~~
foo.cpp:3:13: note: remove extraneous parentheses around the comparison to
    silence this warning
    if ((a == 1)) {
       ~ ^  ~
foo.cpp:3:13: note: use '=' to turn this equality comparison into an assignment
    if ((a == 1)) {
        ^~
        =
1 error generated.
```

GCC Extensions which won't be supported
25 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.
```

GCC accepts stuff which should not
34 occurences

– foo.cpp –

```
// Uncomment this line will fix the issue.

// template<typename Value_t>
//  void b(Value_t value)

template<typename Value_t>
void a(Value_t value) {

    b(value);

}


template<typename Value_t>
void b(Value_t value) {

}


void foo(int y) {

    a(y);

}
```



```
$ g++ -c foo.cpp; echo $?

0

$ clang++ -c foo.cpp

foo.cpp:6:5: error: call to function 'b' that is neither visible in the template
    definition nor found by argument-dependent lookup

  b(value);

  ^

foo.cpp:15:5: note: in instantiation of function template specialization
    'a<int>' requested here

  a(y);

  ^

foo.cpp:9:33: note: 'b' should be declared prior to the call site

template<typename Value_t> void b(Value_t value)

                                ^

1 error generated.
```

GSoC 2012 work

Objective:

Update the Debian infrastructure to allow a change of compiler

Student : Alexander Pashaliyski

Mentors : Paul Tagliamonte & me

First output :

A tutorial/documentation for wanna-build setup

http://wiki.debian.org/DebianWannaBuildInfrastructureOnOneServer

Adapt the Debian tools to replace the compiler

Use /usr/bin/cc and /usr/bin/c++ instead of CC=gcc and CXX=g++

(Both are alternatives)

debian

For now, three tools have been modified to perform such task :

- dpkg
- sbuild
- wanna-build

Next steps

Get the patches applied

Setup i386 & amd64 *official* clang buildd

Should be available as a new suite on buildd.debian.org

PTS – Changelog – Bugs – packages.d.o – b.d-ports.o

Package(s): clang Suite: sid Go

☐ Compact mode ☐ Co-maintainers

Architecture	Version	Status	State
amd64	3.1-8	Installed	
armel	3.1-8	Installed	
armhf	3.1-8	Installed	
hurd-i386	3.1-8	Installed	
i386	3.1-8	Installed	
ia64	3.1-8	BD-Uninstallable	uncompiled

sid
wheezy
squeeze
lenny
lenny-volatile
squeeze-backports
lenny-backports
lenny-backports-sloppy
squeeze-edu
lenny-edu
experimental

Should be available as a new item in the PTS

Add a lintian warning like

W: yourpackage: Hardcoded call to gcc/g++.
Use /usr/bin/cc or /usr/bin/c++ instead

In the clang buildd, fails any packages using directly gcc, g++ or cpp.

Create a repository of packages built with Clang

Future

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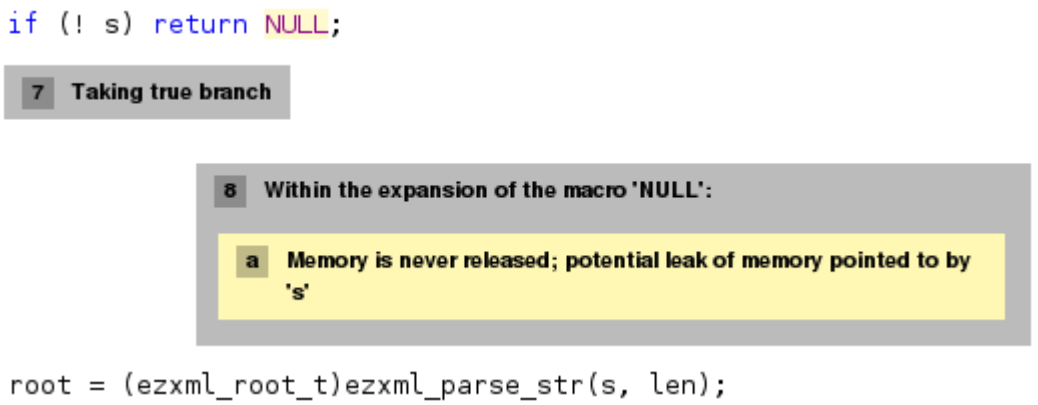
Could consider the rebuild of Debian with :

- clang+plugin. Ex : polly : cache-locality optimisation auto-parallelism and vectorization, etc

- scan-build : static C/C++ analyzer



- Intel compilers

Another GSoC project
Student : Andrej Belym
Mentor : Me

Packaging of

libc ++

libc++ is a new implementation of the C++ standard library, targeting C++0X.

libc++abi

libc++abi is a new implementation of low level support for a standard C++ library.

Clang++ is linking against libstdc++

Example :

```
– main.cpp –
#include <iostream>
using namespace std;
int main(){
	cout << " plop" << endl;
}

$ clang++ -o plop main.cpp
$ ldd plop|grep stdc
   libstdc++.so.6 => /usr/lib/x86_64-linux-gnu/libstdc++.so.6
(0x00007f4b50817000)
```

But Clang++ can link and run with libc++

Example :

```
– main.cpp –
#include <iostream>
using namespace std;
int main(){
	cout << " plop" << endl;
}

$ clang++ -stdlib=libc++ -o plop main.cpp
$ ldd plop|grep libc++
libc++.so.1 => /usr/lib/libc++.so.1 (0x00007ff0eaf1d000)
```

Will soon be upload in Debian experimental

Will try to replace also libgcc_s

Any questions ? Remarks ?
Troll ? (+1)