# Chromium and Clang

Nico Weber and Hans Wennborg

{thakis, hans} (at) chromium.org

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## Chromium: Overview

- Chrome is Google's web browser
- First released 2008
- $\sim$ 200 million active users
- Chrome is basically Chromium + branding.

## Chromium: Lots of code

- $\sim$5 million lines of code
- plus 5 million more in libraries:
- WebKit, V8, libpng, libjpeg, . . .
- 689 committers last 12 months
- Good tools are necessary.

## Timeline

- Dec 2009: First patch mentioning Clang
- Apr 2010: LLVM 2.7, C++ support in alpha
- Sep 2010: Chrome builds on Linux
- Sep 2010: Chrome builds on Mac
- Sep 2010: Clang buildbot added to FYI waterfall

## Timeline (contd.)

- Oct 2010: LLVM 2.8, C++ support complete
- Feb 2011: Style plugin
- Feb 2011: Clang buildbots move to main waterfall
- May 2011: ChromeOS buildbot

## Timeline (contd.)

- Aug 2011: Mac bots go Clang
- Sep 2011: Mac devs are switched to Clang
- Oct 2011: Chrome 15: built with Clang on Mac
- Nov 2011: This talk.

## Advantages of using Clang

## Useful warnings

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- Clang's warnings are extremely useful
- Look good
- Good set on by default
- Find real issues.

## Useful warnings

Example: override bugs

```
class C {
  public:
    virtual void foo();
};

class D : public C {
  public:
    virtual void foo();
};
```

## Useful warnings

Example: override bugs

```
class C {
  public:
    virtual void foo() const;
};

class D : public C {
  public:
    virtual void foo();
};
```

## Useful warnings

Example: `-Woverloaded-virtual`

```
a.cc:8:18: warning: 'D::foo' hides overloaded
      virtual function [-Woverloaded-virtual]
    virtual void foo();
                 ^
a.cc:3:18: note: hidden overloaded virtual
      function 'C::foo' declared here
    virtual void foo() const;
                 ^
1 warning generated.
```

## Useful warnings

Example: override specifier

```
a.cc:8:16: error: 'foo' marked 'override' but does not
      override any member functions
  virtual void foo(double x) override;
               ^
1 error generated.
```

- Previously `__attribute__(override)`
- Now part of C++11 support
- Used for ∼10k functions
- Stops code from breaking all the time.

## Useful warnings

Example: did you mean '!='?

```
a.cc:2:9: warning: using the result of an assignment as
      a condition without parentheses [-Wparentheses]
  if (x |= y)
      ~~^~~~
a.cc:2:9: note: use '!=' to turn this compound
      assignment into an inequality comparison
  if (x |= y)
        ^~
        !=
1 warning generated.
```

## Useful warnings

Example: `-Wparentheses`, ?:

```
a.cc:2:16: warning: operator '?:' has lower precedence
      than '+'; '+' will be evaluated first
  return x + b ? y : 0;
         ~~~~~ ^
a.cc:2:16: note: place parentheses around the '?:'
      expression to evaluate it first
  return x + b ? y : 0;
               ^
             (         )
1 warning generated.
```

- It's a bug every time!

## Useful warnings

Example: `-Wsizeof-pointer-memaccess`

```
a.cc:8:23: warning: argument to 'sizeof' in 'memset'
      call is the same expression as the destination;
      did you mean to dereference it?
  memset(s, 0, sizeof(s));
         ~            ^
1 warning generated.
```

## Tools

- Clang is more than a compiler
- Allows you to build your own tools.

## Tools

### Chromium style checker

```
In file included from a.cc:1:
./a.h:8:3: warning: [chromium-style] Overriding method
      must have "virtual" keyword.
  void foo();
  ^
1 warning generated.
```

# Tools

## Chromium style checker (contd.)

```
In file included from a.cc:1:
./a.h:3:3: warning: [chromium-style] Complex
      constructor has an inlined body.
  C() {}
  ^
1 warning generated.
```

## Tools
V8

- Handle<Object> for referencing gc'able memory

```
Handle<Object> Foo();  // Might trigger a GC.
void Bar(Object*, Object*);

Handle<Object> baz;
Bar(*Foo(), *baz);
```

## Tools

A few rewriter attempts

- Make implicit constructor explicit
- Done using a plugin
- Fixed a few hundred instances, then gave up
- New callback mechanism, update all old call sites
- Got stuck after 4 days with arcrewrite-based system.

## Other tools

### AddressSanitizer (ASan)

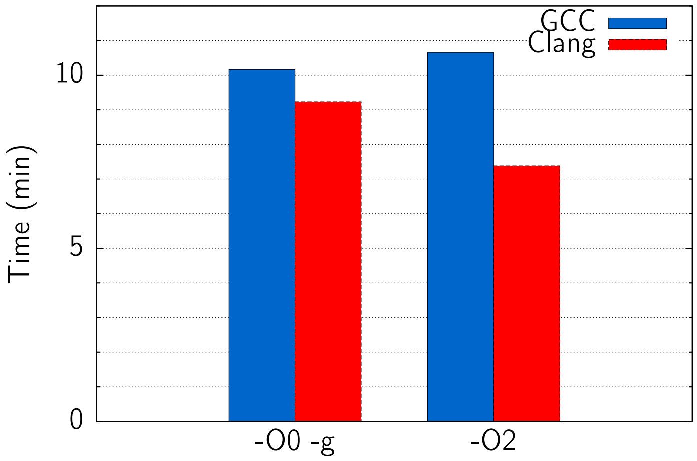
- A fast memory error detector
- Finds use-after-free, out-of-bounds access, etc.
- Go to the talk: Ballroom Salon I/II at 4:30.

## Which Clang to use

- We use Clang trunk without local patches
- Pull and test new version weekly
- Cooperating with other Clang people at Google
- When we branch for release, we branch Clang too
- Binaries: `http://is.gd/chromeclang`

## Build numbers

### Compile time (Linux)



Clang r143497, GCC 4.4.3, Chromium r108631, 8 cores, 24 GB

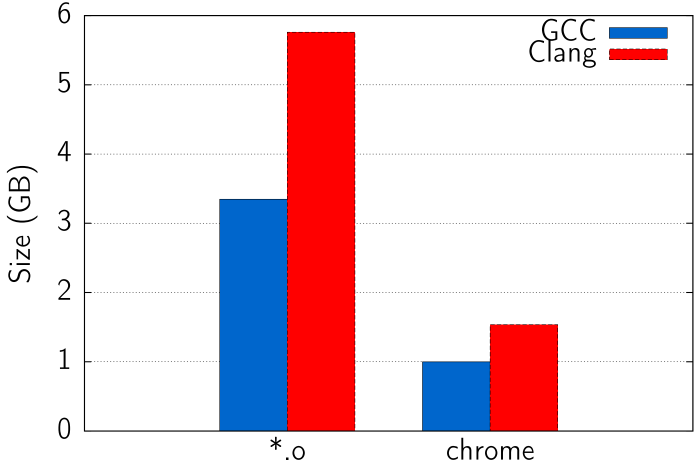
## Build numbers

### Compile time (Mac)

- Mac is also about 30% faster in Debug
- Much faster in Release.

# Build numbers

## Binary size (Linux, Debug)



# Build numbers

Binary size (Mac)

- 10% smaller in Release.

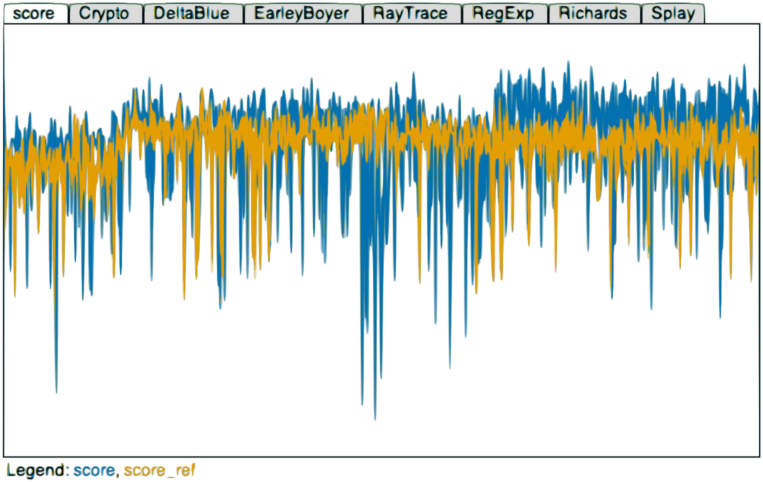
## Build numbers

### Interlude: A few numbers

- 10k files @ 16 cores, $\sim$2 s / file $\Rightarrow$ 20 min local build time
- @ 50 kB / .o, 3MB / s link $\Rightarrow$ 2.5 min
- .o file size matters!

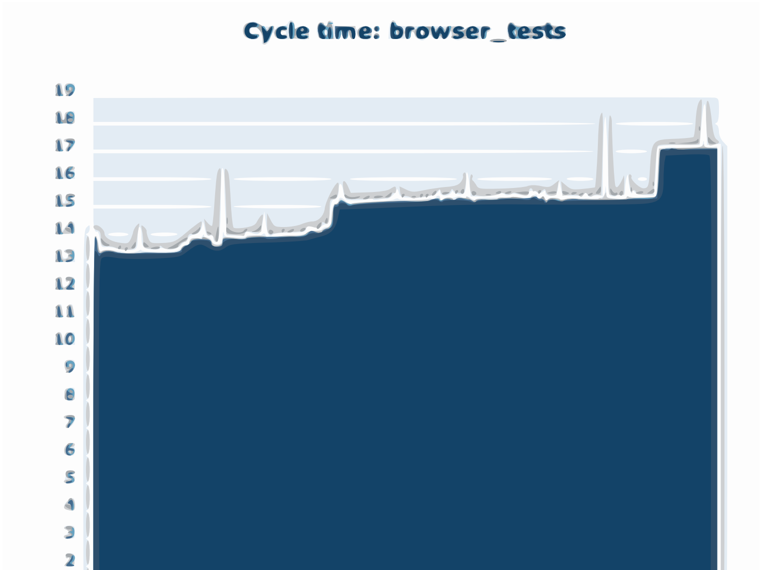
# Build numbers

## Performance



# Build numbers

Performance



## Passing thoughts

- <3 diagnostics
- <3 clang code base
- <3 the way clang is run
- <3 using clang to write own tools
- Please make it easier to write tools.

- That's all!
- Send cakes to clang@chromium.org
- code.google.com/p/chromium/wiki/Clang