



## Add annotations for unreachable control flow (slides)

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# Add annotations for unreachable control flow

ISO/IEC JTC 1/SC 22/WG14 N2757

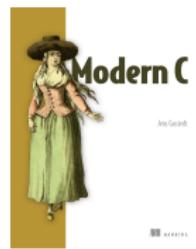
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John Gossell

2011



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# How to distinguish coding errors from UB?

## A program with potential UB

```
#include <stdio.h>
#include <assert.h>

int main(int argc, char* argv[static argc+1]) {
    return printf("we_see_%s\n", argv[2]);
}
```

- This program is undefined when called with less than two arguments.
- It is usually optimized to a tail call to `printf`.
- Some diagnostics may be produced for the access to `argv[2]`.

# How to distinguish coding errors from UB?

## Declaring an intent (current C)

```
#include <stdio.h>
#include <assert.h>

int main(int argc, char* argv[static argc+1]) {
    if (argc <= 2) abort();
    else return printf("we_see_%s\n", argv[2]);
    return puts("this_should_never_be_reached");
}
```

- This program is defined under all circumstances.
- The comparison cannot not be removed during optimization.
- The two programs are not equivalent.
- In general, there are no diagnostics printed.

# How to distinguish coding errors from UB?

## Declaring an intent (our proposal)

```
#include <stdio.h>
#include <assert.h>

int main(int argc, char* argv[static argc+1]) {
    if (argc <= 2) unreachable("two_arguments_needed");
    else return printf("we_see_%s\n", argv[2]);
    return puts("this_should_never_be_reached");
}
```

- This program conveys the intent that two arguments are expected.
- The comparison can be removed during optimization.
- The call to **puts** can be removed during optimization.
- The program is equivalent to the first.

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# Existing practice

## C and C++

gcc	<code>__builtin_unreachable()</code>
clang	<code>__builtin_unreachable()</code>
icc	<code>__builtin_unreachable()</code>
Visual C++	<code>assume(false)</code>

Our proposal is based on P0627R3 for C++.

## Other programming languages

- Rust has

```
unsafe std::hint::unreachable_unchecked!();
```

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# Add a string to convey a reason

Simple wrapper implementations for existing features

```
#define unreachable(...) __unreachable(__VA_ARGS__ "")
```

- For compilers that implement `__builtin_unreachable()`

```
#define __unreachable(REASON) \
((void)REASON, __builtin_unreachable())
```

- For compilers that implement `assume(false)`

```
#define __unreachable(REASON) \
((void)REASON, assume(false))
```

By that, the argument to `unreachable` has to be either empty, or a white-space separated sequence of string literals.

# Add a expression to name the case: **attest**

## Simple wrapper implementations for existing features

- For compilers that implement `__builtin_unreachable()`

```
#define attest(....) \
((__VA_ARGS__) ? (void)0 : __builtin_unreachable()) \
```

- For compilers that implement `assume(false)`

```
#define attest(....) assume(!!(__VA_ARGS__))
```



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# Do we want such a feature?

## Question 1

Does WG14 want a feature similar to **unreachable** with no arguments along the lines of N2757, either provided as

- proper syntax,
- an attribute,
- a function interface or
- a macro interface?

# How do we want such a feature?

## Question 2

Does WG14 want such a feature to be provided as a function interface?

## Question 3

Does WG14 want to add such a function interface to <assert.h>?



# How do we want that feature to be named?

## Question 4

Does WG14 want to use the name **unreachable** for the feature?



# Do we want to add reason?

## Question 5

Does WG14 want to add the possibility to add a string that provides a reason to the feature?

## Question 6

Shall such a string be required to be a string literal?

## Question 7

Shall such a string be required to be compatible to **char const\*** ?

