

P3087

**Make direct-initialization for
enumeration types at least
as permissive as
direct-list-initialization**

Author: Jan Schultke
Presenter: Jan Schultke
Audience: SG17
Project: ISO/IEC 14882 Programming Languages — C++,
ISO/IEC JTC1/SC22/WG21

Tokyo 2024
東京

Contents

1. Introduction
2. Motivation
3. Proposal
4. Impact/Design

1. Introduction

Recent history of enum initialization

- **P0138R2**: Construction Rules for enum class Values (C++17)
- **P0960R3**: Allow initializing aggregates from a parenthesized list of values (C++20)
- “*What about parenthesized initialization of enumerations?*”

Status quo

```
enum class E {};  
E a{0}; // OK, direct-list-initialization  
E{0}; // OK, direct-list-initialization  
E(0); // OK, function-style cast  
E b = 0; // error: cannot convert 'int' to 'E' in initialization  
E c(0); // error: cannot convert 'int' to 'E' in initialization  
new E(0); // error: cannot convert 'int' to 'E' in initialization
```

2. Motivation

Teachability issues

- **Intuition** violation:
 - “*Direct-list-init is direct-init, but without narrowing conversions.*”
- Enumeration initialization is **inconsistent** with ...
 - class type initialization
 - arithmetic type initialization

Don't repeat yourself

```
std::vector<std::byte> bytes;  
bytes.emplace_back(0xff); // ill-formed  
bytes.emplace_back(std::byte{0xff}); // OK, but DRY violation
```

3. Proposal

Wording

In [\[dcl.init.general\]](#), define direct-initialization for enumerations exactly like direct-list-initialization, except that narrowing conversions don't matter.

- (As a consequence, direct-init is defined in terms of `static_cast`.)

Editorial changes to [\[dcl.init.list\]](#) for enumerations:

- itemize (prose to bullets)
- define `T{...}` in terms of `static_cast<T>(...)` instead of `T(...)`

TODO: Feature-detection macro?

4. Impact/Design

Questions

- *“Is existing code affected?”*
 - Only expression testing (SFINAE, etc.)
- *“What about enums without fixed underlying types?”*
 - No changes, direct-init remains **ill-formed** (consistent with direct-list-init)
- *“Should implicit conversions to enums be allowed in general?”*
 - **No!**

Dubious side effect

```
std::byte b(1000.f); // OK ?!
```

References

Jan Schultke; **P3087**: Make direct-initialization for enumeration types at least as permissive as direct-list-initialization (latest revision)

<https://eisenwave.github.io/cpp-proposals/enum-direct-init.html>

Gabriel Dos Reis; **P0138R2**: Construction Rules for enum class Values

<https://www.open-std.org/jtc1/sc22/wg21/docs/papers/2016/p0138r2.pdf>

Ville Voutilainen, Thomas Köppe; **P0960R3**: Allow initializing aggregates from a parenthesized list of values

<https://www.open-std.org/jtc1/sc22/wg21/docs/papers/2019/p0960r3.html>