Relax requirements on wchar_t to match existing practices

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Programming Language C++
Audience: SG-22, EWG, LEWG
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Target

C++23

Abstract

We propose to remove the constraints put on the encoding associated with wchar_t in the core wording.

Revisions

R1

• Rebase and cleanup the wording.

Motivation

The standard claims that wchar_t should encode all characters of all wide encoding as a single code unit. This does not match existing practices, as wchar_t denotes UTF-16 on Windows. The Windows Documentation states:

Windows represents Unicode characters using UTF-16 encoding, in which each character is encoded as a 16-bit value. UTF-16 characters are called wide characters, to distinguish them from 8-bit ANSI characters. The Visual C++ compiler supports the built-in data type wchar_t for wide characters.

This is not merely an issue of MSVC being none conforming. It makes C++ unsuitable for development on a widely deployed operating system.

ISO 10646 also mentions:

NOTE – Former editions of this document included references to a two-octet BMP form called UCS-2 which would be a subset of the UTF-16 encoding form
restricted to the BMP UCS scalar values. The UCS-2 form is deprecated.

Moreover, the requirement that “the values of type wchar_t can represent distinct codes for all members of the largest extended character set specified among the supported locales” also precludes any 2 bytes encodings (including UCS2), if (one of) the execution character set is UTF-8, as not all Unicode codepoints (21 bits) are representable in a single 2 bytes wchar_t.

Instead of stating Windows, and environments where UTF-8 is used are non-conforming, which is not useful to users, we propose to remove the constraint from the core wording.

However, we cannot change the wide functions, both for API/ABI reasons, because they are controlled by C, and at best, this requires complex surgery.

Instead, we move the constraints from the type of wchar_t to the constraints of the execution encoding, as defined by P2314R3 [1].

Previous discussions can be found in this SG-16 issue.

**Behavior changes**

This paper makes UTF-16 in wide literals well-formed. This does not affect implementations that were already accepting them [Compiler Explorer]. This paper is therefore standardizing standard practices.

**What about the library?**

Still the status quo. Further work is needed there.

**C compat**

C has the same wording.

| wide character value representable by an object of type wchar_t, capable of representing any character in the current locale |

C should consider adopting a similar resolution, however, the proposed change has no impact on C compatibility. (we are removing a constraint).

**Previous polls**

SG16 POLL: Add expanded motivation to D2460R0 and forward the paper so revised to EWG with a recommended ship vehicle of C++23.

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Wording

[Editor's note: Modify [basic.fundamental] p8 as follow:]

Type `wchar_t` is a distinct type that has an implementation-defined signed or unsigned integer type as its underlying type. The values of type `wchar_t` can represent distinct codes for all members of the largest extended character set specified among the supported locales.

[Editor's note: Change 16.3.3.3.5.1 [character.seq.general] paragraph 1.]

The C standard library makes widespread use of characters and character sequences that follow a few uniform conventions:

- Properties specified as `locale-specific` may change during program execution by a call to `setlocale(int, const char*)` (28.5.1 [locale.syn]), or by a change to a `locale` object, as described in 28.3 [locales] and Clause 29 [input.output].

- The execution character set and the execution wide-character set are supersets of the basic literal character set (5.3 [lex.charset]). The encodings of the execution character sets and the sets of additional elements (if any) are locale-specific. All elements of the execution wide-character set are encoded as a single code unit representable by a value of type `wchar_t`.

  [Note: The encoding of the execution character sets can be unrelated to any literal encoding. — end note]

- A letter is any of the 26 lowercase or 26 uppercase letters in the basic execution character set.

- The decimal-point character is the locale-specific (single-byte) character used by functions that convert between a (single-byte) character sequence and a value of one of the floating-point types. It is used in the character sequence to denote the beginning of a fractional part. It is represented in [support] through [thread] and [depr], ′′, which is also its value in the "C" locale.

Acknowledgment

Thanks to SG-16 for their feedback on this paper, notably Hubert Tong for mentioning that even UCS-2 does not always satisfy the core wording requirements.

References
