

N2878: `nsec_t` && `timespec::tv_nsec`

`timespec::tv_nsec` is too wide and unsatisfiable by some architectures.

Relaxing the type by introducing **`nsec_t`** can alleviate this.

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1. The issue

The current wording in the current draft C2X standard [N2731](#) from 7.27.1.4 is:

The range and precision of times representable in `clock_t` and `time_t` are implementation-defined. The `timespec` structure shall contain at least the following members, in any order. The semantics of the members and their normal ranges are expressed in the comments.³⁴²⁾

```
time_t tv_sec; // whole seconds -- ≥ 0
long tv_nsec; // nanoseconds -- [0, 999999999]
```

However, this presents a small set of problems:

- a) the minor: this is a hold-over from ILP32 architectures, and on LP64 architectures `longs` are way too big, and
- b) the major: there are existing implementations which *cannot* conform to this, due to ABI requirements.

2. Examples

Under Linux®, on the [X32](#) ABI, the kernel's `struct timespec` is invariably

```
struct timespec {
    time_t tv_sec;
    long tv_nsec;
};
```

under the *kernel ABI*: the LP64 AMD64. This means that from the ILP32 userspace, it looks like this:

```
struct timespec {
    time_t tv_sec;
    int64_t tv_nsec;
};
```

The shortest available `int64_t` is `long long`, and the libc *must* expose a kernel-ABI-compatible `timespec` — a pickle indeed!

3. Proposed wording

3.1. 7.27.1.3

The types declared are `size_t` (described in 7.19);

`clock_t`

and

time_t

which are real types capable of representing times;

nsec_t

which is an implementation-defined integer type capable of representing the range [0, 999999999];

struct timespec

which holds an interval specified in seconds and nanoseconds (which may represent a calendar time based on a particular epoch); and

struct tm

which holds the components of a calendar time, called the *broken-down time*.

3.2. 7.27.1.4

The range and precision of times representable in **clock_t** and **time_t** are implementation-defined. The **timespec** structure shall contain at least the following members, in any order. The semantics of the members and their normal ranges are expressed in the comments.³⁴²⁾

```
time_t tv_sec; // whole seconds -- ≥ 0
long tv_nsec; // nanoseconds [0, 999999999]
nsec_t tv_nsec; // nanoseconds -- [0, 999999999]
```

The **tm** structure shall... [rest of section unchanged]

4. Rationale

Being strictly additive, this changes nothing on already-conforming implementations: **nsec_t** can simply continue to be **long**.

However, this enforces the need to cast **tv_nsec** to a concrete type for formatting or other processing, and allows user code to actually store it in its original form.

5. References

The current Linux ABI **timespec** situation: <https://sourceware.org/pipermail/libc-alpha/2021-December/133702.html> — this is part of a larger thread born out of an attempt to accurately describe **time-spec::tv_nsec** as part of Linux man-pages' **system_data_types(7)**: <https://lore.kernel.org/linux-man/ec1dcc655184f6cdaae40ff8b7970b750434e4ef.1638123425.git.nabijaczleweli@nabijaczleweli.xyz/T/>

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