CON39-C. Do not join or detach a thread that was previously joined or detached

The C Standard, 7.26.5.6 [ISO/IEC 9899:2011], states that a thread shall not be joined once it was previously joined or detached. Similarly, subclause 7.26.5.3 states that a thread shall not be detached once it was previously joined or detached. Violating either of these subclauses results in undefined behavior.

Noncompliant Code Example

This noncompliant code example detaches a thread that is later joined.

```c
#include <stddef.h>
#include <threads.h>

int thread_func(void *arg) {
    /* Do work */
    thrd_detach(thrd_current());
    return 0;
}

int main(void) {
    thrd_t t;

    if (thrd_success != thrd_create(&t, thread_func, NULL)) {
        /* Handle error */
        return 0;
    }

    if (thrd_success != thrd_join(t, 0)) {
        /* Handle error */
        return 0;
    }
    return 0;
}
```

Compliant Solution

This compliant solution does not detach the thread. Its resources are released upon successfully joining with the main thread:

```c
#include <stddef.h>
#include <threads.h>

int thread_func(void *arg) {
    /* Do work */
    return 0;
}

int main(void) {
    thrd_t t;

    if (thrd_success != thrd_create(&t, thread_func, NULL)) {
        /* Handle error */
        return 0;
    }

    if (thrd_success != thrd_join(t, 0)) {
        /* Handle error */
        return 0;
    }
    return 0;
}
```

Risk Assessment
Joining or detaching a previously joined or detached thread is undefined behavior.

<table>
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<tr>
<th>Rule</th>
<th>Severity</th>
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<th>Priority</th>
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<tr>
<td>CON39-C</td>
<td>Low</td>
<td>Likely</td>
<td>Medium</td>
<td>P6</td>
<td>L2</td>
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**Automated Detection**

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<tr>
<th>Tool</th>
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<tr>
<td>Astrée</td>
<td>19.04</td>
<td></td>
<td>Supported, but no explicit checker</td>
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<tr>
<td>Parasoft C/C++test</td>
<td>10.4.2</td>
<td>CERT_C-CON39-a</td>
<td>Do not join or detach a thread that was previously joined or detached</td>
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<td>Polyspace Bug Finder</td>
<td>R2019b</td>
<td>CERT C: Rule CON39-C</td>
<td>Checks for join or detach of a joined or detached thread (rule fully covered)</td>
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</table>

**Related Vulnerabilities**

Search for vulnerabilities resulting from the violation of this rule on the CERT website.

**Bibliography**


Subclause 7.26.5.6, "The `thrd_join` Function"