Using non-standard attributes

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Changes

Changes from P0028R1 [1]:

- Removed alternate names for introducer as using was selected.
- Removed lookup rules and replacing in terms of rewriting rules.

Changes from P0028R0 [2]:

- We now propose a namespace introducer instead of the previous using attribute.
- Scoping is limited to the current attribute list.

1 Introduction

This paper proposes a new attribute introducer to avoid the need of repetitive use of attributes namespaces.

Attributes [3] provide a useful way to add annotations to source code with implementation defined effects. Implementations are expected to add their own attribute namespace where their attributes are defined. In fact, scoped attributes —those under a specific namespace— are specified as conditionally supported. While this approach provides a clean way for different implementations to add their own attributes, it may lead to very verbose code.

To better support the introduction of conditionally supported attributes we propose the addition of an attribute introducer, to avoid repetition of attribute namespaces when making extensive use of attributes to perform code annotations.

2 Problem

Attributes have proved to be a very useful way to perform source code annotations. One example of this is the set of attributes [4] defined in the context of the REPARA project (http://www.repara-project.eu).

A simple example of such use is the annotation of computational kernels that can be later transformed to different programming models.

```c
void f() {
    [[rpr::kernel]]
    for (int i=0; i<iterations; ++i) {
        do_something();
    }
}
```
However, in complex cases multiple attributes need to be used in a single annotation. This results in a verbosity that will make most implementations to look for very short attribute namespaces names.

```c
void f() {
    [[rpr::pipeline(bound, 8, blocking), rpr::stream(A,B)]]
    for (int i=0; i<iterations; ++i) {
        [[rpr::kernel, rpr::out(a), rpr::target(cpu)]]
        a = get_value();

        [[rpr::kernel, rpr::farm(4,ordered), rpr::in(A,C), rpr::out(A,B), rpr::target(cpu,gpu)]]
        for (int j=0;j<max;++j) {
            b = f(a,c);
        }

        [[rpr::kernel, rpr::in(A,B)]]
        g(a,b);
    }
}
```

An alternate solution could be to combine multiple attributes with a more complex syntax, but this would introduce complexities in the attribute syntax itself while making worse the ability to understand the annotations.

### 3 Proposal

We propose a new attribute namespace introducer, to introduce an attribute namespace in the current attribute specifier.

```c
// Current situation
void f() {
    [[rpr::kernel, rpr::target(cpu,gpu)]]
    do_task();
}

// Proposed change
void g() {
    [[using rpr::kernel, target(cpu,gpu)]]
    do_task();
}
```

#### 3.1 Effect of the using introducer

The effect of a `using` introducer is to introduce all the attributes names from a specific attribute namespace into the global attribute namespace. Thus, after a `using` attribute, all the attributes from that namespace can be used without explicit mention to the namespace.

```c
void g() {
    [[using rpr::kernel]] // equivalent to [[rpr::kernel]]
    do_task();
}
```

#### 3.2 Scope of the using introducer

The effect of a `using` introducer is limited to the attribute list where it appears.

```c
void f(X & x) {
    [[rpr::kernel, rpr::target(gpu), rpr::out(x)]] g1(x); // OK
    [[using rpr::kernel, target(gpu), out(x)]] g2(x); // OK
    [[using rpr::kernel]] [[target(gpu)]] g3(x); // Wrong. Target in different attr-list
}
```
3.3 Simplified rules

Instead of introducing complex lookup rules (as in [1]) we propose a simplified set of rules:

Only a single attribute namespace introducer may be used within an attribute specifier.

\[
\text{[[ using ns1: at1, at2, using ns2: at3]]} \quad \text{// Il-formed}
\]

All attributes in an attribute specifier containing a namespace introducer are interpreted as if every attribute in that attribute specifier was prefixed by the introduced namespace.

Thus the following specifier:

\[
\text{[[ using ns1: at1, at2, at3]]}
\]

is equivalent to:

\[
\text{[[ ns1::at1, ns1::at2, ns1::at3]]}
\]

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References


