

## Section 1.1 C++11

## decltype

For example, consider the task of writing a **generic** `sortRange` function template that, given a **range**, either invokes the **sort member function** of the **argument** (the one specifically optimized for that type) if available or falls back to the more general `std::sort`:

```
template <typename Range>
void sortRange(Range& range)
{
    sortRangeImpl(range, 0);
}
```

The client-facing `sortRange` function in the example above delegates its behavior to an **overloaded** `sortRangeImpl` function in the example below, invoking the latter with the range and a **disambiguator** of type `int`. The type of this additional **parameter**, whose value is arbitrary, is used to give priority to the **sort member function** at compile time by exploiting **overload resolution** rules in the presence of an implicit, *standard* conversion from `int` to `long`:

```
template <typename Range>
void sortRangeImpl(Range& range, long) // low priority: standard conversion
{
    // fallback implementation
    std::sort(std::begin(range), std::end(range));
}
```

The fallback overload of `sortRangeImpl` in the code snippet above will accept a **long** disambiguator, requiring a **standard conversion** from `int`, and will simply invoke `std::sort`. The more specialized overload of `sortRangeImpl` in the code snippet below will accept an **int** disambiguator requiring no conversions and thus will be a better match, provided a **range-specific sort** is available:

```
template <typename Range>
void sortRangeImpl(Range& range,
                  int, // high priority: exact match
                  decltype(range.sort())* = 0) // check expression validity
{
    // optimized implementation
    range.sort();
}
```

Note that, by exposing `decltype(range.sort())` as part of `sortRangeImpl`'s declaration, the more specialized overload will be discarded during template substitution if `range.sort()` is not a valid **expression** for the deduced `Range` type.<sup>3</sup>

<sup>3</sup>The technique of exposing a possibly unused unevaluated **expression** — e.g., using `decltype` — in a function's declaration for the purpose of **expression-validity** detection prior to **template instantiation** is commonly known as **expression SFINAE**, which is a restricted form of the more general, classical SFINAE, and acts exclusively on **expressions** visible in a function's **signature** rather than on frequently obscure template-based type computations.