Range constructor for `std::string_view` 2: Constrain Harder

1 Abstract

in Belfast, LWG accepted P1391 partially over concern about the constraints for the range constructor, and as such only the iterator+sentinel constructor was accepted. Please refer to P1391 for the design of the proposed changed. (P1391 being now accepted, I needed a new paper number for the range constructor.)

2 Issues found during wording reviews

The current idiomatic way to construct a `string_view` is to define a `string_view` operator on user-defined classes, as does `std::string`, `QString` Boost Beast, `fmt` and other. With the changes as proposed in P1391R3, the range constructor may be selected over the conversion function. This is not observable in practice, unless the `string_view` returned by the conversion function is not the same value as what the range constructor would create.

```
struct buffer {
   buffer() {};
   char const* begin() const { return data; }
   char const* end() const { return data + 42; }
   operator basic_string_view<char, s>() const{
      return basic_string_view<char, s>(data, data +2);
   }
private:
   char data[42];
};
```

To make sure this conversion function keeps getting selected, we had the fiollowing constraint

- `std::remove_cvref_t<R>` has no `basic_string_view<charT, traits>` conversion operator.

With that constraint, any type that has a conversion operator will use that conversion operator. If a `const` type has a non-const conversion function the program remains ill-form.

Conversion between `string_view` types with different `charT` or different `type_traits` are ill-formed.

If a type otherwise satisfying the constraints has a conversion operator to a different `basic_string_view`, notably `basic_string_view<charT, some-other-traits-type>`, while not itself defining `using type_traits = some-other-traits-type`, a program that was previously ill-formed will call the new range overload.

2.1 Implementability

The following overload satisfies the desired set of constraints

```
template <typename T, typename Traits>
concept has_compatible_traits = !requires { typename T::traits_type; }
|| r::same_as<typename T::traits_type, Traits>;


template<typename charT, typename traits = std::char_traits<char>>
struct basic_string_view {
        //...
        template <r::contiguous_range R>
        requires r::sized_range<R>
          && (!std::is_convertible_v<R, const charT*>)
          &&   std::is_same_v<std::remove_cvref_t<r::range_reference_t<R>>, charT>
          &&   has_compatibe_traits<R, traits>
          && (!requires (std::remove_cvref_t<R> & d) {
               d.operator basic_string_view<char, traits>();
          })
        basic_string_view(R&&);
}
```

3 Proposed wording

Change in [**string.view**] **20.4.2**:

```
template<class charT, class traits = char_traits<charT>>
class basic_string_view {
public:
    [...]

    // construction and assignment
    constexpr basic_string_view() noexcept;
    constexpr basic_string_view(const basic_string_view&) noexcept = default;
    constexpr basic_string_view& operator=(const basic_string_view&) noexcept = default;
    constexpr basic_string_view(const charT* str);
    constexpr basic_string_view(const charT* str, size_type len);
    template <class It, class End>
    constexpr basic_string_view(It begin, End end);
```

```
        template <class R>
        constexpr basic_string_view(R&& r);


        [...]
};

template<class R>
basic_string_view(R&&)
 -> basic_string_view<remove_reference_t<ranges::range_reference_t<R>>>;

template<class It, class End>
basic_string_view(It, End) -> basic_string_view<iter_value_t<It>>;
```

Change in [**string.view.cons**] **20.4.2.1**:

Add after 7

```
template <class R>
constexpr basic_string_view(R&& r);
```

   Constraints:

- R satisfies `ranges::contiguous_range`,

- R satisfies `ranges::sized_range`,

- `is_same_v<remove_reference_t<ranges::range_reference_t<R>>, charT>` is `true`,

- `is_convertible_v<R, const charT*>` is `false`,

- `std::remove_cvref_t<R>` has no `basic_string_view<charT, traits>` conversion operator, and

- If the qualified-id `R::traits_type` is valid and denotes a type, `is_same_v<R::traits_type, traits>` is `true`.

   Expects:

- R models `ranges::contiguous_range`, and

- R models `ranges::sized_range`.

   Effects: Initializes `data_` with `ranges::data(r)` and `size_` with `ranges::size(r)`.

   Throws: What and when `ranges::data(r)` and `ranges::size(r)` throw.

Add to the section [string.view.deduct] the following deduction guides:

```
template<class R>
basic_string_view(R&&)
-> basic_string_view<remove_reference_t<ranges::range_reference_t<R>>>;
```

   Constraints: R satisfies `ranges::contiguous_range`.