Writing Regexps 2021-22 / Regex Parser

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Chapter 1

Namespace Index

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Namespace Documentation

5.1 wr22 Namespace Reference

Namespaces

- namespace regex_parser

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Namespaces

- namespace parser
- namespace regex
- namespace span

5.3 wr22::regex_parser::parser Namespace Reference

Namespaces

- namespace errors

Classes

- class Parser

  A regex parser.

Functions

- template<typename Iter , typename Sentinel >
  Parser (Iter begin, Sentinel end) -> Parser< Iter, Sentinel >

  The type deduction guideline for `Parser`.
- regex::SpannedPart parse_regex (const std::u32string_view &regex)

  Parse a regular expression into its AST.

5.3.1 Function Documentation

5.3.1.1 parse_regex()

```
regex::SpannedPart wr22::regex_parser::parser::parse_regex (
            const std::u32string_view & regex )
```

Parse a regular expression into its AST.

The regular expression is a string view in the UTF-32 encoding. It is parsed and its object representation (see the docs for `regex::SpannedPart`) is built. The returned representation is an owned object and its lifetime does not depend on the lifetime of the `regex` argument.

If the parsing fails, an exception is thrown. `errors::ParseError` is the base class for all exceptions thrown from this function, but more specific exceptions may be caught and handled separately. See the docs for the `errors.hpp` file for details.

Returns

the parsed regex AST if the parsing succeeds.

Exceptions

errors::ParseError	if the parsing fails.

5.3.1.2 Parser()

```
template<typename Iter , typename Sentinel >
wr22::regex_parser::parser::Parser (
            Iter begin,
            Sentinel end ) -> Parser< Iter, Sentinel >
```

The type deduction guideline for `Parser`.

5.4 wr22::regex_parser::parser::errors Namespace Reference

Classes

- class ExpectedEnd

  The error when the parser expected the input to end, but it did not.
- class InvalidRange

  The error indicating that a character range in a character class is invalid.
- struct ParseError

  The base class for parse errors.

- class TooStronglyNested

  The error signalling that the regular expression has too many levels of nesting to be parsed.
- class UnexpectedChar

  The error when the parser got a character it didn't expect at the current position.
- class UnexpectedEnd

  The error when the parser hit the end of the input earlier than it expected.

5.5 wr22::regex_parser::regex Namespace Reference

Namespaces

- namespace capture
- namespace part

  The namespace with the variants of `Part`.

Classes

- class Capture

  Group capture behavior.
- struct CharacterClassData

  A character class representation: a list of character ranges plus some additional properties.
- class CharacterRange

  A non-empty character range, possibly containing only one character.
- struct InvalidCharacterRange
- class Part

  A part of a regular expression and its AST node type.
- struct SpannedCharacterRange

  A `CharacterRange` with its span.
- class SpannedPart

  A version of `Part` including the span information (position in the input) of the root AST node (child nodes always contain it because they are represented as `SpannedPart`s themselves).

Enumerations

- enum class NamedCaptureFlavor { Apostrophes , Angles , AnglesWithP }

  The flavor (dialect) of a named group capture.

Functions

- std::ostream & operator<< (std::ostream &out, const Capture &capture)
- void to_json (nlohmann::json &j, const Capture &capture)
- std::ostream & operator<< (std::ostream &out, const CharacterRange &range)
- void to_json (nlohmann::json &j, const CharacterRange &range)
- std::ostream & operator<< (std::ostream &out, NamedCaptureFlavor flavor)
- void to_json (nlohmann::json &j, NamedCaptureFlavor flavor)
- std::ostream & operator<< (std::ostream &out, const SpannedPart &part)

  Convert a `SpannedPart` to a textual representation and write it to an `std::ostream`.
- void to_json (nlohmann::json &j, const Part &part)
- void to_json (nlohmann::json &j, const SpannedPart &part)
- std::ostream & operator<< (std::ostream &out, const SpannedCharacterRange &range)
- void to_json (nlohmann::json &j, const SpannedCharacterRange &range)

5.5.1 Enumeration Type Documentation

5.5.1.1 NamedCaptureFlavor

```
enum class wr22::regex_parser::regex::NamedCaptureFlavor  [strong]
```

The flavor (dialect) of a named group capture.

The most common variants are included. This list is subject to extension if deemed necessary. The source used as a reference is https://www.regular-expressions.info/named.html.

Enumerator

Apostrophes	The flavor `(?'name'contents)`. Mostly used in C# and other .NET-oriented languages, although can also be found in certain versions Perl, Boost and elsewhere.
Angles	The flavor `(?<name>contents)`. Mostly used in C# and other .NET-oriented languages, although can also be found in certain versions Perl, Boost and elsewhere.
AnglesWithP	The flavor `(?P<name>contents)`. Found in Python, PCRE and elsewhere.

5.5.2 Function Documentation

5.5.2.1 operator<<() [1/5]

```
std::ostream & wr22::regex_parser::regex::operator<< (
            std::ostream & out,
            const Capture & capture )
```

5.5.2.2 operator<<() [2/5]

```
std::ostream & wr22::regex_parser::regex::operator<< (
            std::ostream & out,
            const CharacterRange & range )
```

5.5.2.3 operator<<() [3/5]

```
std::ostream & wr22::regex_parser::regex::operator<< (
            std::ostream & out,
            const SpannedCharacterRange & range )
```

5.5.2.4 operator<<() [4/5]

```
std::ostream & wr22::regex_parser::regex::operator<< (
            std::ostream & out,
            const SpannedPart & spanned_part )
```

Convert a SpannedPart to a textual representation and write it to an std::ostream.

5.5.2.5 operator<<() [5/5]

```
std::ostream & wr22::regex_parser::regex::operator<< (
            std::ostream & out,
            NamedCaptureFlavor flavor )
```

5.5.2.6 to_json() [1/6]

```
void wr22::regex_parser::regex::to_json (
            nlohmann::json & j,
            const Capture & capture )
```

5.5.2.7 to_json() [2/6]

```
void wr22::regex_parser::regex::to_json (
            nlohmann::json & j,
            const CharacterRange & range )
```

5.5.2.8 to_json() [3/6]

```
void wr22::regex_parser::regex::to_json (
            nlohmann::json & j,
            const Part & part )
```

5.5.2.9 to_json() [4/6]

```
void wr22::regex_parser::regex::to_json (
            nlohmann::json & j,
            const SpannedCharacterRange & range )
```

5.5.2.10 to_json() [5/6]

```
void wr22::regex_parser::regex::to_json (
            nlohmann::json & j,
            const SpannedPart & part )
```

5.5.2.11 to_json() [6/6]

```
void wr22::regex_parser::regex::to_json (
            nlohmann::json & j,
            NamedCaptureFlavor flavor )
```

5.6 wr22::regex_parser::regex::capture Namespace Reference

Classes

- struct Index

  Denotes a group captured by index.
- struct Name

  Denotes a group captured by name.
- struct None

  Denotes an non-capturing group.

Typedefs

- using Adt = utils::Adt< None, Index, Name >

Functions

- void to_json (nlohmann::json &j, const None &capture)
- void to_json (nlohmann::json &j, const Index &capture)
- void to_json (nlohmann::json &j, const Name &capture)

5.6.1 Typedef Documentation

5.6.1.1 Adt

```
using wr22::regex_parser::regex::capture::Adt = typedef utils::Adt<None, Index, Name>
```

5.6.2 Function Documentation

5.6.2.1 to_json() [1/3]

```
void wr22::regex_parser::regex::capture::to_json (
            nlohmann::json & j,
            const Index & capture )
```

5.6.2.2 to_json() [2/3]

```
void wr22::regex_parser::regex::capture::to_json (
            nlohmann::json & j,
            const Name & capture )
```

5.6.2.3 to_json() [3/3]

```
void wr22::regex_parser::regex::capture::to_json (
            nlohmann::json & j,
            const None & capture )
```

5.7 wr22::regex_parser::regex::part Namespace Reference

The namespace with the variants of `Part`.

Classes

- struct Alternatives
  A regex part with the list of alternatives to be matched.
- struct CharacterClass
  A regex part specifying a character class (e.g. `[a-z_]`).
- struct Empty
  An empty regex part.
- struct Group
  A regex part that represents a group in parentheses.
- struct Literal
  An regex part that matches a single character literally.
- struct Optional
  A regex part specifying an optional quantifier (`(expression)?`).
- struct Plus
  A regex part specifying an "at least one" quantifier (`(expression)+`).
- struct Sequence
  A regex part with the list of items to be matched one after another.
- struct Star
  A regex part specifying an "at least zero" quantifier (`(expression)*`).
- struct Wildcard
  A regex part specifying any single character (`.`).

Typedefs

- using Adt = utils::Adt< Empty, Literal, Alternatives, Sequence, Group, Optional, Plus, Star, Wildcard, CharacterClass >

Functions

- void to_json (nlohmann::json &j, const part::Empty &part)
- void to_json (nlohmann::json &j, const part::Literal &part)
- void to_json (nlohmann::json &j, const part::Alternatives &part)
- void to_json (nlohmann::json &j, const part::Sequence &part)
- void to_json (nlohmann::json &j, const part::Group &part)
- void to_json (nlohmann::json &j, const part::Optional &part)
- void to_json (nlohmann::json &j, const part::Plus &part)
- void to_json (nlohmann::json &j, const part::Star &part)
- void to_json (nlohmann::json &j, const part::Wildcard &part)
- void to_json (nlohmann::json &j, const part::CharacterClass &part)

5.7.1 Detailed Description

The namespace with the variants of `Part`.

See the docs for the `Part` type for additional information.

5.7.2 Typedef Documentation

5.7.2.1 Adt

```
using wr22::regex_parser::regex::part::Adt = typedef utils::  Adt<Empty, Literal, Alternatives,
Sequence, Group, Optional, Plus, Star, Wildcard, CharacterClass>
```

5.7.3 Function Documentation

5.7.3.1 to_json() [1/10]

```
void wr22::regex_parser::regex::part::to_json (
            nlohmann::json & j,
            const part::Alternatives & part )
```

5.7.3.2 to_json() [2/10]

```
void wr22::regex_parser::regex::part::to_json (
            nlohmann::json & j,
            const part::CharacterClass & part )
```

5.7.3.3 to_json() [3/10]

```
void wr22::regex_parser::regex::part::to_json (
            nlohmann::json & j,
            const part::Empty & part )
```

5.7.3.4 to_json() [4/10]

```
void wr22::regex_parser::regex::part::to_json (
            nlohmann::json & j,
            const part::Group & part )
```

5.7.3.5 to_json() [5/10]

```
void wr22::regex_parser::regex::part::to_json (
            nlohmann::json & j,
            const part::Literal & part )
```

5.7.3.6 to_json() [6/10]

```
void wr22::regex_parser::regex::part::to_json (
            nlohmann::json & j,
            const part::Optional & part )
```

5.7.3.7 to_json() [7/10]

```
void wr22::regex_parser::regex::part::to_json (
            nlohmann::json & j,
            const part::Plus & part )
```

5.7.3.8 to_json() [8/10]

```
void wr22::regex_parser::regex::part::to_json (
            nlohmann::json & j,
            const part::Sequence & part )
```

5.7.3.9 to_json() [9/10]

```
void wr22::regex_parser::regex::part::to_json (
            nlohmann::json & j,
            const part::Star & part )
```

5.7.3.10 to_json() [10/10]

```
void wr22::regex_parser::regex::part::to_json (
            nlohmann::json & j,
            const part::Wildcard & part )
```

5.8 wr22::regex_parser::span Namespace Reference

Classes

- struct InvalidSpan

  The exception thrown on an attempt to construct an invalid span.
- class Span

  Character position range in the input string.

Functions

- std::ostream & operator<< (std::ostream &out, Span span)
- void to_json (nlohmann::json &j, Span span)

5.8.1 Function Documentation

5.8.1.1 operator<<()

```
std::ostream & wr22::regex_parser::span::operator<< (
            std::ostream & out,
            Span span )
```

5.8.1.2 to_json()

```
void wr22::regex_parser::span::to_json (
            nlohmann::json & j,
            Span span )
```

Chapter 6

Class Documentation

6.1 wr22::regex_parser::regex::part::Alternatives Struct Reference

A regex part with the list of alternatives to be matched.

`#include <part.hpp>`

Public Member Functions

- Alternatives (std::vector< SpannedPart > alternatives)
- bool operator== (const Alternatives &rhs) const =default

Public Attributes

- std::vector< SpannedPart > alternatives

  The list of the alternatives.

Static Public Attributes

- static constexpr const char * code_name = "alternatives"

6.1.1 Detailed Description

A regex part with the list of alternatives to be matched.

Alternatives in regular expressions are subexpressions by |. For the whole expression part's match to succeed, at least one of the subexpressions must match the input successfully.

As an example, `a|(b)|cde` would be represented as an `Alternatives` part with 3 alternatives. The alternatives themselves are represented recursively as `SpannedPart`s.

6.1.2 Constructor & Destructor Documentation

6.1.2.1 Alternatives()

```
wr22::regex_parser::regex::part::Alternatives::Alternatives (
            std::vector< SpannedPart > alternatives )  [explicit]
```

6.1.3 Member Function Documentation

6.1.3.1 operator==()

```
bool wr22::regex_parser::regex::part::Alternatives::operator== (
            const Alternatives & rhs ) const  [default]
```

6.1.4 Member Data Documentation

6.1.4.1 alternatives

```
std::vector<SpannedPart> wr22::regex_parser::regex::part::Alternatives::alternatives
```

The list of the alternatives.

6.1.4.2 code_name

```
constexpr const char* wr22::regex_parser::regex::part::Alternatives::code_name = "alternatives"
[static], [constexpr]
```

The documentation for this struct was generated from the following files:

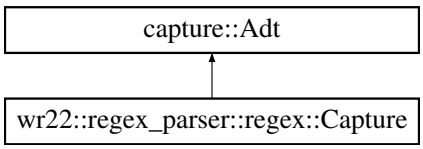
- include/wr22/regex_parser/regex/part.hpp
- src/regex/part.cpp

6.2 wr22::regex_parser::regex::Capture Class Reference

Group capture behavior.

`#include <capture.hpp>`

Inheritance diagram for wr22::regex_parser::regex::Capture:



6.2.1 Detailed Description

Group capture behavior.

A group can be captured by index (when one writes `(contents)`), by name (e.g. `(?<name>contents)` in some dialects) or not captured at all (`(?:contents)`). Objects of this type determine how exactly a certain group is going to be captured. This is a variant type (see `Part` and `utils::Adt` for a more detailed explanation of the concept). The variants for this class (explicitly or implicitly convertible to this type) are located in the `capture` namespace.

The documentation for this class was generated from the following file:

- include/wr22/regex_parser/regex/capture.hpp

6.3 wr22::regex_parser::regex::part::CharacterClass Struct Reference

A regex part specifying a character class (e.g. `[a-z_]`).

`#include <part.hpp>`

Public Member Functions

- CharacterClass (CharacterClassData data)
- bool operator== (const CharacterClass &rhs) const =default

Public Attributes

- CharacterClassData data

  The list of character ranges.

Static Public Attributes

- static constexpr const char * code_name = "character_class"

6.3.1 Detailed Description

A regex part specifying a character class (e.g. `[a-z_]`).

6.3.2 Constructor & Destructor Documentation

6.3.2.1 CharacterClass()

```
wr22::regex_parser::regex::part::CharacterClass::CharacterClass (
            CharacterClassData data )  [explicit]
```

6.3.3 Member Function Documentation

6.3.3.1 operator==()

```
bool wr22::regex_parser::regex::part::CharacterClass::operator== (
            const CharacterClass & rhs ) const  [default]
```

6.3.4 Member Data Documentation

6.3.4.1 code_name

```
constexpr const char* wr22::regex_parser::regex::part::CharacterClass::code_name = "character↩
_class"  [static], [constexpr]
```

6.3.4.2 data

```
CharacterClassData wr22::regex_parser::regex::part::CharacterClass::data
```

The list of character ranges.

The documentation for this struct was generated from the following files:

- include/wr22/regex_parser/regex/part.hpp
- src/regex/part.cpp

6.4 wr22::regex_parser::regex::CharacterClassData Struct Reference

A character class representation: a list of character ranges plus some additional properties.

`#include <character_class_data.hpp>`

Public Member Functions

- bool operator== (const CharacterClassData &rhs) const =default

Public Attributes

- std::vector< SpannedCharacterRange > ranges

  List of character ranges and their spans.
- bool inverted

  True if the match is inverted (i.e. `[^something]`), false otherwise.

6.4.1 Detailed Description

A character class representation: a list of character ranges plus some additional properties.

6.4.2 Member Function Documentation

6.4.2.1 operator==()

```
bool wr22::regex_parser::regex::CharacterClassData::operator== (
            const CharacterClassData & rhs ) const  [default]
```

6.4.3 Member Data Documentation

6.4.3.1 inverted

```
bool wr22::regex_parser::regex::CharacterClassData::inverted
```

True if the match is inverted (i.e. `[^something]`), false otherwise.

6.4.3.2 ranges

`std::vector<SpannedCharacterRange> wr22::regex_parser::regex::CharacterClassData::ranges`

List of character ranges and their spans.

Example: for `[a-z123]` it is '['a'..'z' [1..4], '1'..'1' [4..4], '2'..'2' [5..5], '3'..'3' [6..6]]` (both ends in character ranges are included; [A..B] are spans with the left end included and the right one excluded).

The documentation for this struct was generated from the following file:

- include/wr22/regex_parser/regex/character_class_data.hpp

6.5 wr22::regex_parser::regex::CharacterRange Class Reference

A non-empty character range, possibly containing only one character.

`#include <character_range.hpp>`

Public Member Functions

- char32_t first () const noexcept

  Get the left range bound (inclusive).
- char32_t last () const noexcept

  Get the right range bound (inclusive).
- bool contains (char32_t character) const noexcept

  Check if this range contains a given character.
- bool is_single_character () const noexcept

  Check if this range contains exactly one character.
- bool operator== (const CharacterRange &rhs) const noexcept=default

Static Public Member Functions

- static CharacterRange from_endpoints (char32_t first, char32_t last)

  Construct a character range given its two inclusive endpoints.
- static CharacterRange from_single_character (char32_t character) noexcept

  Construct a character range containing one given character.

6.5.1 Detailed Description

A non-empty character range, possibly containing only one character.

6.5.2 Member Function Documentation

6.5.2.1 contains()

```
bool wr22::regex_parser::regex::CharacterRange::contains (
            char32_t character ) const  [noexcept]
```

Check if this range contains a given character.

6.5.2.2 first()

```
char32_t wr22::regex_parser::regex::CharacterRange::first ( ) const  [noexcept]
```

Get the left range bound (inclusive).

6.5.2.3 from_endpoints()

```
CharacterRange wr22::regex_parser::regex::CharacterRange::from_endpoints (
            char32_t first,
            char32_t last )  [static]
```

Construct a character range given its two inclusive endpoints.

Exceptions

`InvalidCharacterRange`	if `last < first.`

6.5.2.4 from_single_character()

```
CharacterRange wr22::regex_parser::regex::CharacterRange::from_single_character (
            char32_t character )  [static], [noexcept]
```

Construct a character range containing one given character.

6.5.2.5 is_single_character()

```
bool wr22::regex_parser::regex::CharacterRange::is_single_character ( ) const  [noexcept]
```

Check if this range contains exactly one character.

6.5.2.6 last()

```
char32_t wr22::regex_parser::regex::CharacterRange::last ( ) const  [noexcept]
```

Get the right range bound (inclusive).

6.5.2.7 operator==()

```
bool wr22::regex_parser::regex::CharacterRange::operator== (
            const CharacterRange & rhs ) const  [default], [noexcept]
```

The documentation for this class was generated from the following files:

- include/wr22/regex_parser/regex/character_range.hpp
- src/regex/character_range.cpp

6.6 wr22::regex_parser::regex::part::Empty Struct Reference

An empty regex part.

`#include <part.hpp>`

Public Member Functions

- Empty ()=default
- bool operator== (const Empty &rhs) const =default

Static Public Attributes

- static constexpr const char * code_name = "empty"

6.6.1 Detailed Description

An empty regex part.

Corresponds to an empty regular expression (`""`) or the contents of an empty parenthesized group (`"()"`).

6.6.2 Constructor & Destructor Documentation

6.6.2.1 Empty()

```
wr22::regex_parser::regex::part::Empty::Empty ( )  [explicit], [default]
```

6.6.3 Member Function Documentation

6.6.3.1 operator==()

```
bool wr22::regex_parser::regex::part::Empty::operator== (
            const Empty & rhs ) const  [default]
```

6.6.4 Member Data Documentation

6.6.4.1 code_name

```
constexpr const char* wr22::regex_parser::regex::part::Empty::code_name = "empty"  [static],
[constexpr]
```

The documentation for this struct was generated from the following file:

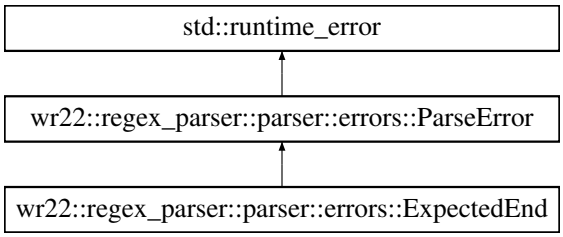
- include/wr22/regex_parser/regex/part.hpp

6.7 wr22::regex_parser::parser::errors::ExpectedEnd Class Reference

The error when the parser expected the input to end, but it did not.

```
#include <errors.hpp>
```

Inheritance diagram for wr22::regex_parser::parser::errors::ExpectedEnd:



Public Member Functions

- ExpectedEnd (size_t position, char32_t char_got)

  Constructor.
- size_t position () const

  Get the input position. See the constructor docs for a more detailed description.
- char32_t char_got () const

  Get the character the parser has received.

6.7.1 Detailed Description

The error when the parser expected the input to end, but it did not.

6.7.2 Constructor & Destructor Documentation

6.7.2.1 ExpectedEnd()

```
wr22::regex_parser::parser::errors::ExpectedEnd::ExpectedEnd (
            size_t position,
            char32_t char_got )
```

Constructor.

Parameters

position	the 0-based position in the input when the parser has encountered the end of input.
char_got	the character that the parser has received instead of the end of input.

6.7.3 Member Function Documentation

6.7.3.1 char_got()

```
char32_t wr22::regex_parser::parser::errors::ExpectedEnd::char_got ( ) const
```

Get the character the parser has received.

See the constructor docs for a more detailed description.

6.7.3.2 position()

```
size_t wr22::regex_parser::parser::errors::ExpectedEnd::position ( ) const
```

Get the input position. See the constructor docs for a more detailed description.

The documentation for this class was generated from the following files:

- include/wr22/regex_parser/parser/errors.hpp
- src/parser/errors.cpp

6.8 wr22::regex_parser::regex::part::Group Struct Reference

A regex part that represents a group in parentheses.

```
#include <part.hpp>
```

Public Member Functions

- Group (Capture capture, SpannedPart inner)

  Convenience constructor.
- bool operator== (const Group &rhs) const =default

Public Attributes

- Capture capture

  Capture behavior.
- utils::Box< SpannedPart > inner

  The smart pointer to the group contents.

Static Public Attributes

- static constexpr const char * code_name = "group"

6.8.1 Detailed Description

A regex part that represents a group in parentheses.

A group in regular expressions is virtually everything that is enclosed with parentheses: `(some group)`, `(?:blablabla)` and `(?P<group_name>group contents)` are all groups.

A group has two main attributes: (1) how it is captured during matching and (2) the contents of the group. The contents is simply another `SpannedPart`. The capture behavior is expressed by a separate type `Capture`. See its docs for additional info, and take a look at `https://www.regular-expressions.info/brackets.html` for an introduction to or a recap of regex groups and capturing.

6.8.2 Constructor & Destructor Documentation

6.8.2.1 Group()

```
wr22::regex_parser::regex::part::Group::Group (
            Capture capture,
            SpannedPart inner )  [explicit]
```

Convenience constructor.

6.8.3 Member Function Documentation

6.8.3.1 operator==()

```
bool wr22::regex_parser::regex::part::Group::operator== (
            const Group & rhs ) const  [default]
```

6.8.4 Member Data Documentation

6.8.4.1 capture

```
Capture wr22::regex_parser::regex::part::Group::capture
```

Capture behavior.

6.8.4.2 code_name

```
constexpr const char* wr22::regex_parser::regex::part::Group::code_name = "group"  [static],
[constexpr]
```

6.8.4.3 inner

```
utils::Box<SpannedPart> wr22::regex_parser::regex::part::Group::inner
```

The smart pointer to the group contents.

The documentation for this struct was generated from the following files:

- include/wr22/regex_parser/regex/part.hpp
- src/regex/part.cpp

6.9 wr22::regex_parser::regex::capture::Index Struct Reference

Denotes a group captured by index.

```
#include <capture.hpp>
```

Public Member Functions

- Index ()=default
- bool operator== (const Index &rhs) const =default

Static Public Attributes

- static constexpr const char * code_name = "index"

6.9.1 Detailed Description

Denotes a group captured by index.

6.9.2 Constructor & Destructor Documentation

6.9.2.1 Index()

```
wr22::regex_parser::regex::capture::Index::Index ( )  [explicit], [default]
```

6.9.3 Member Function Documentation

6.9.3.1 operator==()

```
bool wr22::regex_parser::regex::capture::Index::operator== (
            const Index & rhs ) const  [default]
```

6.9.4 Member Data Documentation

6.9.4.1 code_name

```
constexpr const char* wr22::regex_parser::regex::capture::Index::code_name = "index"  [static],
[constexpr]
```

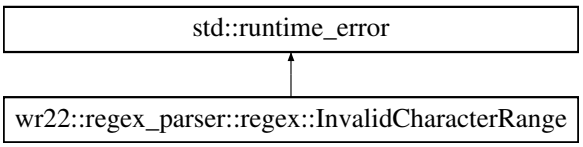
The documentation for this struct was generated from the following file:

- include/wr22/regex_parser/regex/capture.hpp

6.10 wr22::regex_parser::regex::InvalidCharacterRange Struct Reference

```
#include <character_range.hpp>
```

Inheritance diagram for wr22::regex_parser::regex::InvalidCharacterRange:



Public Member Functions

- InvalidCharacterRange (char32_t first, char32_t last)

Public Attributes

- char32_t first
- char32_t last

6.10.1 Constructor & Destructor Documentation

6.10.1.1 InvalidCharacterRange()

```
wr22::regex_parser::regex::InvalidCharacterRange::InvalidCharacterRange (
            char32_t first,
            char32_t last )  [explicit]
```

6.10.2 Member Data Documentation

6.10.2.1 first

```
char32_t wr22::regex_parser::regex::InvalidCharacterRange::first
```

6.10.2.2 last

```
char32_t wr22::regex_parser::regex::InvalidCharacterRange::last
```

The documentation for this struct was generated from the following files:

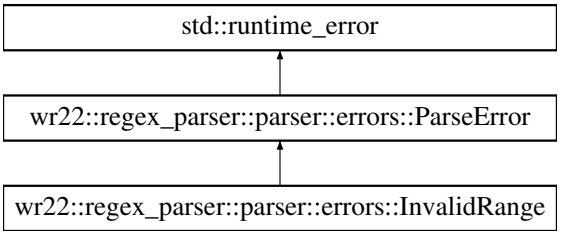
- include/wr22/regex_parser/regex/character_range.hpp
- src/regex/character_range.cpp

6.11 wr22::regex_parser::parser::errors::InvalidRange Class Reference

The error indicating that a character range in a character class is invalid.

```
#include <errors.hpp>
```

Inheritance diagram for wr22::regex_parser::parser::errors::InvalidRange:



Public Member Functions

- InvalidRange (span::Span span, char32_t first, char32_t last)

  Constructor.
- span::Span span () const

  Get the span of the character range. See the constructor docs for a more detailed explanation.
- char32_t first () const

  Get the first character in the character range.
- char32_t last () const

  Get the last character in the character range.

6.11.1 Detailed Description

The error indicating that a character range in a character class is invalid.

6.11.2 Constructor & Destructor Documentation

6.11.2.1 InvalidRange()

```
wr22::regex_parser::parser::errors::InvalidRange::InvalidRange (
            span::Span span,
            char32_t first,
            char32_t last )
```

Constructor.

Parameters

span	the span of the character range considered.
first	the first character in (left bound of) the range, as in the regex.
last	the last character in (right bound of) the range, as in the regex.

6.11.3 Member Function Documentation

6.11.3.1 first()

```
char32_t wr22::regex_parser::parser::errors::InvalidRange::first ( ) const
```

Get the first character in the character range.

See the constructor docs for a more detailed explanation.

6.11.3.2 last()

```
char32_t wr22::regex_parser::parser::errors::InvalidRange::last ( ) const
```

Get the last character in the character range.

See the constructor docs for a more detailed explanation.

6.11.3.3 span()

```
span::Span wr22::regex_parser::parser::errors::InvalidRange::span ( ) const
```

Get the span of the character range. See the constructor docs for a more detailed explanation.

The documentation for this class was generated from the following files:

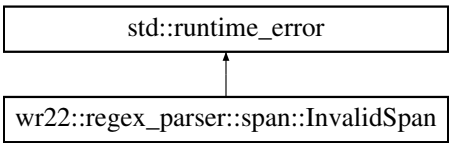
- include/wr22/regex_parser/parser/errors.hpp
- src/parser/errors.cpp

6.12 wr22::regex_parser::span::InvalidSpan Struct Reference

The exception thrown on an attempt to construct an invalid span.

```
#include <span.hpp>
```

Inheritance diagram for wr22::regex_parser::span::InvalidSpan:



Public Member Functions

- InvalidSpan (size_t begin, size_t end)

Public Attributes

- size_t begin
- size_t end

6.12.1 Detailed Description

The exception thrown on an attempt to construct an invalid span.

See the documentation for Span for additional information.

6.12.2 Constructor & Destructor Documentation

6.12.2.1 InvalidSpan()

```
wr22::regex_parser::span::InvalidSpan::InvalidSpan (
            size_t begin,
            size_t end )
```

6.12.3 Member Data Documentation

6.12.3.1 begin

```
size_t wr22::regex_parser::span::InvalidSpan::begin
```

6.12.3.2 end

```
size_t wr22::regex_parser::span::InvalidSpan::end
```

The documentation for this struct was generated from the following files:

- include/wr22/regex_parser/span/span.hpp
- src/span/span.cpp

6.13 wr22::regex_parser::regex::part::Literal Struct Reference

An regex part that matches a single character literally.

```
#include <part.hpp>
```

Public Member Functions

- Literal (char32_t character)
- bool operator== (const Literal &rhs) const =default

Public Attributes

- char32_t character

Static Public Attributes

- static constexpr const char * code_name = "literal"

6.13.1 Detailed Description

An regex part that matches a single character literally.

Corresponds to a plain character in a regular expression. E.g. the regex "`foo`" contains three character literals: `f`, `o` and `o`.

6.13.2 Constructor & Destructor Documentation

6.13.2.1 Literal()

```
wr22::regex_parser::regex::part::Literal::Literal (
            char32_t character )  [explicit]
```

6.13.3 Member Function Documentation

6.13.3.1 operator==()

```
bool wr22::regex_parser::regex::part::Literal::operator== (
            const Literal & rhs ) const  [default]
```

6.13.4 Member Data Documentation

6.13.4.1 character

```
char32_t wr22::regex_parser::regex::part::Literal::character
```

6.13.4.2 code_name

```
constexpr const char* wr22::regex_parser::regex::part::Literal::code_name = "literal"  [static],
[constexpr]
```

The documentation for this struct was generated from the following files:

- include/wr22/regex_parser/regex/part.hpp
- src/regex/part.cpp

6.14 wr22::regex_parser::regex::capture::Name Struct Reference

Denotes a group captured by name.

```
#include <capture.hpp>
```

Public Member Functions

- Name (std::string name, NamedCaptureFlavor flavor)
- bool operator== (const Name &rhs) const =default

Public Attributes

- std::string name
- NamedCaptureFlavor flavor

Static Public Attributes

- static constexpr const char * code_name = "name"

6.14.1 Detailed Description

Denotes a group captured by name.

A specific name and the syntax variant for this name's specification (see `NamedCaptureFlavor`) are stored.

6.14.2 Constructor & Destructor Documentation

6.14.2.1 Name()

```
wr22::regex_parser::regex::capture::Name::Name (
            std::string name,
            NamedCaptureFlavor flavor )  [explicit]
```

6.14.3 Member Function Documentation

6.14.3.1 operator==()

```
bool wr22::regex_parser::regex::capture::Name::operator== (
            const Name & rhs ) const  [default]
```

6.14.4 Member Data Documentation

6.14.4.1 code_name

```
constexpr const char* wr22::regex_parser::regex::capture::Name::code_name = "name"  [static],
[constexpr]
```

6.14.4.2 flavor

```
NamedCaptureFlavor wr22::regex_parser::regex::capture::Name::flavor
```

6.14.4.3 name

```
std::string wr22::regex_parser::regex::capture::Name::name
```

The documentation for this struct was generated from the following files:

- include/wr22/regex_parser/regex/capture.hpp
- src/parser/capture.cpp

6.15 wr22::regex_parser::regex::capture::None Struct Reference

Denotes an non-capturing group.

```
#include <capture.hpp>
```

Public Member Functions

- None ()=default
- bool operator== (const None &rhs) const =default

Static Public Attributes

- static constexpr const char * code_name = "none"

6.15.1 Detailed Description

Denotes an non-capturing group.

6.15.2 Constructor & Destructor Documentation

6.15.2.1 None()

```
wr22::regex_parser::regex::capture::None::None ( )  [explicit], [default]
```

6.15.3 Member Function Documentation

6.15.3.1 operator==()

```
bool wr22::regex_parser::regex::capture::None::operator== (
            const None & rhs ) const  [default]
```

6.15.4 Member Data Documentation

6.15.4.1 code_name

```
constexpr const char* wr22::regex_parser::regex::capture::None::code_name = "none"  [static],
[constexpr]
```

The documentation for this struct was generated from the following file:

- include/wr22/regex_parser/regex/capture.hpp

6.16 wr22::regex_parser::regex::part::Optional Struct Reference

A regex part specifying an optional quantifier (`(expression)?`).

```
#include <part.hpp>
```

Public Member Functions

- Optional (SpannedPart inner)

  Convenience constructor.
- bool operator== (const Optional &rhs) const =default

Public Attributes

- utils::Box< SpannedPart > inner

  The smart pointer to the subexpression under the quantifier.

Static Public Attributes

- static constexpr const char * code_name = "optional"

6.16.1 Detailed Description

A regex part specifying an optional quantifier (`(expression)?`).

6.16.2 Constructor & Destructor Documentation

6.16.2.1 Optional()

```
wr22::regex_parser::regex::part::Optional::Optional (
            SpannedPart inner )  [explicit]
```

Convenience constructor.

6.16.3 Member Function Documentation

6.16.3.1 operator==()

```
bool wr22::regex_parser::regex::part::Optional::operator== (
            const Optional & rhs ) const  [default]
```

6.16.4 Member Data Documentation

6.16.4.1 code_name

```
constexpr const char* wr22::regex_parser::regex::part::Optional::code_name = "optional"  [static],
[constexpr]
```

6.16.4.2 inner

```
utils::Box<SpannedPart> wr22::regex_parser::regex::part::Optional::inner
```

The smart pointer to the subexpression under the quantifier.

The documentation for this struct was generated from the following files:

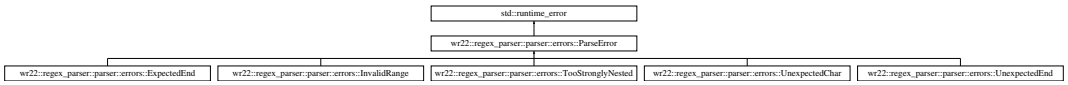
- include/wr22/regex_parser/regex/part.hpp
- src/regex/part.cpp

6.17 wr22::regex_parser::parser::errors::ParseError Struct Reference

The base class for parse errors.

```
#include <errors.hpp>
```

Inheritance diagram for wr22::regex_parser::parser::errors::ParseError:



6.17.1 Detailed Description

The base class for parse errors.

This exception type should be caught if it is desired to catch all parse errors. However, there are more specific exceptions deriving from this one that can be handled separately for greater flexibility.

The documentation for this struct was generated from the following file:

- include/wr22/regex_parser/parser/errors.hpp

6.18 wr22::regex_parser::parser::Parser< Iter, Sentinel > Class Template Reference

A regex parser.

Public Member Functions

- Parser (Iter begin, Sentinel end)
  Constructor.
- void expect_end ()
  Ensure that the parser has consumed all of the input.
- regex::SpannedPart parse_regex ()
  Parse a regex consuming part of the remaining input.
- regex::SpannedPart parse_alternatives ()
  Intermediate rule: parse a pipe-separated list of alternatives (e.g.
- regex::SpannedPart parse_sequence ()
  Intermediate rule: parse a sequence of atoms (e.g.
- regex::SpannedPart parse_sequence_or_empty ()
  Intermediate rule: parse a possibly empty sequence of atoms.
- regex::SpannedPart parse_atom ()
  Intermediate rule: parse an atom.
- regex::SpannedPart parse_wildcard ()
  Intermediate rule: parse a wildcard (.
- regex::SpannedPart parse_char_literal ()
  Intermediate rule: parse a character literal.
- regex::SpannedPart parse_group ()
  Intermediate rule: parse a parenthesized group (any capture variant).
- std::pair< std::string, Span > parse_group_name (char32_t closing_par)
  Intermediate rule: parse a group name.
- regex::SpannedPart parse_char_class ()
  Intermediate rule: parse a character class (e.g.

6.18.1 Detailed Description

template<typename Iter, typename Sentinel>
requires requires(Iter iter, Sentinel end) { ++iter; { *iter } -> std::convertible_to<char32_t>; { iter == end } -> std::convertible_to<bool>; { iter != end } -> std::convertible_to<bool>; }
class wr22::regex_parser::parser::Parser< Iter, Sentinel >

A regex parser.

For additional information see the methods' docs, particularly the constructor and the `parse_regex` method.

6.18.2 Constructor & Destructor Documentation

6.18.2.1 Parser()

```
template<typename Iter , typename Sentinel >
wr22::regex_parser::parser::Parser< Iter, Sentinel >::Parser (
            Iter begin,
            Sentinel end )  [inline]
```

Constructor.

This constructor stores a pair of forward iterators that should generate a sequence of Unicode code points (`char32_t`). The `begin` iterator and the `end` sentinel may have different types provided that the iterator can is equality comparable with the sentinel.

SAFETY: The iterators must not be invalidated as long as this `Parser` object is still alive.

6.18.3 Member Function Documentation

6.18.3.1 expect_end()

```
template<typename Iter , typename Sentinel >
void wr22::regex_parser::parser::Parser< Iter, Sentinel >::expect_end ( )  [inline]
```

Ensure that the parser has consumed all of the input.

Does nothing if all input has been consumed.

Exceptions

errors::ExpectedEnd	if this is not the case.

6.18.3.2 parse_alternatives()

```
template<typename Iter , typename Sentinel >
regex::SpannedPart wr22::regex_parser::parser::Parser< Iter, Sentinel >::parse_alternatives (
)  [inline]
```

Intermediate rule: parse a pipe-separated list of alternatives (e.g.

`a|bb|ccc`).

Returns

the list of parsed alternatives packed into `regex::part::Alternatives` or, if and only if the list of alternatives contains exactly 1 element, the only alternative unchanged.

Exceptions

errors::ParseError	if the input cannot be parsed.

6.18.3.3 parse_atom()

```
template<typename Iter , typename Sentinel >
regex::SpannedPart wr22::regex_parser::parser::Parser< Iter, Sentinel >::parse_atom ( )  [inline]
```

Intermediate rule: parse an atom.

Currently, this grammar only recognizes two kinds of atoms: character literals (individual plain characters in a regex) and parenthesized groups. As the project development goes on, new kinds of atoms will be added.

Returns

the parsed atom (some variant of `regex::SpannedPart` depending on the atom kind).

Exceptions

errors::ParseError	if the input cannot be parsed.

6.18.3.4 parse_char_class()

```
template<typename Iter , typename Sentinel >
regex::SpannedPart wr22::regex_parser::parser::Parser< Iter, Sentinel >::parse_char_class ( )
[inline]
```

Intermediate rule: parse a character class (e.g.

[^a-z0-9_-]).

Returns

the character class AST node.

- is found right after the character range started or right after another range. In either case, it is considered as a plain character.

6.18.3.5 parse_char_literal()

```
template<typename Iter , typename Sentinel >
regex::SpannedPart wr22::regex_parser::parser::Parser< Iter, Sentinel >::parse_char_literal (
) [inline]
```

Intermediate rule: parse a character literal.

Returns

the parsed character literal (`regex::part::Literal`).

Exceptions

errors::UnexpectedEnd	if all characters from the input have already been consumed.

6.18.3.6 parse_group()

```
template<typename Iter , typename Sentinel >
```

```
regex::SpannedPart wr22::regex_parser::parser::Parser< Iter, Sentinel >::parse_group ( )
[inline]
```

Intermediate rule: parse a parenthesized group (any capture variant).

Returns

the parsed group (`regex::part::Group`).

6.18.3.7 parse_group_name()

```
template<typename Iter , typename Sentinel >
std::pair< std::string, Span > wr22::regex_parser::parser::Parser< Iter, Sentinel >::parse_↩
group_name (
            char32_t closing_par )  [inline]
```

Intermediate rule: parse a group name.

Returns

the UTF-8 encoded group name as an `std::string`.

6.18.3.8 parse_regex()

```
template<typename Iter , typename Sentinel >
regex::SpannedPart wr22::regex_parser::parser::Parser< Iter, Sentinel >::parse_regex ( )
[inline]
```

Parse a regex consuming part of the remaining input.

This is **the** method that should be called to parse a regular expression because it represents the root rule of the regex grammar. Please note that this method may not consume all of the parser's input. Hence, if a whole regex is to be parsed, the `expect_end` method should be called afterwards.

Returns

the parsed regex AST (some variant of `regex::SpannedPart` depending on the input).

Exceptions

errors::ParseError	if the input cannot be parsed.

6.18.3.9 parse_sequence()

```
template<typename Iter , typename Sentinel >
regex::SpannedPart wr22::regex_parser::parser::Parser< Iter, Sentinel >::parse_sequence ( )
[inline]
```

Intermediate rule: parse a sequence of atoms (e.g.

`a(?:b)[c-e]`).

Returns

the list of parsed atoms packed into `regex::part::Sequence` or, if and only if this list of contains exactly 1 element, the only atom unchanged.

Exceptions

errors::ParseError	if the input cannot be parsed.

6.18.3.10 parse_sequence_or_empty()

```
template<typename Iter , typename Sentinel >
regex::SpannedPart wr22::regex_parser::parser::Parser< Iter, Sentinel >::parse_sequence_or_↩
empty ( ) [inline]
```

Intermediate rule: parse a possibly empty sequence of atoms.

Returns

`regex::part::Empty` if the sequence is empty, or calls `parse_sequence` otherwise.

Exceptions

errors::ParseError	if the input cannot be parsed.

6.18.3.11 parse_wildcard()

```
template<typename Iter , typename Sentinel >
regex::SpannedPart wr22::regex_parser::parser::Parser< Iter, Sentinel >::parse_wildcard ( )
[inline]
```

Intermediate rule: parse a wildcard (`.`

).

Returns

the wildcard AST node.

Exceptions

errors::UnexpectedEnd	if all characters from the input have already been consumed.
errors::UnexpectedChar	if the next input character is not `.`.

The documentation for this class was generated from the following file:

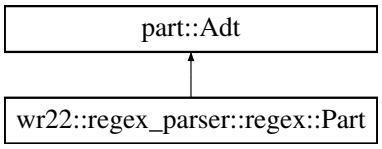
- src/parser/regex.cpp

6.19 wr22::regex_parser::regex::Part Class Reference

A part of a regular expression and its AST node type.

`#include <part.hpp>`

Inheritance diagram for wr22::regex_parser::regex::Part:



6.19.1 Detailed Description

A part of a regular expression and its AST node type.

The parsed regular expressions are represented as abstract syntax trees (ASTs). These are tree-like data structures where each node represents a regular expression part (or the whole regex), and, depending on their type, these nodes may have subexpressions. Subexpressions are `Part`s themselves, which also have child expressions and so on. For example, `part::Sequence` has a number of subexpressions, and each of them is of the type `Part` and is an AST node.

Each regex part has its own simple function. For example, `part::Alternatives` tries to match several alternative subexpressions against the input and succeeds if at least one of them does; and `part::Sequence` matches several subexpressions one after another, requiring them all to match respective parts of the input. By combining these simple nodes, it becomes possible to represent complex regular expressions. For example, the regex `aaa|bb` can be represented as a `part::Alternatives`, where each of the alternatives is a `parts::Sequence` of `part::Literal`s.

The `Part` itself is represented by `std::variant` via the helper class `utils::Adt`. In a nutshell, it allows a regex part to "have" one of the several predefined types (the so-called variants, which are defined in the `part` namespace), but still be represented as a `Part`. For the list of operations that can be performed on this type, e.g. to check if an instance of `Parts` has a specific variant and, if yes, access the value of this variant, see the documentation for the `utils::Adt` class, which `Part` inherits from.

Note that this type contains no span information for the root AST node. For a spanned version, see `SpannedPart`.

The documentation for this class was generated from the following file:

- include/wr22/regex_parser/regex/part.hpp

6.20 wr22::regex_parser::regex::part::Plus Struct Reference

A regex part specifying an "at least one" quantifier (`(expression)+`).

`#include <part.hpp>`

Public Member Functions

- Plus (SpannedPart inner)

  Convenience constructor.
- bool operator== (const Plus &rhs) const =default

Public Attributes

- utils::Box< SpannedPart > inner

  The smart pointer to the subexpression under the quantifier.

Static Public Attributes

- static constexpr const char * code_name = "plus"

6.20.1 Detailed Description

A regex part specifying an "at least one" quantifier (`(expression)+`).

6.20.2 Constructor & Destructor Documentation

6.20.2.1 Plus()

```
wr22::regex_parser::regex::part::Plus::Plus (
            SpannedPart inner )  [explicit]
```

Convenience constructor.

6.20.3 Member Function Documentation

6.20.3.1 operator==()

```
bool wr22::regex_parser::regex::part::Plus::operator== (
            const Plus & rhs ) const  [default]
```

6.20.4 Member Data Documentation

6.20.4.1 code_name

```
constexpr const char* wr22::regex_parser::regex::part::Plus::code_name = "plus"  [static],
[constexpr]
```

6.20.4.2 inner

```
utils::Box<SpannedPart> wr22::regex_parser::regex::part::Plus::inner
```

The smart pointer to the subexpression under the quantifier.

The documentation for this struct was generated from the following files:

- include/wr22/regex_parser/regex/part.hpp
- src/regex/part.cpp

6.21 wr22::regex_parser::regex::part::Sequence Struct Reference

A regex part with the list of items to be matched one after another.

```
#include <part.hpp>
```

Public Member Functions

- Sequence (std::vector< SpannedPart > items)
- bool operator== (const Sequence &rhs) const =default

Public Attributes

- std::vector< SpannedPart > items

  The list of the subexpressions.

Static Public Attributes

- static constexpr const char * code_name = "sequence"

6.21.1 Detailed Description

A regex part with the list of items to be matched one after another.

Sequences in regular expressions are just subexpressions going directly one after another. As an example, `a[b-e].` is a sequence of 3 subexpressions: `a`, `[b-e]` and `.`. As an another example, `ab` is a sequence of 2 subexpressions: `a` and `b`.

6.21.2 Constructor & Destructor Documentation

6.21.2.1 Sequence()

```
wr22::regex_parser::regex::part::Sequence::Sequence (
            std::vector< SpannedPart > items )  [explicit]
```

6.21.3 Member Function Documentation

6.21.3.1 operator==()

```
bool wr22::regex_parser::regex::part::Sequence::operator== (
            const Sequence & rhs ) const  [default]
```

6.21.4 Member Data Documentation

6.21.4.1 code_name

```
constexpr const char* wr22::regex_parser::regex::part::Sequence::code_name = "sequence"  [static],
[constexpr]
```

6.21.4.2 items

```
std::vector<SpannedPart> wr22::regex_parser::regex::part::Sequence::items
```

The list of the subexpressions.

The documentation for this struct was generated from the following files:

- include/wr22/regex_parser/regex/part.hpp
- src/regex/part.cpp

6.22 wr22::regex_parser::span::Span Class Reference

Character position range in the input string.

`#include <span.hpp>`

Public Member Functions

- Span extend_right (size_t num_positions) const

  Construct a new span that equals the current span extended to the right by a specified number of positions.
- size_t length () const

  Get the length of the span (the number of characters covered).
- size_t begin () const

  Get the `begin` position of the span.
- size_t end () const

  Get the `end` position of the span.
- bool operator== (const Span &other) const =default
- bool operator!= (const Span &other) const =default

Static Public Member Functions

- static Span make_empty (size_t position)

  Construct an empty span that "starts" at a given position.
- static Span make_single_position (size_t position)

  Construct a span that captures only one position.
- static Span make_from_positions (size_t begin, size_t end)

  Construct a span with given values of `begin` and `end` without any transformations.
- static Span make_with_length (size_t begin, size_t length)

  Construct a span with a given value of `begin` and a given length.

6.22.1 Detailed Description

Character position range in the input string.

The range is encoded by two numbers: `begin`, the position (0-based index) of the first character in the range, and `end`, the past-the-end position, or the 0-based index of the last character in the range **plus 1**. This is to be consistent with the behavior of C++ iterators and `begin()`/`end()` functions on STL containers. Please note, however, that the `begin()`/`end()` methods here are just accessors that are not used for iteration, they return plain indices which have no iterator semantics.

Invalid spans (`begin > end`) are not allowed and their construction will result in an error. See the documentation for the relevant methods for details.

6.22.2 Member Function Documentation

6.22.2.1 begin()

```
size_t wr22::regex_parser::span::Span::begin ( ) const
```

Get the `begin` position of the span.

6.22.2.2 end()

```
size_t wr22::regex_parser::span::Span::end ( ) const
```

Get the `end` position of the span.

6.22.2.3 extend_right()

```
Span wr22::regex_parser::span::Span::extend_right (
            size_t num_positions ) const
```

Construct a new span that equals the current span extended to the right by a specified number of positions.

Please note that this method creates a new span and does not modify the existing one.

Formally, `[begin..end].extend_right(n) = [begin..(end+n)]`.

Exceptions

InvalidSpan	if `end + length` overflows `size_t`. Note that the error message might not be precise enough.

6.22.2.4 length()

```
size_t wr22::regex_parser::span::Span::length ( ) const
```

Get the length of the span (the number of characters covered).

6.22.2.5 make_empty()

```
Span wr22::regex_parser::span::Span::make_empty (
            size_t position )  [static]
```

Construct an empty span that "starts" at a given position.

The resulting span will have `begin = position` and `end = position`.

6.22.2.6 make_from_positions()

```
Span wr22::regex_parser::span::Span::make_from_positions (
            size_t begin,
            size_t end )  [static]
```

Construct a span with given values of `begin` and `end` without any transformations.

Exceptions

InvalidSpan	if `end < begin`.

6.22.2.7 make_single_position()

```
Span wr22::regex_parser::span::Span::make_single_position (
            size_t position )  [static]
```

Construct a span that captures only one position.

The resulting span will have `begin = position` and `end = position + 1`.

Exceptions

InvalidSpan	if `position + 1` overflows `size_t`. Note that the error message might not be precise enough.

6.22.2.8 make_with_length()

```
Span wr22::regex_parser::span::Span::make_with_length (
            size_t begin,
            size_t length )  [static]
```

Construct a span with a given value of `begin` and a given length.

The length is determined by the number of characters covered by this span, and, since `begin` and `end` form a half-interval, it equals `end - begin`.

Exceptions

InvalidSpan	if `begin + length` overflows `size_t`. Note that the error message might not be precise enough.

6.22.2.9 operator"!=()

```
bool wr22::regex_parser::span::Span::operator!= (
            const Span & other ) const  [default]
```

6.22.2.10 operator==()

```
bool wr22::regex_parser::span::Span::operator== (
            const Span & other ) const  [default]
```

The documentation for this class was generated from the following files:

- include/wr22/regex_parser/span/span.hpp
- src/span/span.cpp

6.23 wr22::regex_parser::regex::SpannedCharacterRange Struct Reference

A `CharacterRange` with its span.

`#include <spanned_character_range.hpp>`

Public Member Functions

- bool operator== (const SpannedCharacterRange &rhs) const =default

Public Attributes

- CharacterRange range
- span::Span span

6.23.1 Detailed Description

A `CharacterRange` with its span.

6.23.2 Member Function Documentation

6.23.2.1 operator==()

```
bool wr22::regex_parser::regex::SpannedCharacterRange::operator== (
            const SpannedCharacterRange & rhs ) const  [default]
```

6.23.3 Member Data Documentation

6.23.3.1 range

`CharacterRange wr22::regex_parser::regex::SpannedCharacterRange::range`

6.23.3.2 span

`span::Span wr22::regex_parser::regex::SpannedCharacterRange::span`

The documentation for this struct was generated from the following file:

- include/wr22/regex_parser/regex/spanned_character_range.hpp

6.24 wr22::regex_parser::regex::SpannedPart Class Reference

A version of `Part` including the span information (position in the input) of the root AST node (child nodes always contain it because they are represented as `SpannedPart`s themselves).

`#include <part.hpp>`

Public Member Functions

- SpannedPart (Part part, span::Span span)
- bool operator== (const SpannedPart &other) const =default
- bool operator!= (const SpannedPart &other) const =default
- const Part & part () const

  Access the wrapped `Part` (const version).
- Part & part ()

  Access the wrapped `Part` (non-const version).
- span::Span span () const

  Get the associated span.

6.24.1 Detailed Description

A version of `Part` including the span information (position in the input) of the root AST node (child nodes always contain it because they are represented as `SpannedPart`s themselves).

6.24.2 Constructor & Destructor Documentation

6.24.2.1 SpannedPart()

```
wr22::regex_parser::regex::SpannedPart::SpannedPart (
            Part part,
            span::Span span )  [explicit]
```

6.24.3 Member Function Documentation

6.24.3.1 operator"!=()

```
bool wr22::regex_parser::regex::SpannedPart::operator!= (
            const SpannedPart & other ) const  [default]
```

6.24.3.2 operator==()

```
bool wr22::regex_parser::regex::SpannedPart::operator== (
            const SpannedPart & other ) const  [default]
```

6.24.3.3 part() [1/2]

```
Part & wr22::regex_parser::regex::SpannedPart::part ( )
```

Access the wrapped `Part` (non-const version).

6.24.3.4 part() [2/2]

```
const Part & wr22::regex_parser::regex::SpannedPart::part ( ) const
```

Access the wrapped `Part` (const version).

6.24.3.5 span()

```
span::Span wr22::regex_parser::regex::SpannedPart::span ( ) const
```

Get the associated span.

The documentation for this class was generated from the following files:

- include/wr22/regex_parser/regex/part.hpp
- src/regex/part.cpp

6.25 wr22::regex_parser::regex::part::Star Struct Reference

A regex part specifying an "at least zero" quantifier (`(expression)*`).

`#include <part.hpp>`

Public Member Functions

- Star (SpannedPart inner)

  Convenience constructor.
- bool operator== (const Star &rhs) const =default

Public Attributes

- utils::Box< SpannedPart > inner

  The smart pointer to the subexpression under the quantifier.

Static Public Attributes

- static constexpr const char * code_name = "star"

6.25.1 Detailed Description

A regex part specifying an "at least zero" quantifier (`(expression)*`).

6.25.2 Constructor & Destructor Documentation

6.25.2.1 Star()

```
wr22::regex_parser::regex::part::Star::Star (
            SpannedPart inner )  [explicit]
```

Convenience constructor.

6.25.3 Member Function Documentation

6.25.3.1 operator==()

```
bool wr22::regex_parser::regex::part::Star::operator== (
            const Star & rhs ) const  [default]
```

6.25.4 Member Data Documentation

6.25.4.1 code_name

```
constexpr const char* wr22::regex_parser::regex::part::Star::code_name = "star"  [static],
[constexpr]
```

6.25.4.2 inner

```
utils::Box<SpannedPart> wr22::regex_parser::regex::part::Star::inner
```

The smart pointer to the subexpression under the quantifier.

The documentation for this struct was generated from the following files:

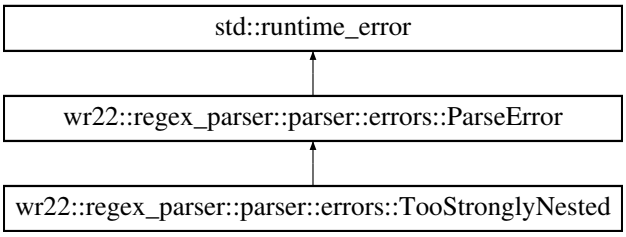
- include/wr22/regex_parser/regex/part.hpp
- src/regex/part.cpp

6.26 wr22::regex_parser::parser::errors::TooStronglyNested Class Reference

The error signalling that the regular expression has too many levels of nesting to be parsed.

```
#include <errors.hpp>
```

Inheritance diagram for wr22::regex_parser::parser::errors::TooStronglyNested:



Public Member Functions

- TooStronglyNested ()

  Constructor.

6.26.1 Detailed Description

The error signalling that the regular expression has too many levels of nesting to be parsed.

6.26.2 Constructor & Destructor Documentation

6.26.2.1 TooStronglyNested()

```
wr22::regex_parser::parser::errors::TooStronglyNested::TooStronglyNested ( )
```

Constructor.

The documentation for this class was generated from the following files:

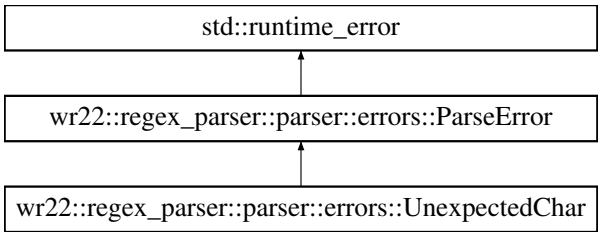
- include/wr22/regex_parser/parser/errors.hpp
- src/parser/errors.cpp

6.27 wr22::regex_parser::parser::errors::UnexpectedChar Class Reference

The error when the parser got a character it didn't expect at the current position.

```
#include <errors.hpp>
```

Inheritance diagram for wr22::regex_parser::parser::errors::UnexpectedChar:



Public Member Functions

- UnexpectedChar (size_t position, char32_t char_got, std::string expected, std::optional< char32_t > needs_closing)

  Constructor.
- size_t position () const

  Get the input position. See the constructor docs for a more detailed description.
- char32_t char_got () const

  Get the character the parser has received.
- const std::string & expected () const

  Get the description of expected characters.
- std::optional< char32_t > needs_closing () const

  Get the bracket that needs to be closed.

6.27.1 Detailed Description

The error when the parser got a character it didn't expect at the current position.

6.27.2 Constructor & Destructor Documentation

6.27.2.1 UnexpectedChar()

```
wr22::regex_parser::parser::errors::UnexpectedChar::UnexpectedChar (
            size_t position,
            char32_t char_got,
            std::string expected,
            std::optional< char32_t > needs_closing )
```

Constructor.

Parameters

position	the 0-based position in the input when the parser has encountered the unexpected character.
char_got	the character that the parser has received.
expected	a textual description of a class of characters expected instead.
needs_closing	a character describing the type of bracket that needs to be closed, if any.

6.27.3 Member Function Documentation

6.27.3.1 char_got()

```
char32_t wr22::regex_parser::parser::errors::UnexpectedChar::char_got ( ) const
```

Get the character the parser has received.

See the constructor docs for a more detailed description.

6.27.3.2 expected()

```
const std::string & wr22::regex_parser::parser::errors::UnexpectedChar::expected ( ) const
```

Get the description of expected characters.

See the constructor docs for a more detailed description.

6.27.3.3 needs_closing()

```
std::optional< char32_t > wr22::regex_parser::parser::errors::UnexpectedChar::needs_closing (
) const
```

Get the bracket that needs to be closed.

6.27.3.4 position()

```
size_t wr22::regex_parser::parser::errors::UnexpectedChar::position ( ) const
```

Get the input position. See the constructor docs for a more detailed description.

The documentation for this class was generated from the following files:

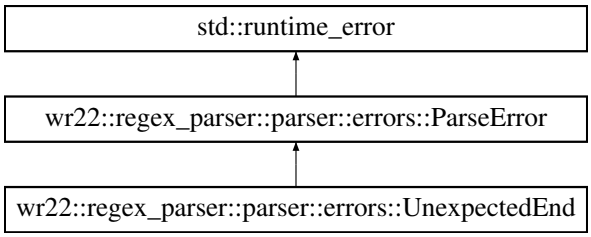
- include/wr22/regex_parser/parser/errors.hpp
- src/parser/errors.cpp

6.28 wr22::regex_parser::parser::errors::UnexpectedEnd Class Reference

The error when the parser hit the end of the input earlier than it expected.

```
#include <errors.hpp>
```

Inheritance diagram for wr22::regex_parser::parser::errors::UnexpectedEnd:



Public Member Functions

- UnexpectedEnd (size_t position, std::string expected, std::optional< char32_t > needs_closing)
  Constructor.
- size_t position () const
  Get the input position. See the constructor docs for a more detailed description.
- const std::string & expected () const
  Get the description of expected characters.
- std::optional< char32_t > needs_closing () const
  Get the bracket that needs to be closed.

6.28.1 Detailed Description

The error when the parser hit the end of the input earlier than it expected.

6.28.2 Constructor & Destructor Documentation

6.28.2.1 UnexpectedEnd()

```
wr22::regex_parser::parser::errors::UnexpectedEnd::UnexpectedEnd (
            size_t position,
            std::string expected,
            std::optional< char32_t > needs_closing )
```

Constructor.

Parameters

position	the 0-based position in the input when the parser has encountered the end of input.
expected	a textual description of a class of characters expected instead.
needs_closing	a character describing the type of bracket that needs to be closed, if any.

6.28.3 Member Function Documentation

6.28.3.1 expected()

```
const std::string & wr22::regex_parser::parser::errors::UnexpectedEnd::expected ( ) const
```

Get the description of expected characters.

See the constructor docs for a more detailed description.

6.28.3.2 needs_closing()

```
std::optional< char32_t > wr22::regex_parser::parser::errors::UnexpectedEnd::needs_closing ( )
const
```

Get the bracket that needs to be closed.

6.28.3.3 position()

```
size_t wr22::regex_parser::parser::errors::UnexpectedEnd::position ( ) const
```

Get the input position. See the constructor docs for a more detailed description.

The documentation for this class was generated from the following files:

- include/wr22/regex_parser/parser/errors.hpp
- src/parser/errors.cpp

6.29 wr22::regex_parser::regex::part::Wildcard Struct Reference

A regex part specifying any single character (`.`).

```
#include <part.hpp>
```

Public Member Functions

- Wildcard ()=default
- bool operator== (const Wildcard &rhs) const =default

Static Public Attributes

- static constexpr const char * code_name = "wildcard"

6.29.1 Detailed Description

A regex part specifying any single character (`.`).

6.29.2 Constructor & Destructor Documentation

6.29.2.1 Wildcard()

```
wr22::regex_parser::regex::part::Wildcard::Wildcard ( )  [explicit], [default]
```

6.29.3 Member Function Documentation

6.29.3.1 operator==()

```
bool wr22::regex_parser::regex::part::Wildcard::operator== (
            const Wildcard & rhs ) const  [default]
```

6.29.4 Member Data Documentation

6.29.4.1 code_name

```
constexpr const char* wr22::regex_parser::regex::part::Wildcard::code_name = "wildcard"  [static],
[constexpr]
```

The documentation for this struct was generated from the following file:

- include/wr22/regex_parser/regex/part.hpp

Chapter 7

File Documentation

7.1 include/wr22/regex_parser/parser/errors.hpp File Reference

```
#include <wr22/regex_parser/span/span.hpp>
#include <exception>
#include <optional>
#include <stdexcept>
#include <string>
```

Classes

- struct wr22::regex_parser::parser::errors::ParseError

  The base class for parse errors.
- class wr22::regex_parser::parser::errors::UnexpectedEnd

  The error when the parser hit the end of the input earlier than it expected.
- class wr22::regex_parser::parser::errors::ExpectedEnd

  The error when the parser expected the input to end, but it did not.
- class wr22::regex_parser::parser::errors::UnexpectedChar

  The error when the parser got a character it didn't expect at the current position.
- class wr22::regex_parser::parser::errors::InvalidRange

  The error indicating that a character range in a character class is invalid.
- class wr22::regex_parser::parser::errors::TooStronglyNested

  The error signalling that the regular expression has too many levels of nesting to be parsed.

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::parser
- namespace wr22::regex_parser::parser::errors

7.2 errors.hpp

Go to the documentation of this file.

```
1 #pragma once
2
3 // wr22
4 #include <wr22/regex_parser/span/span.hpp>
5
6 // STL
7 #include <exception>
8 #include <optional>
9 #include <stdexcept>
10 #include <string>
11
12 namespace wr22::regex_parser::parser::errors {
13
19 struct ParseError : public std::runtime_error {
20     using std::runtime_error::runtime_error;
21 };
22
24 class UnexpectedEnd : public ParseError {
25 public:
33     UnexpectedEnd(size_t position, std::string expected, std::optional<char32_t> needs_closing);
34
36     size_t position() const;
39     const std::string& expected() const;
41     std::optional<char32_t> needs_closing() const;
42
43 private:
44     size_t m_position;
45     std::string m_expected;
46     std::optional<char32_t> m_needs_closing;
47 };
48
50 class ExpectedEnd : public ParseError {
51 public:
57     ExpectedEnd(size_t position, char32_t char_got);
58
60     size_t position() const;
63     char32_t char_got() const;
64
65 private:
66     size_t m_position;
67     char32_t m_char_got;
68 };
69
71 class UnexpectedChar : public ParseError {
72 public:
81     UnexpectedChar(
82         size_t position,
83         char32_t char_got,
84         std::string expected,
85         std::optional<char32_t> needs_closing);
86
88     size_t position() const;
91     char32_t char_got() const;
94     const std::string& expected() const;
96     std::optional<char32_t> needs_closing() const;
97
98 private:
99     size_t m_position;
100     char32_t m_char_got;
101     std::string m_expected;
102     std::optional<char32_t> m_needs_closing;
103 };
104
106 class InvalidRange : public ParseError {
107 public:
113     InvalidRange(span::Span span, char32_t first, char32_t last);
114
116     span::Span span() const;
119     char32_t first() const;
122     char32_t last() const;
123
124 private:
125     span::Span m_span;
126     char32_t m_first;
127     char32_t m_last;
128 };
129
131 class TooStronglyNested : public ParseError {
132 public:
134     TooStronglyNested();
135 };
136
137 }  // namespace wr22::regex_parser::parser::errors
```

7.3 include/wr22/regex_parser/parser/regex.hpp File Reference

```
#include <wr22/regex_parser/regex/part.hpp>
#include <string_view>
```

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::parser

Functions

- regex::SpannedPart wr22::regex_parser::parser::parse_regex (const std::u32string_view &regex)

  Parse a regular expression into its AST.

7.4 regex.hpp

Go to the documentation of this file.

```
1 #pragma once
2
3 // wr22
4 #include <wr22/regex_parser/regex/part.hpp>
5
6 // stl
7 #include <string_view>
8
9 namespace wr22::regex_parser::parser {
10
23 regex::SpannedPart parse_regex(const std::u32string_view& regex);
24
25 }  // namespace wr22::regex_parser::parser
```

7.5 include/wr22/regex_parser/regex/capture.hpp File Reference

```
#include <wr22/regex_parser/regex/named_capture_flavor.hpp>
#include <wr22/utils/adt.hpp>
#include <iosfwd>
#include <string>
#include <nlohmann/json.hpp>
```

Classes

- struct wr22::regex_parser::regex::capture::None

  Denotes an non-capturing group.
- struct wr22::regex_parser::regex::capture::Index

  Denotes a group captured by index.
- struct wr22::regex_parser::regex::capture::Name

  Denotes a group captured by name.
- class wr22::regex_parser::regex::Capture

  Group capture behavior.

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::regex
- namespace wr22::regex_parser::regex::capture

Typedefs

- using wr22::regex_parser::regex::capture::Adt = utils::Adt< None, Index, Name >

Functions

- void wr22::regex_parser::regex::capture::to_json (nlohmann::json &j, const None &capture)
- void wr22::regex_parser::regex::capture::to_json (nlohmann::json &j, const Index &capture)
- void wr22::regex_parser::regex::capture::to_json (nlohmann::json &j, const Name &capture)
- std::ostream & wr22::regex_parser::regex::operator<< (std::ostream &out, const Capture &capture)
- void wr22::regex_parser::regex::to_json (nlohmann::json &j, const Capture &capture)

7.6 capture.hpp

Go to the documentation of this file.

```
1 #pragma once
2
3 // wr22
4 #include <wr22/regex_parser/regex/named_capture_flavor.hpp>
5 #include <wr22/utils/adt.hpp>
6
7 // stl
8 #include <iosfwd>
9 #include <string>
10
11 // nlohmann
12 #include <nlohmann/json.hpp>
13
14 namespace wr22::regex_parser::regex {
15
16 class Capture;
17
18 namespace capture {
20     struct None {
21         explicit None() = default;
22         bool operator==(const None& rhs) const = default;
23         static constexpr const char* code_name = "none";
24     };
25     void to_json(nlohmann::json& j, const None& capture);
26
28     struct Index {
29         explicit Index() = default;
30         bool operator==(const Index& rhs) const = default;
31         static constexpr const char* code_name = "index";
32     };
33     void to_json(nlohmann::json& j, const Index& capture);
34
39     struct Name {
40         explicit Name(std::string name, NamedCaptureFlavor flavor);
41
42         std::string name;
43         NamedCaptureFlavor flavor;
44         bool operator==(const Name& rhs) const = default;
45         static constexpr const char* code_name = "name";
46     };
47     void to_json(nlohmann::json& j, const Name& capture);
48
49     using Adt = utils::Adt<None, Index, Name>;
50 }  // namespace capture
51
57 //
```

```
61 class Capture : public capture::Adt {
62 public:
63     using capture::Adt::Adt;
64 };
65
66 std::ostream& operator«(std::ostream& out, const Capture& capture);
67 void to_json(nlohmann::json& j, const Capture& capture);
68
69 }  // namespace wr22::regex_parser::regex
```

7.7 include/wr22/regex_parser/regex/character_class_data.hpp File Reference

```
#include <wr22/regex_parser/regex/spanned_character_range.hpp>
#include <vector>
```

Classes

- struct wr22::regex_parser::regex::CharacterClassData

  A character class representation: a list of character ranges plus some additional properties.

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::regex

7.8 character_class_data.hpp

Go to the documentation of this file.

```
1 #pragma once
2
3 // wr22
4 #include <wr22/regex_parser/regex/spanned_character_range.hpp>
5
6 // stl
7 #include <vector>
8
9 namespace wr22::regex_parser::regex {
10
12 struct CharacterClassData {
19     std::vector<SpannedCharacterRange> ranges;
20
22     bool inverted;
23
24     bool operator==(const CharacterClassData& rhs) const = default;
25 };
26
27 }
```

7.9 include/wr22/regex_parser/regex/character_range.hpp File Reference

```
#include <stdexcept>
#include <iosfwd>
#include <fmt/core.h>
#include <nlohmann/json.hpp>
```

Classes

- struct wr22::regex_parser::regex::InvalidCharacterRange
- class wr22::regex_parser::regex::CharacterRange

  A non-empty character range, possibly containing only one character.

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::regex

Functions

- std::ostream & wr22::regex_parser::regex::operator<< (std::ostream &out, const CharacterRange &range)
- void wr22::regex_parser::regex::to_json (nlohmann::json &j, const CharacterRange &range)

7.10 character_range.hpp

Go to the documentation of this file.

```
1 #pragma once
2
3 // stl
4 #include <stdexcept>
5 #include <iosfwd>
6
7 // fmt
8 #include <fmt/core.h>
9
10 // nlohmann
11 #include <nlohmann/json.hpp>
12
13 namespace wr22::regex_parser::regex {
14
15 struct InvalidCharacterRange : public std::runtime_error {
16     explicit InvalidCharacterRange(char32_t first, char32_t last);
17
18     char32_t first;
19     char32_t last;
20 };
21
23 class CharacterRange {
24 public:
28     static CharacterRange from_endpoints(char32_t first, char32_t last);
29
31     static CharacterRange from_single_character(char32_t character) noexcept;
32
34     char32_t first() const noexcept;
35
37     char32_t last() const noexcept;
38
40     bool contains(char32_t character) const noexcept;
41
43     bool is_single_character() const noexcept;
44
45     bool operator==(const CharacterRange& rhs) const noexcept = default;
46
47 private:
51     explicit CharacterRange(char32_t first, char32_t last);
52
53     char32_t m_first;
54     char32_t m_last;
55 };
56
57 std::ostream& operator«(std::ostream& out, const CharacterRange& range);
58 void to_json(nlohmann::json& j, const CharacterRange& range);
59
60 }  // namespace wr22::regex_parser::regex
```

7.11 include/wr22/regex_parser/regex/named_capture_flavor.hpp File Reference

```
#include <iosfwd>
#include <nlohmann/json.hpp>
```

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::regex

Enumerations

- enum class wr22::regex_parser::regex::NamedCaptureFlavor { wr22::regex_parser::regex::Apostrophes , wr22::regex_parser::regex::Angles , wr22::regex_parser::regex::AnglesWithP }

  The flavor (dialect) of a named group capture.

Functions

- std::ostream & wr22::regex_parser::regex::operator<< (std::ostream &out, NamedCaptureFlavor flavor)
- void wr22::regex_parser::regex::to_json (nlohmann::json &j, NamedCaptureFlavor flavor)

7.12 named_capture_flavor.hpp

Go to the documentation of this file.

```
1 #pragma once
2
3 // stl
4 #include <iosfwd>
5
6 // nlohmann
7 #include <nlohmann/json.hpp>
8
9 namespace wr22::regex_parser::regex {
10
15 enum class NamedCaptureFlavor
16 {
19     Apostrophes,
22     Angles,
24     AnglesWithP,
25 };
26
27 std::ostream& operator«(std::ostream& out, NamedCaptureFlavor flavor);
28 void to_json(nlohmann::json& j, NamedCaptureFlavor flavor);
29
30 }  // namespace wr22::regex_parser::regex
```

7.13 include/wr22/regex_parser/regex/part.hpp File Reference

```
#include <nlohmann/json_fwd.hpp>
#include <wr22/regex_parser/regex/capture.hpp>
#include <wr22/regex_parser/regex/character_class_data.hpp>
#include <wr22/regex_parser/span/span.hpp>
#include <wr22/utils/adt.hpp>
#include <wr22/utils/box.hpp>
#include <iosfwd>
#include <memory>
#include <vector>
#include <nlohmann/json.hpp>
```

Classes

- struct wr22::regex_parser::regex::part::Empty

  An empty regex part.
- struct wr22::regex_parser::regex::part::Literal

  An regex part that matches a single character literally.
- struct wr22::regex_parser::regex::part::Alternatives

  A regex part with the list of alternatives to be matched.
- struct wr22::regex_parser::regex::part::Sequence

  A regex part with the list of items to be matched one after another.
- struct wr22::regex_parser::regex::part::Group

  A regex part that represents a group in parentheses.
- struct wr22::regex_parser::regex::part::Optional

  A regex part specifying an optional quantifier (`(expression)?`).
- struct wr22::regex_parser::regex::part::Plus

  A regex part specifying an "at least one" quantifier (`(expression)+`).
- struct wr22::regex_parser::regex::part::Star

  A regex part specifying an "at least zero" quantifier (`(expression)*`).
- struct wr22::regex_parser::regex::part::Wildcard

  A regex part specifying any single character (`.`).
- struct wr22::regex_parser::regex::part::CharacterClass

  A regex part specifying a character class (e.g. `[a-z_]`).
- class wr22::regex_parser::regex::Part

  A part of a regular expression and its AST node type.
- class wr22::regex_parser::regex::SpannedPart

  A version of `Part` including the span information (position in the input) of the root AST node (child nodes always contain it because they are represented as `SpannedPart`s themselves).

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::regex
- namespace wr22::regex_parser::regex::part

  The namespace with the variants of `Part`.

Typedefs

- using wr22::regex_parser::regex::part::Adt = utils::Adt< Empty, Literal, Alternatives, Sequence, Group, Optional, Plus, Star, Wildcard, CharacterClass >

Functions

- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Empty &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Literal &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Alternatives &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Sequence &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Group &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Optional &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Plus &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Star &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Wildcard &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::CharacterClass &part)
- void wr22::regex_parser::regex::to_json (nlohmann::json &j, const Part &part)
- void wr22::regex_parser::regex::to_json (nlohmann::json &j, const SpannedPart &part)
- std::ostream & wr22::regex_parser::regex::operator<< (std::ostream &out, const SpannedPart &part)

  Convert a `SpannedPart` to a textual representation and write it to an `std::ostream`.

7.14 part.hpp

Go to the documentation of this file.

```
1 #pragma once
2
3 // wr22
4 #include <nlohmann/json_fwd.hpp>
5 #include <wr22/regex_parser/regex/capture.hpp>
6 #include <wr22/regex_parser/regex/character_class_data.hpp>
7 #include <wr22/regex_parser/span/span.hpp>
8 #include <wr22/utils/adt.hpp>
9 #include <wr22/utils/box.hpp>
10
11 // stl
12 #include <iosfwd>
13 #include <memory>
14 #include <vector>
15
16 // nlohmann
17 #include <nlohmann/json.hpp>
18
19 namespace wr22::regex_parser::regex {
20
21 // Forward declarations.
22 class Part;
23 class SpannedPart;
24
28 namespace part {
33     struct Empty {
34         explicit Empty() = default;
35         bool operator==(const Empty& rhs) const = default;
36         static constexpr const char* code_name = "empty";
37     };
38     void to_json(nlohmann::json& j, const Empty& part);
39
44     struct Literal {
45         explicit Literal(char32_t character);
46         bool operator==(const Literal& rhs) const = default;
47         static constexpr const char* code_name = "literal";
48
49         char32_t character;
50     };
51     void to_json(nlohmann::json& j, const Literal& part);
52
61     struct Alternatives {
62         explicit Alternatives(std::vector<SpannedPart> alternatives);
```

```
63          bool operator==(const Alternatives& rhs) const = default;
64          static constexpr const char* code_name = "alternatives";
65
67          std::vector<SpannedPart> alternatives;
68      };
69      void to_json(nlohmann::json& j, const Alternatives& part);
70
76      struct Sequence {
77          explicit Sequence(std::vector<SpannedPart> items);
78          bool operator==(const Sequence& rhs) const = default;
79          static constexpr const char* code_name = "sequence";
80
82          std::vector<SpannedPart> items;
83      };
84      void to_json(nlohmann::json& j, const Sequence& part);
85
96      struct Group {
98          explicit Group(Capture capture, SpannedPart inner);
99          bool operator==(const Group& rhs) const = default;
100         static constexpr const char* code_name = "group";
101
103         Capture capture;
105         utils::Box<SpannedPart> inner;
106     };
107     void to_json(nlohmann::json& j, const Group& part);
108
110     struct Optional {
112         explicit Optional(SpannedPart inner);
113         bool operator==(const Optional& rhs) const = default;
114         static constexpr const char* code_name = "optional";
115
117         utils::Box<SpannedPart> inner;
118     };
119     void to_json(nlohmann::json& j, const Optional& part);
120
122     struct Plus {
124         explicit Plus(SpannedPart inner);
125         bool operator==(const Plus& rhs) const = default;
126         static constexpr const char* code_name = "plus";
127
129         utils::Box<SpannedPart> inner;
130     };
131     void to_json(nlohmann::json& j, const Plus& part);
132
134     struct Star {
136         explicit Star(SpannedPart inner);
137         bool operator==(const Star& rhs) const = default;
138         static constexpr const char* code_name = "star";
139
141         utils::Box<SpannedPart> inner;
142     };
143     void to_json(nlohmann::json& j, const Star& part);
144
146     struct Wildcard {
147         explicit Wildcard() = default;
148         bool operator==(const Wildcard& rhs) const = default;
149         static constexpr const char* code_name = "wildcard";
150     };
151     void to_json(nlohmann::json& j, const Wildcard& part);
152
154     struct CharacterClass {
155         explicit CharacterClass(CharacterClassData data);
156         bool operator==(const CharacterClass& rhs) const = default;
157         static constexpr const char* code_name = "character_class";
158
160         CharacterClassData data;
161     };
162     void to_json(nlohmann::json& j, const CharacterClass& part);
163
164     using Adt = utils::
165         Adt<Empty, Literal, Alternatives, Sequence, Group, Optional, Plus, Star, Wildcard,
    CharacterClass>;
166 }  // namespace part
167
194 class Part : public part::Adt {
195 public:
196     using part::Adt::Adt;
197 };
198 void to_json(nlohmann::json& j, const Part& part);
199
202 class SpannedPart {
203 public:
204     explicit SpannedPart(Part part, span::Span span);
205
206     bool operator==(const SpannedPart& other) const = default;
207     bool operator!=(const SpannedPart& other) const = default;
208
```

```
210     const Part& part() const;
212     Part& part();
213
215     span::Span span() const;
216
217 private:
218     Part m_part;
219     span::Span m_span;
220 };
221 void to_json(nlohmann::json& j, const SpannedPart& part);
222
224 std::ostream& operator<<(std::ostream& out, const SpannedPart& part);
225
226 }  // namespace wr22::regex_parser::regex
```

7.15 include/wr22/regex_parser/regex/spanned_character_range.hpp File Reference

```
#include <wr22/regex_parser/regex/character_range.hpp>
#include <wr22/regex_parser/span/span.hpp>
#include <iosfwd>
#include <nlohmann/json.hpp>
```

Classes

- struct wr22::regex_parser::regex::SpannedCharacterRange

  A `CharacterRange` with its span.

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::regex

Functions

- std::ostream & wr22::regex_parser::regex::operator<< (std::ostream &out, const SpannedCharacterRange &range)
- void wr22::regex_parser::regex::to_json (nlohmann::json &j, const SpannedCharacterRange &range)

7.16 spanned_character_range.hpp

Go to the documentation of this file.

```
1 #pragma once
2
3 // wr22
4 #include <wr22/regex_parser/regex/character_range.hpp>
5 #include <wr22/regex_parser/span/span.hpp>
6
7 // stl
8 #include <iosfwd>
9
10 // nlohmann
11 #include <nlohmann/json.hpp>
12
13 namespace wr22::regex_parser::regex {
```

```
14
16 struct SpannedCharacterRange {
17     CharacterRange range;
18     span::Span span;
19
20     bool operator==(const SpannedCharacterRange& rhs) const = default;
21 };
22
23 std::ostream& operator<<(std::ostream& out, const SpannedCharacterRange& range);
24 void to_json(nlohmann::json& j, const SpannedCharacterRange& range);
25
26 }  // namespace wr22::regex_parser::regex
```

7.17 include/wr22/regex_parser/span/span.hpp File Reference

```
#include <cstddef>
#include <stdexcept>
#include <ostream>
#include <nlohmann/json.hpp>
```

Classes

- struct wr22::regex_parser::span::InvalidSpan

  The exception thrown on an attempt to construct an invalid span.
- class wr22::regex_parser::span::Span

  Character position range in the input string.

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::span

Functions

- std::ostream & wr22::regex_parser::span::operator<< (std::ostream &out, Span span)
- void wr22::regex_parser::span::to_json (nlohmann::json &j, Span span)

7.18 span.hpp

Go to the documentation of this file.

```
1 #pragma once
2
3 // stl
4 #include <cstddef>
5 #include <stdexcept>
6 #include <ostream>
7
8 // nlohmann
9 #include <nlohmann/json.hpp>
10
11 namespace wr22::regex_parser::span {
12
16 struct InvalidSpan : public std::runtime_error {
17     InvalidSpan(size_t begin, size_t end);
18
```

```
19     size_t begin;
20     size_t end;
21 };
22
34 class Span {
35 public:
39     static Span make_empty(size_t position);
40
46     static Span make_single_position(size_t position);
47
51     static Span make_from_positions(size_t begin, size_t end);
52
60     static Span make_with_length(size_t begin, size_t length);
61
69     Span extend_right(size_t num_positions) const;
70
72     size_t length() const;
73
75     size_t begin() const;
76
78     size_t end() const;
79
80     bool operator==(const Span& other) const = default;
81     bool operator!=(const Span& other) const = default;
82
83 private:
90     explicit Span(size_t begin, size_t end);
91
92     size_t m_begin;
93     size_t m_end;
94 };
95
96 std::ostream& operator«(std::ostream& out, Span span);
97 void to_json(nlohmann::json& j, Span span);
98
99 }  // namespace wr22::regex_parser::span
```

7.19 src/parser/capture.cpp File Reference

```
#include <wr22/regex_parser/regex/capture.hpp>
#include <wr22/regex_parser/regex/named_capture_flavor.hpp>
#include <iterator>
#include <ostream>
#include <fmt/core.h>
#include <fmt/ostream.h>
```

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::regex
- namespace wr22::regex_parser::regex::capture

Functions

- std::ostream & wr22::regex_parser::regex::operator<< (std::ostream &out, const Capture &capture)
- void wr22::regex_parser::regex::to_json (nlohmann::json &j, const Capture &capture)
- void wr22::regex_parser::regex::capture::to_json (nlohmann::json &j, const None &capture)
- void wr22::regex_parser::regex::capture::to_json (nlohmann::json &j, const Index &capture)
- void wr22::regex_parser::regex::capture::to_json (nlohmann::json &j, const Name &capture)

7.20 src/parser/errors.cpp File Reference

```
#include <wr22/regex_parser/parser/errors.hpp>
#include <wr22/unicode/conversion.hpp>
#include <fmt/core.h>
#include <fmt/ostream.h>
```

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::parser
- namespace wr22::regex_parser::parser::errors

7.21 src/parser/regex.cpp File Reference

```
#include <wr22/regex_parser/parser/errors.hpp>
#include <wr22/regex_parser/parser/regex.hpp>
#include <wr22/regex_parser/regex/part.hpp>
#include <wr22/regex_parser/span/span.hpp>
#include <wr22/unicode/conversion.hpp>
#include <wr22/utils/nonconcurrent_semaphore.hpp>
#include <optional>
#include <stdexcept>
#include <string>
#include <vector>
```

Classes

- class wr22::regex_parser::parser::Parser< Iter, Sentinel >

  A regex parser.

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::parser

Functions

- template<typename Iter , typename Sentinel >
  wr22::regex_parser::parser::Parser (Iter begin, Sentinel end) -> Parser< Iter, Sentinel >

  The type deduction guideline for `Parser`.
- regex::SpannedPart wr22::regex_parser::parser::parse_regex (const std::u32string_view &regex)

  Parse a regular expression into its AST.

7.22 src/regex/character_range.cpp File Reference

```
#include <wr22/regex_parser/regex/character_range.hpp>
#include <wr22/unicode/conversion.hpp>
#include <ostream>
#include <fmt/core.h>
#include <fmt/ostream.h>
```

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::regex

Functions

- std::ostream & wr22::regex_parser::regex::operator<< (std::ostream &out, const CharacterRange &range)
- void wr22::regex_parser::regex::to_json (nlohmann::json &j, const CharacterRange &range)

7.23 src/regex/named_capture_flavor.cpp File Reference

```
#include <wr22/regex_parser/regex/named_capture_flavor.hpp>
#include <ostream>
```

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::regex

Functions

- std::ostream & wr22::regex_parser::regex::operator<< (std::ostream &out, NamedCaptureFlavor flavor)
- void wr22::regex_parser::regex::to_json (nlohmann::json &j, NamedCaptureFlavor flavor)

7.24 src/regex/part.cpp File Reference

```
#include <wr22/regex_parser/regex/part.hpp>
#include <wr22/regex_parser/span/span.hpp>
#include <wr22/unicode/conversion.hpp>
#include <iterator>
#include <ostream>
#include <fmt/core.h>
#include <fmt/ostream.h>
```

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::regex
- namespace wr22::regex_parser::regex::part

  The namespace with the variants of `Part`.

Functions

- std::ostream & wr22::regex_parser::regex::operator<< (std::ostream &out, const SpannedPart &part)

  Convert a `SpannedPart` *to a textual representation and write it to an* `std::ostream`.
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Empty &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Literal &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Alternatives &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Sequence &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Group &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Optional &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Plus &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Star &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::Wildcard &part)
- void wr22::regex_parser::regex::part::to_json (nlohmann::json &j, const part::CharacterClass &part)
- void wr22::regex_parser::regex::to_json (nlohmann::json &j, const Part &part)
- void wr22::regex_parser::regex::to_json (nlohmann::json &j, const SpannedPart &part)

7.25 src/regex/spanned_character_range.cpp File Reference

```
#include <wr22/regex_parser/regex/spanned_character_range.hpp>
#include <ostream>
#include <fmt/core.h>
#include <fmt/ostream.h>
```

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::regex

Functions

- std::ostream & wr22::regex_parser::regex::operator<< (std::ostream &out, const SpannedCharacterRange &range)
- void wr22::regex_parser::regex::to_json (nlohmann::json &j, const SpannedCharacterRange &range)

7.26 src/span/span.cpp File Reference

```
#include <stdexcept>
#include <wr22/regex_parser/span/span.hpp>
#include <fmt/core.h>
#include <fmt/ostream.h>
```

Namespaces

- namespace wr22
- namespace wr22::regex_parser
- namespace wr22::regex_parser::span

Functions

- std::ostream & wr22::regex_parser::span::operator<< (std::ostream &out, Span span)
- void wr22::regex_parser::span::to_json (nlohmann::json &j, Span span)

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