P1406R2
Add more std::hash specializations

New Proposal, 2018-12-04

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Project:

ISO/IEC JTC1/SC22/WG21 14882: Programming Language — C++

Audience:

LEWGI, LEWG, LWG

Source:

https://github.com/ZaMaZaN4iK/ConfsANDProps/blob/master/Proposals/P1406_complex_hash/complex_hash.bs

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Abstract

In Standard library we already have std::hash specializations for some classes like std::string. Unfortunately, we have no specializations for a lot of other classes from Standard Library like std::array, std::tuple, etc. At the moment people who need hash calucations for such containers must use Boost.Hash functions or write std::hash specialization manually. This proposal adds std::hash specializations for different containers from Standard Library. Addresses an issue LWG #1025.

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§ 1. Changes since R1

- Removed a requirement for the same hash value for different containers with the same content.
- Left std::hash specializations only for std::tuple, std::pair, std::array, std::basic_string. Other specializations are moved to another paper because of lack of motivation.

§ 2. Design decisions

- We do not enable `hash` for unordered_set, unordered_map, unordered_multiset, unordered_multimap because of the hashing collisions and buckets count. Position of the elment depends on those two factors, which leads to different hashes for containers with the same content.
- We do not enable hash for `stack` and `queue` adapters for now. Probably will be enabled in future papers.

§ 3. Proposed wording

Add a new Section "19.4.6, Hash support [pair.hash]", with following content:

```
template<typename A, typename B>
  struct hash<pair<A, B>>;
```

Enabled if specializations `hash<remove_const_t<A>>` and `hash<remove_const_t<B>>` are both enabled, and disabled otherwise.

Let `PAIR` denote a `pair` type, `x` denote a value of type `PAIR`. For enabled specialization `hash<PAIR>` the following holds: `hash<PAIR>{}(x) == hash<decltype(tuple{x})>{}(x)`.

Add a new Section "19.5.3.11, Hash support [tuple.hash]", with following content:

```
template<typename... T>
  struct hash<tuple<T...>>;
```

Enabled if specialization `hash<remove_const_t<U>>` is enabled for every template argument `U` in the parameter pack, and disabled otherwise.

Add a new Section "21.3.7.7, Hash support [array.hash]", with following content:

```
template<typename T, std::size_t N>
  struct hash<array<T, N>>;
```

Enabled if specialization `hash<remove_const_t<T>>` is enabled, and disabled otherwise.

Remove a paragraph from Section "20.3.5, Hash support [basic.string.hash]", with following content:

```
template<> struct hash<string>;
template<> struct hash<u8string>;
template<> struct hash<u16string>;
template<> struct hash<u32string>;
template<> struct hash<wstring>;
template<> struct hash<pmr::string>;
template<> struct hash<pmr::u8string>;
template<> struct hash<pmr::u16string>;
template<> struct hash<pmr::u32string>;
template<> struct hash<pmr::wstring>;
```

Add a new paragraph to Section "20.3.5, Hash support [basic.string.hash]", with following content:

```
template<typename charT, typename Allocator>
  struct hash<basic_string<charT, char_traits<charT>, Allocator>>;
```

Enabled if specialization `hash<remove_const_t<charT>>` is enabled, and disabled otherwise.

§ 4. Possible implementation

Some possible implementations can be found in Boost.Hash library.

§ 5. References

Boost.Hash