Co nowego w C++14

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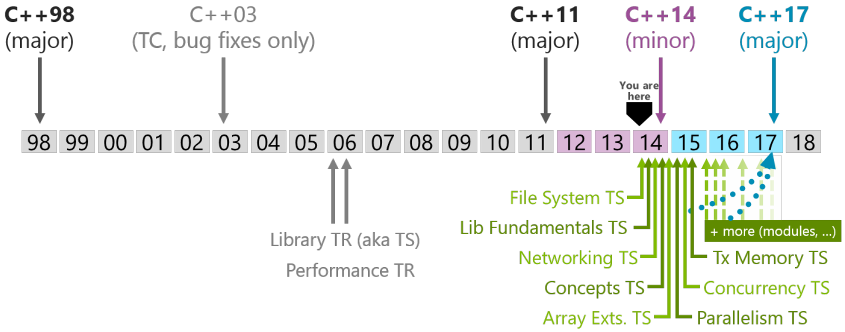
timeline


C++98
(major)
C++03
(TC, bug fixes only)
C++11
(major)
C++14
(minor)
C++17
(major)
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Library TR (aka TS)
Performance TR
File System TS
Lib Fundamentals TS
Networking TS
Concepts TS
Array Exts. TS
+ more (modules, ...)
Tx Memory TS
Concurrency TS
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Plan

New language features

- Function return type deduction
- Alternate type deduction on declaration
- Relaxed constexpr restrictions
- Variable templates
- Aggregate member initialization
- Binary literals
- Digit separators
- Generic lambdas
- Lambda captures expressions

Czego NIE bedzie

New standard library features

- Shared mutexes and locking
- Heterogeneous lookup in associative containers
- Standard user-defined literals
- Tuple addressing via type
- Smaller library features

Function return type deduction

```
template <class T, class W>
??? sum(T t, W w) {
    return t + w;
}
```

Function return type deduction, rozwiazanie z C++11

```
template <class T, class W>
auto sum(T t, W w) -> decltype(t + w) {
    return t + w;
}
```

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Copy paste!

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Dużo lepiej!

Function return type deduction, rozwiazanie z C++14

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template <class T, class W>
auto sum(T t, W w) {
    return t + w;
}
```

Dużo lepiej! (ale mogło by być jeszcze ładniej)

Function return type deduction, rozwiazanie z C++17

```
auto sum(auto t, auto w) {
    return t + w;
}
```

Zaimplementowane w g++-4.9

```cpp
template <typename T>
auto sum(auto t, auto w, int k, T tt) {
    return t + w;
}
```

Function return type deduction, rozwiazanie z C++48

```
sum(t,  w) {
    return t + w;
}
```

Funkcja z wieloma returnami

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```
auto Correct(int i) {
    if (i == 1)
    return i; // return type deduced as int
    else
    return Correct(i-1)+i;// ok to call it now
}
```

Funkcja z wieloma returnami

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auto Correct(int i) {
    if (i == 1)
    return i; // return type deduced as int
    else
    return Correct(i-1)+i;// ok to call it now
}
```

```
auto Wrong(int i) {
    if (i != 1)
    return Wrong(i-1)+i;//Too soon to call this
    // No prior return statement.
    else
    return i;   // return type deduced as int
}
```

Alternate type deduction on declaration

```
std::map<int, std::pair<double, float>> map
    = f(1, 2, "bu bu bu");
```

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auto map = f(1, 2, "bu bu bu");
//Kompilator sam domysli sie typu zmiennej map
```

Alternate type deduction on declaration

```
std::map<int, std::pair<double, float>> map
    = f(1, 2, "bu bu bu");
```

```
auto map = f(1, 2, "bu bu bu");
//Kompilator sam domysli sie typu zmiennej map
```

A co jeśli f zwraca referencje?

Alternate type deduction on declaration

```
decltype(f(1, 2, "bu bu bu")) map
    = f(1, 2, "bu bu bu");
```

Alternate type deduction on declaration, rozwiazanie w C++14

```
decltype(auto) map = f(1, 2, "bu bu bu");
```

Alternate type deduction on declaration in function return type deduction

```
decltype(auto) f()  {
    return some_reference;
}
```

Relaxed constexpr restrictions

```
constexpr int factorial(int n)
{
    return n <= 1 ? 1 : (n * factorial(n-1));
}
```

Relaxed constexpr restrictions - niedozwolone w C++11

```
constexpr int factorial_iterative(int n)
{
  int ret = 1;
  while(n > 0) {
          ret = ret * (n--);
  }
  return ret;
}
```

Relaxed constexpr restrictions

- Any declarations except:
  - static or thread_local variables.
  - variable declarations without initializers.
  - goto statements.
- The conditional branching statements if and switch.
- All looping statements, including range-based for.
- Expressions may change the value of an object

Variable templates

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```
template<typename T>
constexpr T pi = T(3.1415926535897932385);
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```

```
template <typename T>
T area_of_circle_with_radius(T r) {
    return pi<T> * r * r;
}
```

Aggregate member initialization

```
struct S {
    int a;
    const char* b;
    int c;
    int d = b[a];
};
```

Aggregate member initialization

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struct S {
    int a;
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};
```

```
S ss = { 1, "asdf" };
```

Aggregate member initialization

```
struct X { int i, j, k = 42; };
X a[] = { 1, 2, 3, 4, 5, 6 };
X b[2] = { { 1, 2, 3 }, { 4, 5, 6 } };
```

Binary literals

```
int a = 0xf;
```

Binary literals

```
int a = 0xf;
```

```
int b = 0b1111;
```

Digit separators

```
auto integer_literal = 1'000'000;
auto floating_point_literal = 0.000'015'3;
auto binary_literal = 0b0100'1100'0110;
auto silly_example = 1'0'0'000'00;
```

Generic lambdas

```
struct unnamed_lambda
{
    auto operator()(int x, int y) const
        {return x + y;}
};
auto lambda = unnamed_lambda{};
```

```
auto lambda = [](int x, int y) { return x + y; };
```

Generic lambdas

```
auto lambda = [](auto x, auto y) {return x + y; };
```

```
struct unnamed_lambda
{
   template<typename T, typename U>
   auto operator()(T x, U y) const {return x + y;}
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Generic lambdas, przyklad

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std::vector<int> v = {2, -1, 3};
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```
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```

```
void abs_sort(auto & range) {
    std::sort(std::begin(range), std::end(range),
            [](auto x, auto y){
                return std::abs(x) < std::abs(y);
            });
}
```

Generic lambdas, przylad range

```
void abs_sort(auto & range) {
      boost::sort(range,
            [](auto x, auto y){
                return std::abs(x) < std::abs(y);
            });
}
```

Lambda captures expressions

```
auto lambda = [=] {return value;};
auto lambda = [&] {return value;};
```

Lambda captures expressions

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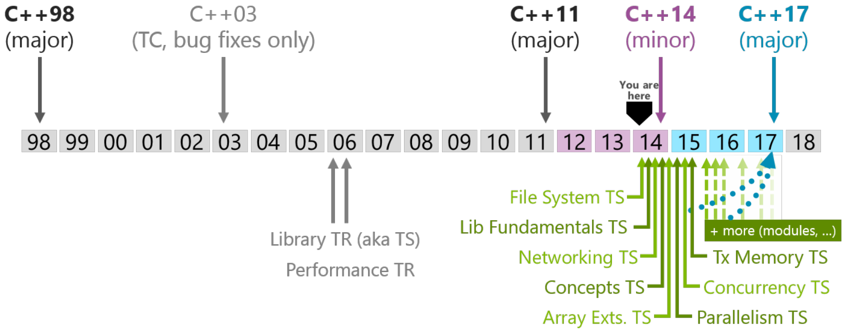
auto lambda = [=] {return value;};
auto lambda = [&] {return value;};
```

```
auto lambda = [value = 1] {return value;};
auto lambda = [value = std::move(some_value)] {
                return value;};
```



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- MSVC - nic nie trzeba

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- clang++ –std=c++1y
- MSVC - nic nie trzeba (ale sa do tylu z implementacja)

Referencje

- isocpp.org/wiki/faq/cpp14-language
- en.wikipedia.org/wiki/C%2B%2B14
- opisy funkcjonalnosci np. open-std.org/JTC1/SC22/WG21/docs/papers/2013/n3638.html

Dziekuje za uwage!