Программирование на языке C++

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C++ String

std::string

Строки - объекты, представляющие собой последовательность символов

Не является встроенным типом языка, но входит в состав стандартной библиотеки.

```
#include <string>
#include <iostream>

int main()
{
    std::string str = "I'm C++ string!";
    std::cout << str << std::endl;
}
```

```
I’m C++ string!
```

Размер строки

size_t size() const;
size_t length() const;

```cpp
#include <string>
#include <iostream>

int main()
{
  std::string str = "I'm C++ string!";
  std::cout << "Str      = " << str << std::endl;
  std::cout << "Str size = " << str.size() << std::endl;

  str = "New text..";
  std::cout << "Str      = " << str << std::endl;
  std::cout << "Str size = " << str.length() << std::endl;
}
```

```
Str       = I'm C++ string!
Str size  = 15
Str       = New text..
Str size  = 10
```

Проверка пустой строки

bool empty() const;

Флаги форматирования потока вывода:

std::boolalpha

std::noboolalpha

```cpp
#include <string>
#include <iostream>

int main()
{
  std::string str1 = "Not empty string";
  std::string str2 = "";

  std::cout << "Is str1 empty: " << str1.empty() << std::endl;
  std::cout << "Is str2 empty: " << str2.empty() << std::endl;

  std::cout << std::boolalpha;
  std::cout << "Is str1 empty: " << str1.empty() << std::endl;
  std::cout << "Is str2 empty: " << str2.empty() << std::endl;
}
```

```
Is str1 empty: 0
Is str2 empty: 1
Is str1 empty: false
Is str2 empty: true
```

Конкатенация строк

```cpp
#include <string>
#include <iostream>

int main()
{
  std::string str1 = "First";
  std::string str2 = "Second";

  std::string resultStr = str1 + " and " + str2;
  resultStr += " and 3rd";

  std::cout << resultStr << std::endl;
}
```

```
First and Second and 3rd
```

Работа с потоком ввода std::cin

operator>> возвращает символы до ближайшего пробельного символа. Остальные символы остаются в std::cin

```
#include <string>
#include <iostream>

int main()
{
  std::string title;
  std::cout << "Enter title: ";
  std::cin >> title;

  std::cout << "Title: " << title << std::endl;
}
```

```
Enter title: Microsoft Windows XP
Title: Microsoft
```

Работа с потоком ввода std::cin

operator>> возвращает символы до ближайшего пробельного символа. Остальные символы остаются в std::cin

```
#include <string>
#include <iostream>

int main()
{
  std::string title, description;
  std::cout << "Enter title: ";
  std::cin >> title;

  std::cout << "Enter description: ";
  std::cin >> description;

  std::cout << "Title: " << title << std::endl;
  std::cout << "Description: " << description << std::endl;

  return 0;
}
```

```
Enter title: Microsoft Windows XP
Enter description: Title: Microsoft
Description: Windows
```

Работа с потоком ввода std::cin

std::getline принимает 2 параметра - поток ввода и строку назначения

std::ws - манипулятор ввода. Игнорирует лидирующие пробельные символы

```
#include <string>
#include <iostream>

int main()
{
  std::string title, description;
  std::cout << "Enter title: ";
  std::getline(std::cin >> std::ws, title);

  std::cout << "Enter description: ";
  std::getline(std::cin >> std::ws, description);

  std::cout << "Title: " << title << std::endl;
  std::cout << "Description: " << description << std::endl;

  return 0;
}
```

```
Enter title: Microsoft Windows XP
Enter description: Operation System
Title: Microsoft Windows XP
Description: Operation System
```

Преобразование в целые числа

int stoi(const std::string& str, std::size_t* pos = nullptr, int base = 10);

long stol(const std::string& str, std::size_t* pos = nullptr, int base = 10);

long long stoll(const std::string& str, std::size_t* pos = nullptr, int base = 10);

```
#include <string>
#include <iostream>

int main()
{
  std::string str{ "164" };
  int intValue = std::stoi(str);
  std::cout << "Integer value: " << intValue << std::endl;
}
```

```
Integer value: 164
```

Преобразование в целые числа

Методы stoi, stol и stoll в качестве третьего необязательного параметра принимают основание системы счисления (по умолчанию 10)

```
#include <string>
#include <iostream>

int main()
{
  std::string str{ "0xA4" };
  int intValue = std::stoi(str, 0, 16);
  std::cout << "Integer value: " << intValue << std::endl;
}
```

```
Integer value: 164
```

Преобразование в целые числа

Методы stoi, stol и stoll в качестве третьего необязательного параметра принимают основание системы счисления (по умолчанию 10)

```
#include <string>
#include <iostream>

int main()
{
  std::string str{ "10100100" };
  int intValue = std::stoi(str, 0, 2);
  std::cout << "Integer value: " << intValue << std::endl;
}
```

```
Integer value: 164
```

Некорректное преобразование

```
#include <string>
#include <iostream>

int main()
{
  std::string str{ "Text" };
  int intValue = std::stoi(str);
  std::cout << "Integer value: " << intValue << std::endl;
}
```

```
Signal SIGABRT (signal SIGABRT)
```

Преобразование в числа с плавающей точкой

float stof(const std::string& str,
std::size_t* pos = nullptr);

double stod(const std::string& str,
std::size_t* pos = nullptr);

long double stold(const std::string& str,
std::size_t* pos = nullptr);

```
#include <string>
#include <iostream>
#include <iomanip>

int main()
{
  std::string str{ "3.14159265358979323846264338327950288419" };

  const float fValue = std::stof(str);
  const double dValue = std::stod(str);
  const long double ldValue = std::stold(str);

  std::cout << std::setprecision(32);
  std::cout << "Float value       : " << fValue << std::endl;
  std::cout << "Double value      : " << dValue << std::endl;
  std::cout << "Long Double value : " << ldValue << std::endl;
}
```

```
Float value       : 3.1415927410125732421875
Double value      : 3.141592653589793115997963468544
Long Double value : 3.141592653589793238512808959406
```

Получение C-string из std::string

const CharT* c_str() const;
const CharT* data() const;

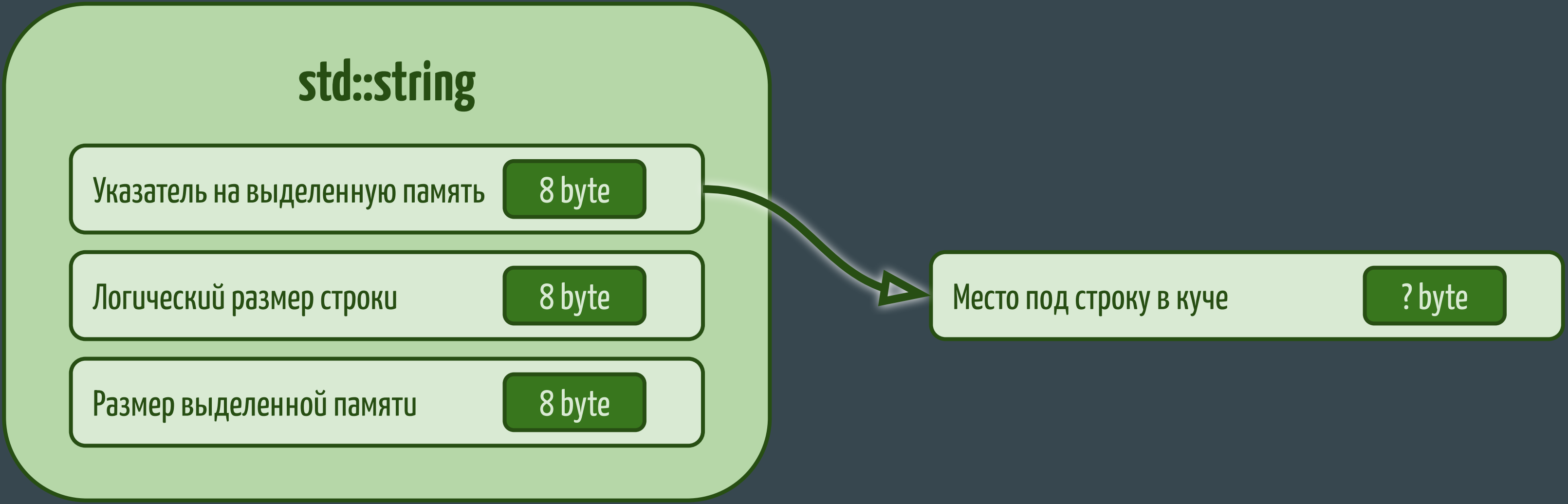
```
#include <string>
#include <iostream>

class dbConnection;

dbConnection* OpenDataBaseConnection(const char* dbName);
void CloseDataBaseConnection(dbConnection* connection);

int main()
{
  std::string dbName;
  std::cout << "Enter data base name: " << std::endl;
  std::cin >> dbName;

  dbConnection* connection = OpenDataBaseConnection(dbName.c_str());
  // ...
  CloseDataBaseConnection(connection);
}
```

Внутреннее представление std::string

```cpp
#include <cstring>
#include <iostream>

int main()
{
  std::string emptyString;
  std::cout << "emptyString  = " << emptyString << "; size = " << sizeof(emptyString) << std::endl;

  std::string filledString{ "Some important information" };
  std::cout << "filledString = " << filledString << "; size = " << sizeof(filledString) << std::endl;
}
```

```
emptyString  = ; size = 24
filledString = Some important information; size = 24
```

Внутреннее представление std::string



Обращение к символу по индексу

reference operator[](size_type pos);

reference at(size_type pos);

```
#include <string>
#include <iostream>
#include <cassert>

int main() {
  std::string str{"abcdefgh"};

  assert(str[0] == 'a');
  std::cout << "2th symbol of \"" << str << "\" is " << str[1] << ‘\n’;

  str[2] = 'w';
  char &ch = str[3];
  ch = 'z';

  std::cout << "Result string is \"" << str << "\"" << std::endl;
}
```

```
2th symbol of "abcdefgh" is b
Result string is "abwzefgh"
```

Посимвольный анализ строки

```
#include <string>
#include <map>
#include <iostream>

int main()
{
  std::string famousQuote = "Life did not intend to make us perfect.
Whoever is perfect belongs in a museum. -- Erich Maria Remarque";

  std::map<char, int> symbCounter;
  for(char& ch : famousQuote) {
    if(std::isalpha(ch)) {
      ++symbCounter[std::tolower(ch)];
    }
  }

  for(auto& symbData : symbCounter) {
   cout << symbData.first << " : " << symbData.second << endl;
  }
}
```

```
a : 5
b : 1
c : 3
d : 3
e : 14
f : 3
g : 1
h : 2
i : 7
k : 1
l : 2
m : 5
n : 5
o : 4
p : 2
q : 1
r : 7
s : 4
t : 5
u : 4
v : 1
w : 1
```

Функции стандартной библиотеки (cctype) для анализа кода символа

```
int isalnum ( int c );
int isalpha ( int c );
int isblank ( int c );
int iscntrl ( int c );
int isdigit ( int c );
int isgraph ( int c );
```

```
int islower ( int c );
int isprint ( int c );
int ispunct ( int c );
int isspace ( int c );
int isupper ( int c );
int isxdigit ( int c );
```

```
int tolower ( int c );
int toupper ( int c );
```

Разбор std::string на отдельные слова

```cpp
#include <string>
#include <iostream>
#include <sstream>

int main()
{
  std::string famousQuote = "Life did not intend to make us perfect.
Whoever is perfect belongs in a museum. -- Erich Maria Remarque";
  std::istringstream is{famousQuote, std::istringstream::in };

  std::string longestWord;
  std::string currentWord;
  while(is >> currentWord) {
    std::cout << currentWord << std::endl;

    if(currentWord.size() > longestWord.size()) {
      longestWord = currentWord;
    }
  }

  std::cout << "Longest word is \"" << longestWord << "\" which contains ";
  std::cout << longestWord.size() << " letters." << std::endl;
}
```

```
Life
did
not
intend
to
make
us
perfect.
Whoever
is
perfect
belongs
in
a
museum.
--
Erich
Maria
Remarque
Longest word is "perfect."
which contains 8 letters.
```

std::string посимвольная проверка. Замена символов

```cpp
#include <string>
#include <iostream>

int main()
{
  std::string famousQuote = "Success is not final; failure is not fatal: It is the courage to continue that counts. -- Winston Churchill";

  std::cout << "Source string = " << famousQuote << std::endl;
  for (char& ch : famousQuote) {
    if (!std::isalpha(ch)) {
      ch=' ';
    }
  }
  std::cout << "Result string = " << famousQuote << std::endl;
}
```

```
Source string = Success is not final; failure is not fatal: It is the courage to continue that counts. -- Winston Churchill
Result string = Success is not final  failure is not fatal  It is the courage to continue that counts     Winston Churchill
```

Алгоритм замены символов

```
#include <string>
#include <iostream>
#include <algorithm>


int main()
{
  std::string famousQuote = "Success is not final; failure is not fatal: It is the courage to continue that 
counts. -- Winston Churchill";

  std::cout << "Source string = " << famousQuote << std::endl;
  std::replace_if(famousQuote.begin(), famousQuote.end(), [](char& ch){
    return !std::isalpha(ch);
  }, ' ');
  std::cout << "Result string = " << famousQuote << std::endl;
}
```

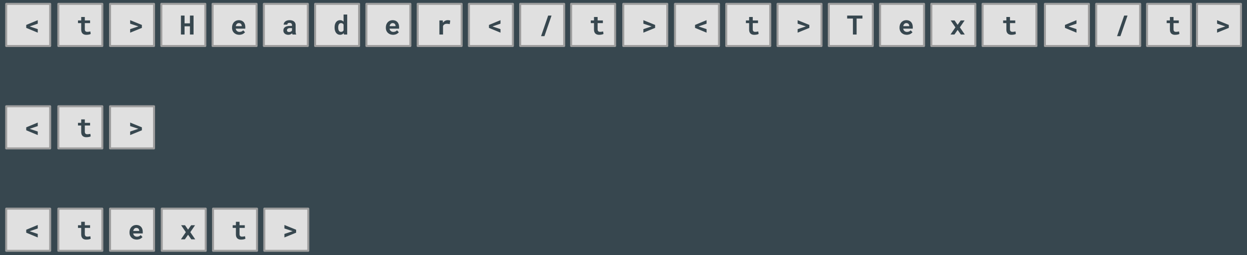
```
Source string = Success is not final; failure is not fatal: It is the courage to continue that counts. -- Winston Churchill
Result string = Success is not final  failure is not fatal  It is the courage to continue that counts     Winston Churchill
```

Поиск и замена слов в строке

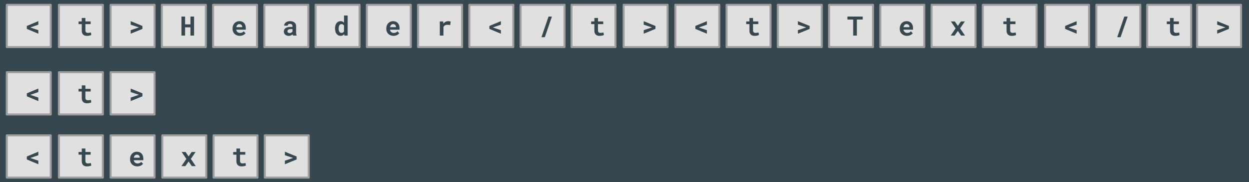
```
#include <string>
#include <iostream>
#include <algorithm>

std::string StringReplacer(const std::string& inputStr, const std::string& src, const std::string& dst)
{
  std::string result{ inputStr };

  size_t pos = result.find(src);
  while(pos != std::string::npos) {
    result.replace(pos, src.size(), dst);
    pos += dst.size();
    pos = result.find(src, pos);
  }

  return result;
}

int main()
{
  std::string str = "<t>Header</t><t>Description section</t>";
  str = StringReplacer(str, "<t>", "<text>");
  str = StringReplacer(str, "</t>", "<end text>");
  std::cout << "Result string: " << str << std::endl;
}
```

Поиск и замена слов в строке

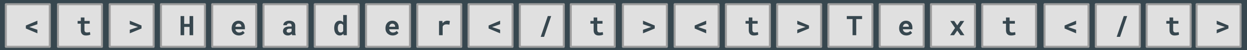
```cpp
std::string str = "<t>Header</t><t>Description section</t>";
str = StringReplacer(str, "<t>", "<text>");


std::string StringReplacer(
    const std::string& inputStr,
    const std::string& src,
    const std::string& dst)
```



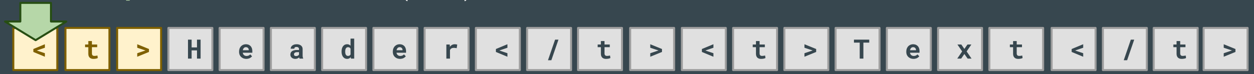
```cpp
std::string StringReplacer(
    const std::string& inputStr,
    const std::string& src,
    const std::string& dst)
```



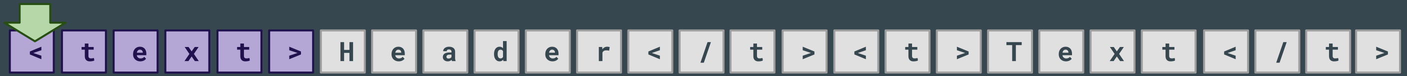
```cpp
std::string result{ inputStr };
```



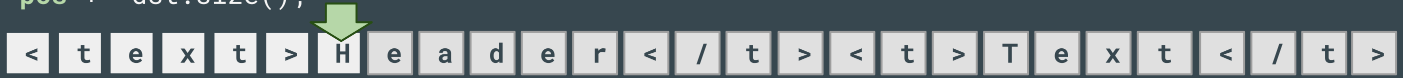
```cpp
size_t pos = result.find(src);
```



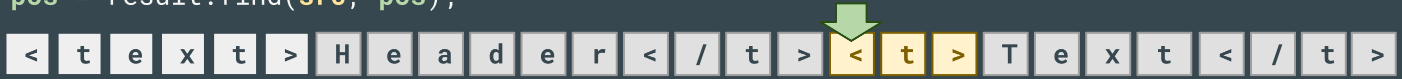
```cpp
result.replace(pos, src.size(), dst);
```



```cpp
pos += dst.size();
```



```cpp
pos = result.find(src, pos);
```



<text>Header</t><t>Text</t>