INTRODUCTION TO C++

Presented By,

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HISTORY OF C++

- C++ is a multi-paradigm programming language that supports object oriented programming (OOP) created by Bjarne Stroustrup in 1983 at Bell labs, C++ is an extension of C programming and the programs written in C language can run in C++ compiler.
- The development of C++ actually began four years before its release, in 1979. It did not start with the name C++. Its first name was C with classes.

- In the late part of 1983, C with classes was first used for AT&T's internal programming needs. Its name was changed to C++ later in the same year.
- It is of course also used in a wide range of other application domains, notable graphics programming. C++ supports inheritance through class derivation. Dynamic binding is provided by Virtual class function.

DIFFERENCE BETWEEN C AND C++

C	C++
C is Procedural Language.	C++ is non-Procedural i.e. Object oriented Language.
Top down approach is used in Program Design.	Bottom up approach adopted in Program Design.
Multiple Declaration of global variables are allowed.	Multiple Declaration of global variables are not allowed.
C requires all the variables to be defined at the starting of a scope.	C++ allows the declaration of variable anywhere in the scope i.e. at time of its First use.
In C, malloc () and calloc () Functions are used for Memory Allocation and free () function for memory Deallocating.	In C++, new and delete operators are used for Memory Allocating and Deallocating.

USES OF C++ LANGUAGE

- C++ is used by programmers to develop computer software
- It is used to create general system software
- Used to build drivers for various computer devices
- Software for servers and software for specific applications
- Used in the creation of video games.

ADVANTAGE OF C++

- ✓ C++ is relatively-low level and is a systems programming language.
- ✓ It has a large community.
- ✓ It has a relatively clear and mature standard.
- ✓ Modularity’
- ✓ Reusability and readability

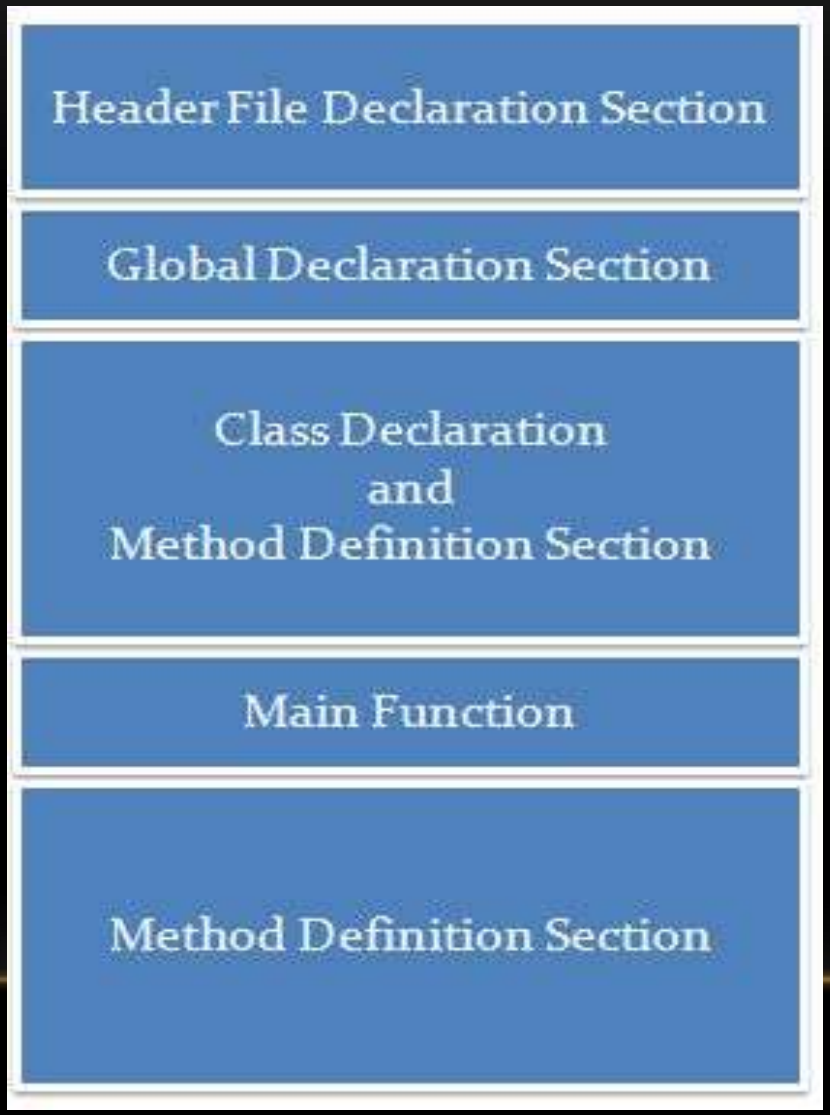
DISADVANTAGE OF C++

- Data is global or local.
- It emphasis on instructions bur not on data.
- It can be generally heavy if not careful.
- Data is global and global data does not have security.

STANDARD LIBRARIES

- The C++ Standard Library can be categories into two parts:
- **The standard function library:** This library consists of general-purpose, stand-alone function that are not part of any class. The function library is inherited from C.
- **The object oriented class library:** This is a collection of classes and associated function.
- Standard C++ library incorporates all the standard C libraries also, with small additions and changes to support type safety.

STRUCTURE OF C++



SIMPLE PROGRAM C++

```
#include<iostream.h>/*Header File*/
int main()/*Main Function*/
{
cout<<"\n*HELLO*\n";
/*Output Statements*/
}
```

C++ DATA TYPES

Primary data type	int, float, char, void
User defined data type	structure, union, class, enumeration
Derived data type	array, function, pointer, reference

C++ VARIABLES SCOPE

- A scope is a region of the program and broadly speaking there are three places, where variables can be declared −
- Inside a function or a block which is called **local variables**,
- In the definition of function parameters which is called **formal parameters**.
- Outside of all functions which is called **global variables**.

LOCAL VARIABLES

```
#include <iostream.h>
 int main ()
 {
        int a, b;
        int c;
                    // Local variable declaration
        a = 10;
        b = 20;
                    // actual initialization
 c = a + b;
cout << c;
return 0;
 }
```

Output = ?

Output = 30

GLOBAL VARIABLES

```
#include <iostream.h>
        // Global variable declaration:
                Int g;
int main ()
{
        // Local variable declaration:
                int a, b;
         // actual initialization
                a = 10;
                b = 20;
   g = a + b;
   cout << g;
   return 0;
}
```

Output = ?

Output = 30

OPERATORS

- Arithmetic operators
- Relational operators
- Logical operators
- Bitwise operators
- Assignment operators

ARITHMETIC OPERATORS

```
#include<iostream.h>
#include<conio.h>
void main()
{
int a,b,c;
cout<<“enter the value for a and b”;
cin>>a>>b;
c=a+b;
cout<<c;
c=a-b;
cout<<c;
c=a*b;
cout<<c;
c=a/b;
cout<<c;
c=a++;
cout<<“incrementation of a by one”<<c;
c=a--;
cout<<”decrementation of a by one”<<c);
}
```

RELATIONAL OPERATORS

```
#include<iostream.h>
#include<conio.h>
void main()
{
int a,b; a=10;b=13;
if(a<b)
{  cout<<“a is less than b”;  }
if(a>b)
{  cout<<”a is greater than b”;  }
if(a<=b)
{  cout<<”a is less than or equal
to b”;  }
if(a>=b)
{  cout<<“a is greater than or
equal to b”;  }
if(a==b)
{  cout<<”a is equal to b”;  }
if(a!=b)
{  cout<<”a is not equal to b”);
}
}
```

LOGICAL OPERATORS

```
#include<iostream.h>
#include<conio.h>
void main()
{
int a,b;
a=12;
b=10;
if(a&&b)
{ cout<<"condition is true"; }
if(a||b)
{ cout<<"condition is true"; }
a=0;
b=10;
if(a&&b)
{ cout<<"condition is true"; }
else
cout<<"condition is not true";
if(!(a&&b))
{ cout<<"condition is true"; } }
```

BITWISE OPERATOR

Bitwise operator works on bits and perform bit-by-bit operation.

P	Q	P&Q	P|Q	P^Q
0	0	0	0	0
0	1	0	1	1
1	0	0	1	1
1	1	1	1	0

Assume if A = 60; and B = 13; now in binary format they will be as follows:

A = 0011 1100 ----> **Binary Number for 60**

B = 0000 1101 ----> **Binary Number for 13**

A&B	=	0000 1100
A|B	=	0011 1101
A^B	=	0011 0001
~A	=	1100 0011

```
#include <iostream.h>
int main() {
int a = 7; // a = 111
int b = 5; // b = 101
cout << "Bitwise Operators\n";
cout << "a & b = " << (a&b) << "\n";
cout << "a | b = " << (a|b) << "\n";
cout << "a ^ b = " << (a^b) << "\n";
cout << "~a = " << (~a) << "\n";
cout << "~b = " << (~b) << "\n";
cout << "a >> b = " << (a>>b) << "\n";
cout << "a << b = " << (a<<b) << "\n";
}
```

Output = ?

Output

Bitwise Operators
a & b = 5
a | b = 7
a ^ b = 2
~a = -8
~b = -6
a >> b = 0
a << b = 224

ASSIGNMENT OPERATOR

An assignment operator, in the context of the C programming language, is a basic component denoted as "=".

```
int x = 25;
x = 50;
```

FUNCTIONS

- Function is a set of statements to perform some task.
- Every C++ program has at least one function, which is **main()**, and all the most trivial programs can define additional functions.
- **Syntax of Function**

```
return-type function-name (parameters)
{
 // function-body
}
```

DECLARING, DEFINING AND CALLING FUNCTION

```
#include < iostream.h>
int sum (int x, int y);   //declaring function
int main()
{
 int a = 10;
 int b = 20;
 int c = sum (a, b);   //calling function
 cout << c;
}
int sum (int x, int y)   //defining function
{
 return (x+ y);
}
```

Output = ?

Output = 30

CALLING A FUNCTION

- Functions are called by their names. If the function is without argument, it can be called directly using its name. But for functions with arguments, we have two ways to call them,

- **Call by Value**
- **Call by Reference**

CALL BY VALUE

```
#include <iostream.h>
void swap(int x, int y); // function declaration
 int main ()
{
            int a = 100;
            int b = 200;   // local variable declaration:
 cout << "Before swap, value of a :" << a << endl;
cout << "Before swap, value of b :" << b << endl;
             swap(a, b); // calling a function to swap the values.
 cout << "After swap, value of a :" << a << endl;
 cout << "After swap, value of b :" << b << endl;
return 0;   }
```

OUTPUT:

```
Before swap, value of a :100
Before swap, value of b :200
After swap, value of a :200
After swap, value of b :100
```

CALL BY REFERENCE

```
#include <iostream.h>
void swap(int &x, int &y); // function declaration
 int main ()
{
            int a = 100;
            int b = 200;        // local variable declaration:
 cout << "Before swap, value of a :" << a << endl;
cout << "Before swap, value of b :" << b << endl;
             swap(a, b); // calling a function to swap the values using variable reference.*/
 cout << "After swap, value of a :" << a << endl;
 cout << "After swap, value of b :" << b << endl;
return 0;
}
```

OUTPUT:

```
Before swap, value of a :100
Before swap, value of b :200
After swap, value of a :200
After swap, value of b :100
```

ARRAYS

- Array is defined as a set of homogeneous data items. An Array is a group of elements that share a common name that are differentiated from one another by their positions within the array.
- It is a data structure which allows a collective name to be given to a group of elements which all have the same type.

Syntax

datatype arrayname[array size];

- The Array which is declared as above is called single-dimension array

- Example: **float salary[10];**

  float → data type

  salary → array name

  [10] → array size(integer)

- The size of an array must be an integer constant and the data type can be any valid C++ data type.

ARRAY INITIALIZATION

- In C++ elements of an array can be initialized one by one or using a single statement

float balance[5]={1000.0, 2.0, 3.4,7.0, 50};

- The number of values between braces { } cannot be larger than the number of elements that we declare for the array between square brackets [ ].

	0	1	2	3	4
balance	1000.0	2.0	3.4	7.0	50.0

C++ ARRAY IN DETAIL

CONCEPT	DESCRIPTION
Multi-dimensional arrays	C++ supports multidimensional arrays. The simplest form of the multidimensional array is the two-dimensional array.
Pointer to an array	You can generate a pointer to the first element of an array by simply specifying the array name, without any index.
Passing arrays to functions	You can pass to the function a pointer to an array by specifying the array's name without an index.
Return array from functions	C++ allows a function to return an array.

POINTERS

- Pointer is a user defined data type which creates special types of variables which can hold the address of primitive data type like char, int, float, double or user defined data type like function, pointer etc. or derived data type like array, structure, union, enum.

What Are Pointers?

- A pointer is a variable whose value is the address of another variable. Like any variable or constant, you must declare a pointer before you can work with it.

Syntax

```
datatype *var-name;
```

```
int    *ip;          // pointer to an integer
double *dp;          // pointer to a double
float  *fp;          // pointer to a float
char   *ch           // pointer to character
```

USING POINTERS IN C++

- There are few important operations, which we will do with the pointers very frequently.

  (a) we define a pointer variables

  (b) assign the address of a variable to a pointer and

  (c) finally access the value at the address available in the pointer variable.

- This is done by using unary operator * that returns the value of the variable located at the address specified by its operand.

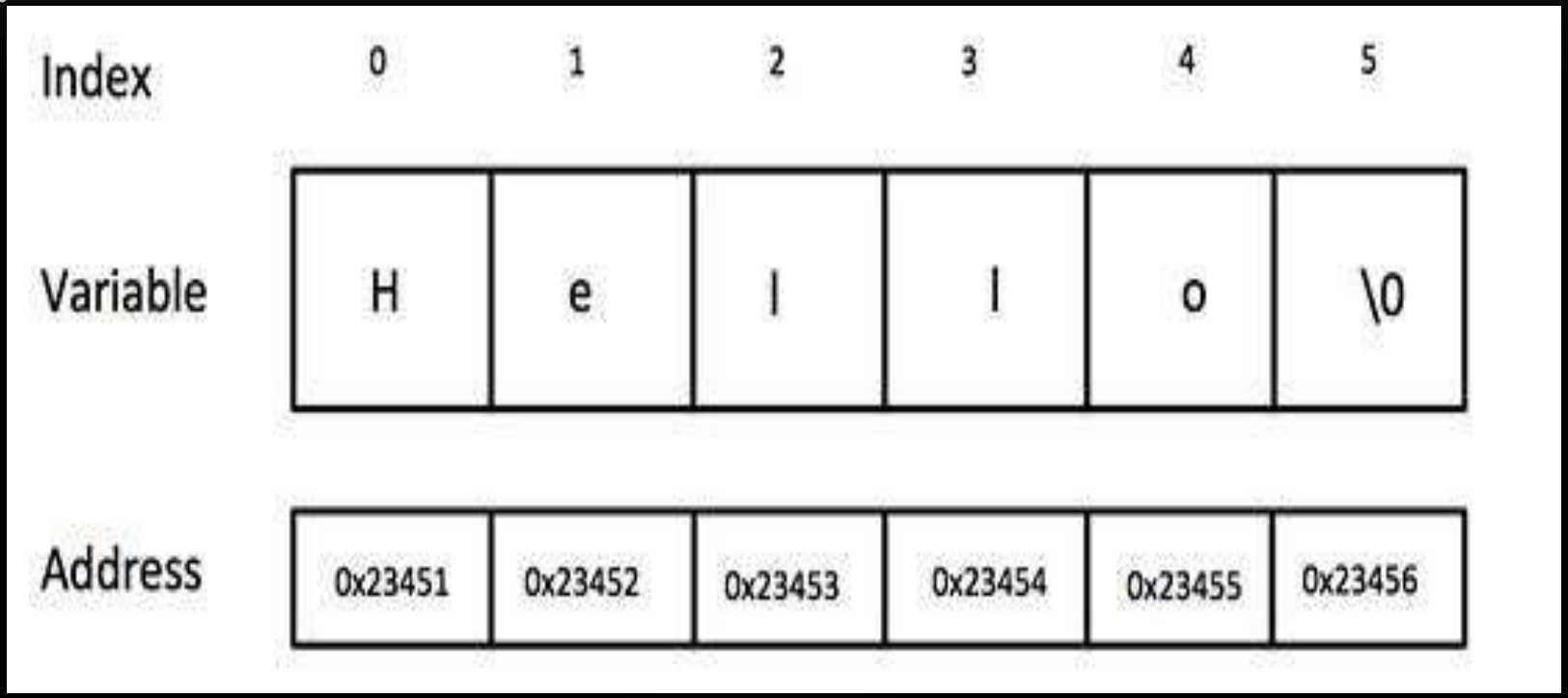
C++ POINTERS IN DETAIL

CONCEPT	DESCRIPTION
C++ Null Pointers	C++ supports null pointer, which is a constant with a value of zero defined in several standard libraries.
C++ pointer arithmetic	There are four arithmetic operators that can be used on pointers: ++, --, +, -
C++ pointers vs. arrays	There is a close relationship between pointers and arrays. Let us check how?
C++ array of pointers	You can define arrays to hold a number of pointers.
C++ pointer to pointer	C++ allows you to have pointer on a pointer and so on.
Passing pointers to functions	Passing an argument by reference or by address both enable the passed argument to be changed in the calling function by the called function.
Return pointer from functions	C++ allows a function to return a pointer to local variable, static variable and dynamically allocated memory as well.

C++ STRINGS

- The following declaration and initialization create a string consisting of the word "Hello". To hold the null character at the end of the array, the size of the character array containing the string is one more than the number of characters in the word "Hello.“

- **Method 1: char greeting[6] = {'H', 'e', 'l', 'l', 'o', '\0'};**
- **Method 2: char greeting[] = "Hello";**


Index
0
1
2
3
4
5
Variable
H
e
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Address
0x23451
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0x23456

```
#include <iostream.h>
 int main ()
 {
 char greeting[6] = {'H', 'e', 'l', 'l', 'o', '\0'};
cout << "Greeting message: ";
 cout << greeting << endl;
 return 0;
 }
```

OUTPUT

OUTPUT

Greeting message: Hello

Functions	Purpose
strcpy(s1, s2);	Copies string s2 into string s1.
strcat(s1, s2);	Concatenates string s2 onto the end of string s1.
strlen(s1);	Returns the length of string s1.
strcmp(s1, s2);	Returns 0 if s1 and s2 are the same; less than 0 if s1<s2; greater than 0 if s1>s2.
strchr(s1, ch);	Returns a pointer to the first occurrence of character ch in string s1.
strstr(s1, s2);	Returns a pointer to the first occurrence of string s2 in string s1.

```
#include <iostream>
#include <cstring>
int main () {
   char str1[10] = "Hello";
   char str2[10] = "World";
   char str3[10];
   int  len;
            strcpy( str3, str1); // copy str1 into str3
   cout << "strcpy( str3, str1) : " << str3 << endl;
            strcat( str1, str2); // concatenates str1 and str2
   cout << "strcat( str1, str2): " << str1 << endl;
            len = strlen(str1); // total length of str1 after concatenation
   cout << "strlen(str1) : " << len << endl;
   return 0;
}
```

FILE HANDLING IN C++

- **File Handling** concept in C++ language is used for store a data permanently in computer. Using file handling we can store our data in Secondary memory (Hard disk).

Why use File Handling

- For permanent storage.
- The transfer of input - data or output - data from one computer to another can be easily done by using files.

- For read and write from a file you need another standard C++ library called **fstream**, which defines three new data types:

Datatype	Description
ofstream	This is used to create a file and write data on files
ifstream	This is used to read data from files
fstream	This is used to both read and write data from/to files

HOW TO ACHIEVE FILE HANDLING

For achieving file handling in C++ we need follow following steps

- Naming a file
- Opening a file
- Reading data from file
- Writing data into file
- Closing a file

FUNCTIONS USE IN FILE HANDLING

Function	Operation
open()	To create a file
close()	To close an existing file
get()	Read a single character from a file
put()	write a single character in file.
read()	Read data from file
write()	Write data into file.

FILE READ OPERATION

```
#include<conio.h>
#include<fstream.h>
int main()
{
   char c,fname[10];
   cout<<"Enter file name:";
   cin>>fname;
   ifstream in(fname);
            if(!in)
    {
    cout<<"File Does not Exist";
    getch();
    return 0;
}
cout<<"\n\n";
while(in.eof()==0)
{
            in.get(c);
            cout<<c;
}
getch();
 }
```

FILE WRITE OPERATION

```
#include<iostream.h>
#include<stdio.h>
#include<conio.h>
#include<fstream.h>
int main()
{           char c,fname[10];
            ofstream out;
            cout<<"Enter File name:";
            cin>>fname;
            out.open(fname);
            cout<<"Enter contents to store in file (Enter # at end):\n";
            while((c=getchar())!='#')
            {               out<<c;             }
            out.close();
            getch();
            return 0;    }
```