C# Coding Conventions

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Coding conventions serve the following purposes:

- ✓ They create a consistent look to the code, so that readers can focus on content, not layout.
- ✓ They enable readers to understand the code more quickly by making assumptions based on previous experience.
- ✓ They facilitate copying, changing, and maintaining the code.
- ✓ They demonstrate C# best practices.

> **ⓘ Important**
>
> The guidelines in this article are used by Microsoft to develop samples and documentation. They were adopted from the **.NET Runtime, C# Coding Style** guidelines. You can use them, or adapt them to your needs. The primary objectives are consistency and readability within your project, team, organization, or company source code.

Naming conventions

There are several naming conventions to consider when writing C# code.

In the following examples, any of the guidance pertaining to elements marked `public` is also applicable when working with `protected` and `protected internal` elements, all of which are intended to be visible to external callers.

Pascal case

Use pascal casing ("PascalCasing") when naming a `class`, `record`, or `struct`.

C#

```
public class DataService
{
}
```

C#

```
public record PhysicalAddress(
    string Street,
    string City,
    string StateOrProvince,
    string ZipCode);
```

C#

```
public struct ValueCoordinate
{
}
```

When naming an `interface`, use pascal casing in addition to prefixing the name with an `I`. This clearly indicates to consumers that it's an `interface`.

C#

```
public interface IWorkerQueue
{
}
```

When naming `public` members of types, such as fields, properties, events, methods, and local functions, use pascal casing.

C#

```
public class ExampleEvents
{
    // A public field, these should be used sparingly
    public bool IsValid;

    // An init-only property
    public IWorkerQueue WorkerQueue { get; init; }

    // An event
    public event Action EventProcessing;

    // Method
    public void StartEventProcessing()
    {
        // Local function
        static int CountQueueItems() => WorkerQueue.Count;
        // ...
    }
}
```

When writing positional records, use pascal casing for parameters as they're the public properties of the record.

C#

```
public record PhysicalAddress(
    string Street,
    string City,
    string StateOrProvince,
    string ZipCode);
```

For more information on positional records, see Positional syntax for property definition.

Camel case

Use camel casing ("camelCasing") when naming `private` or `internal` fields, and prefix them with `_`.

C#

```
public class DataService
{
    private IWorkerQueue _workerQueue;
}
```

Tip

When editing C# code that follows these naming conventions in an IDE that supports statement completion, typing `_` will show all of the object-scoped members.

When working with `static` fields that are `private` or `internal`, use the `s_` prefix and for thread static use `t_`.

C#

```
public class DataService
{
    private static IWorkerQueue s_workerQueue;

    [ThreadStatic]
    private static TimeSpan t_timeSpan;
}
```

When writing method parameters, use camel casing.

```
C#

public T SomeMethod<T>(int someNumber, bool isValid)
{
}
```

For more information on C# naming conventions, see C# Coding Style .

Additional naming conventions

- Examples that don't include using directives, use namespace qualifications. If you know that a namespace is imported by default in a project, you don't have to fully qualify the names from that namespace. Qualified names can be broken after a dot (.) if they are too long for a single line, as shown in the following example.

  ```
  C#

  var currentPerformanceCounterCategory = new System.Diagnostics.
      PerformanceCounterCategory();
  ```

- You don't have to change the names of objects that were created by using the Visual Studio designer tools to make them fit other guidelines.

Layout conventions

Good layout uses formatting to emphasize the structure of your code and to make the code easier to read. Microsoft examples and samples conform to the following conventions:

- Use the default Code Editor settings (smart indenting, four-character indents, tabs saved as spaces). For more information, see Options, Text Editor, C#, Formatting.
- Write only one statement per line.
- Write only one declaration per line.
- If continuation lines are not indented automatically, indent them one tab stop (four spaces).
- Add at least one blank line between method definitions and property definitions.

- Use parentheses to make clauses in an expression apparent, as shown in the following code.

```
C#
```

```
if ((val1 > val2) && (val1 > val3))
{
    // Take appropriate action.
}
```

Commenting conventions

- Place the comment on a separate line, not at the end of a line of code.
- Begin comment text with an uppercase letter.
- End comment text with a period.
- Insert one space between the comment delimiter (//) and the comment text, as shown in the following example.

```
C#
```

```
// The following declaration creates a query. It does not run
// the query.
```

- Don't create formatted blocks of asterisks around comments.
- Ensure all public members have the necessary XML comments providing appropriate descriptions about their behavior.

Language guidelines

The following sections describe practices that the C# team follows to prepare code examples and samples.

String data type

- Use string interpolation to concatenate short strings, as shown in the following code.

```
C#
```

```
string displayName = $"{nameList[n].LastName},
{nameList[n].FirstName}";
```

- To append strings in loops, especially when you're working with large amounts of text, use a StringBuilder object.

```
C#

var phrase =
"lalalalalalalalalalalalalalalalalalalalalalalalalalalalalala";
var manyPhrases = new StringBuilder();
for (var i = 0; i < 10000; i++)
{
    manyPhrases.Append(phrase);
}
//Console.WriteLine("tra" + manyPhrases);
```

Implicitly typed local variables

- Use implicit typing for local variables when the type of the variable is obvious from the right side of the assignment, or when the precise type is not important.

```
C#

var var1 = "This is clearly a string.";
var var2 = 27;
```

- Don't use var when the type is not apparent from the right side of the assignment. Don't assume the type is clear from a method name. A variable type is considered clear if it's a `new` operator or an explicit cast.

```
C#

int var3 = Convert.ToInt32(Console.ReadLine());
int var4 = ExampleClass.ResultSoFar();
```

- Don't rely on the variable name to specify the type of the variable. It might not be correct. In the following example, the variable name `inputInt` is misleading. It's a string.

```
C#

var inputInt = Console.ReadLine();
```

```
Console.WriteLine(inputInt);
```

- Avoid the use of `var` in place of dynamic. Use `dynamic` when you want run-time type inference. For more information, see Using type dynamic (C# Programming Guide).

- Use implicit typing to determine the type of the loop variable in for loops.

  The following example uses implicit typing in a `for` statement.

  C#

  ```
  var phrase =
  "lalalalalalalalalalalalalalalalalalalalalalalalalalalalalala";
  var manyPhrases = new StringBuilder();
  for (var i = 0; i < 10000; i++)
  {
      manyPhrases.Append(phrase);
  }
  //Console.WriteLine("tra" + manyPhrases);
  ```

- Don't use implicit typing to determine the type of the loop variable in foreach loops. In most cases, the type of elements in the collection isn't immediately obvious. The collection's name shouldn't be solely relied upon for inferring the type of its elements.

  The following example uses explicit typing in a `foreach` statement.

  C#

  ```
  foreach (char ch in laugh)
  {
      if (ch == 'h')
          Console.Write("H");
      else
          Console.Write(ch);
  }
  Console.WriteLine();
  ```

  > **Note**
  >
  > Be careful not to accidentally change a type of an element of the iterable collection. For example, it is easy to switch from **System.Linq.IQueryable** to **System.Collections.IEnumerable** in a `foreach` statement, which changes the execution of a query.

Unsigned data types

In general, use `int` rather than unsigned types. The use of `int` is common throughout C#, and it is easier to interact with other libraries when you use `int`.

Arrays

Use the concise syntax when you initialize arrays on the declaration line. In the following example, note that you can't use `var` instead of `string[]`.

C#

```
string[] vowels1 = { "a", "e", "i", "o", "u" };
```

If you use explicit instantiation, you can use `var`.

C#

```
var vowels2 = new string[] { "a", "e", "i", "o", "u" };
```

Delegates

Use Func<> and Action<> instead of defining delegate types. In a class, define the delegate method.

C#

```
public static Action<string> ActionExample1 = x => Console.WriteLine($"x is:
{x}");

public static Action<string, string> ActionExample2 = (x, y) =>
    Console.WriteLine($"x is: {x}, y is {y}");

public static Func<string, int> FuncExample1 = x => Convert.ToInt32(x);

public static Func<int, int, int> FuncExample2 = (x, y) => x + y;
```

Call the method using the signature defined by the `Func<>` or `Action<>` delegate.

C#

```
ActionExample1("string for x");

ActionExample2("string for x", "string for y");
```

```
Console.WriteLine($"The value is {FuncExample1("1")}");

Console.WriteLine($"The sum is {FuncExample2(1, 2)}");
```

If you create instances of a delegate type, use the concise syntax. In a class, define the delegate type and a method that has a matching signature.

C#

```
public delegate void Del(string message);

public static void DelMethod(string str)
{
    Console.WriteLine("DelMethod argument: {0}", str);
}
```

Create an instance of the delegate type and call it. The following declaration shows the condensed syntax.

C#

```
Del exampleDel2 = DelMethod;
exampleDel2("Hey");
```

The following declaration uses the full syntax.

C#

```
Del exampleDel1 = new Del(DelMethod);
exampleDel1("Hey");
```

`try-catch` and `using` statements in exception handling

- Use a try-catch statement for most exception handling.

C#

```
static string GetValueFromArray(string[] array, int index)
{
    try
    {
        return array[index];
    }
    catch (System.IndexOutOfRangeException ex)
    {
        Console.WriteLine("Index is out of range: {0}", index);
        throw;
```

```
    }
}
```

- Simplify your code by using the C# using statement. If you have a try-finally statement in which the only code in the `finally` block is a call to the Dispose method, use a `using` statement instead.

  In the following example, the `try-finally` statement only calls `Dispose` in the `finally` block.

  C#

```
Font font1 = new Font("Arial", 10.0f);
try
{
    byte charset = font1.GdiCharSet;
}
finally
{
    if (font1 != null)
    {
        ((IDisposable)font1).Dispose();
    }
}
```

  You can do the same thing with a `using` statement.

  C#

```
using (Font font2 = new Font("Arial", 10.0f))
{
    byte charset2 = font2.GdiCharSet;
}
```

  Use the new using syntax that doesn't require braces:

  C#

```
using Font font3 = new Font("Arial", 10.0f);
byte charset3 = font3.GdiCharSet;
```

&& and || operators

To avoid exceptions and increase performance by skipping unnecessary comparisons, use && instead of & and || instead of | when you perform comparisons, as shown in the

following example.

```
C#

Console.Write("Enter a dividend: ");
int dividend = Convert.ToInt32(Console.ReadLine());

Console.Write("Enter a divisor: ");
int divisor = Convert.ToInt32(Console.ReadLine());

if ((divisor != 0) && (dividend / divisor > 0))
{
    Console.WriteLine("Quotient: {0}", dividend / divisor);
}
else
{
    Console.WriteLine("Attempted division by 0 ends up here.");
}
```

If the divisor is 0, the second clause in the `if` statement would cause a run-time error. But the && operator short-circuits when the first expression is false. That is, it doesn't evaluate the second expression. The & operator would evaluate both, resulting in a run-time error when `divisor` is 0.

`new` operator

- Use one of the concise forms of object instantiation, as shown in the following declarations. The second example shows syntax that is available starting in C# 9.

  ```
  C#

  var instance1 = new ExampleClass();
  ```

  ```
  C#

  ExampleClass instance2 = new();
  ```

  The preceding declarations are equivalent to the following declaration.

  ```
  C#

  ExampleClass instance2 = new ExampleClass();
  ```

- Use object initializers to simplify object creation, as shown in the following example.

C#

```
var instance3 = new ExampleClass { Name = "Desktop", ID = 37414,
    Location = "Redmond", Age = 2.3 };
```

The following example sets the same properties as the preceding example but doesn't use initializers.

C#

```
var instance4 = new ExampleClass();
instance4.Name = "Desktop";
instance4.ID = 37414;
instance4.Location = "Redmond";
instance4.Age = 2.3;
```

Event handling

If you're defining an event handler that you don't need to remove later, use a lambda expression.

C#

```
public Form2()
{
    this.Click += (s, e) =>
        {
            MessageBox.Show(
                ((MouseEventArgs)e).Location.ToString());
        };
}
```

The lambda expression shortens the following traditional definition.

C#

```
public Form1()
{
    this.Click += new EventHandler(Form1_Click);
}

void Form1_Click(object? sender, EventArgs e)
{
    MessageBox.Show(((MouseEventArgs)e).Location.ToString());
}
```

Static members

Call static members by using the class name: *ClassName.StaticMember*. This practice makes code more readable by making static access clear. Don't qualify a static member defined in a base class with the name of a derived class. While that code compiles, the code readability is misleading, and the code may break in the future if you add a static member with the same name to the derived class.

LINQ queries

- Use meaningful names for query variables. The following example uses `seattleCustomers` for customers who are located in Seattle.

  C#

  ```
  var seattleCustomers = from customer in customers
                         where customer.City == "Seattle"
                         select customer.Name;
  ```

- Use aliases to make sure that property names of anonymous types are correctly capitalized, using Pascal casing.

  C#

  ```
  var localDistributors =
      from customer in customers
      join distributor in distributors on customer.City equals
  distributor.City
      select new { Customer = customer, Distributor = distributor };
  ```

- Rename properties when the property names in the result would be ambiguous. For example, if your query returns a customer name and a distributor ID, instead of leaving them as `Name` and `ID` in the result, rename them to clarify that `Name` is the name of a customer, and `ID` is the ID of a distributor.

  C#

  ```
  var localDistributors2 =
      from customer in customers
      join distributor in distributors on customer.City equals
  distributor.City
      select new { CustomerName = customer.Name, DistributorID =
  distributor.ID };
  ```

- Use implicit typing in the declaration of query variables and range variables.

```
C#

var seattleCustomers = from customer in customers
                       where customer.City == "Seattle"
                       select customer.Name;
```

- Align query clauses under the from clause, as shown in the previous examples.
- Use where clauses before other query clauses to ensure that later query clauses operate on the reduced, filtered set of data.

```
C#

var seattleCustomers2 = from customer in customers
                        where customer.City == "Seattle"
                        orderby customer.Name
                        select customer;
```

- Use multiple `from` clauses instead of a join clause to access inner collections. For example, a collection of `Student` objects might each contain a collection of test scores. When the following query is executed, it returns each score that is over 90, along with the last name of the student who received the score.

```
C#

var scoreQuery = from student in students
                 from score in student.Scores!
                 where score > 90
                 select new { Last = student.LastName, score };
```

Security

Follow the guidelines in Secure Coding Guidelines.

See also

- .NET runtime coding guidelines
- Visual Basic Coding Conventions
- Secure Coding Guidelines