
Visual Studio LIVE!
EXPERT SOLUTIONS FOR .NET DEVELOPERS
San Diego
Essential C# 8.0
Mark Michaelis
Nerd
Level: Intermediate
IntelliTect
Code Again for the First Time!
25 YEARS OF CODING INNOVATION


Mark Michaelis
Chief Technical Architect,
Author, Trainer
ESSENTIAL C# 7.0
Sixth Edition
MARK MICHAELIS
ERIC LIPPERT
IntelliTect
MVP
Microsoft Most Valuable Professional
Microsoft Regional Director
Professional Scrum Master II
25 YEARS OF CODING INNOVATION

If you were king, what would you do with C#?

Nullable Reference Types

- Invoking a member on a null value will issue a `System.NullReferenceException` exception, and every invocation that results in a `System.NullReferenceException` in production code is a bug.
- With nullable reference types we "fall in" to doing the wrong thing rather than the right thing. (The "fall in" action is to invoke a reference type without checking for null.)
- There's an inconsistency between reference types and value types (following the introduction of Nullable<T>) in that value types are nullable when decorated with "?" (for example, int? number); otherwise, they default to non-nullable.
- It's not possible to run static flow analysis to check all paths regarding whether a value will be null before dereferencing it, or not.
- There's no reasonable syntax to indicate that a reference type value of null is invalid for a particular declaration.
- There's no way to decorate parameters to not allow null

What to do about it?

Provide syntax to expect null:

- Enable the developer to explicitly identify when a reference type is expected to contain nulls—and, therefore, not flag occasions when it's explicitly assigned null.

Make default reference types expect non-nullable:

- Change the default expectation of all reference types to be non-nullable, but do so with an opt-in compiler switch rather than suddenly overwhelm the developer with warnings for existing code.

Decrease the occurrence of NullReferenceExceptions:

- Reduce the likelihood of NullReferenceException exceptions by improving the static flow analysis that flags potential occasions where a value hasn't been explicitly checked for null before invoking one of the value's members.

Enable suppression of static flow analysis warning:

- Support some form of "trust me, I'm a programmer" declaration that allows the developer to override the static flow analysis of the complier and, therefore, suppress any warnings of a possible NullReferenceException.

Conclusion: Nullable Reference Type

- Warning you to remove a null assignment to a non-nullable type potentially eliminates a bug because a value is no longer null when it shouldn't be.
- Alternatively, adding a nullable modifier improves your code by being more explicit about your intent.
- Over time the impedance mismatch between nullable updated code and older code will dissolve, decreasing the `NullReferenceException` bugs that used to occur.
- The nullability feature is off by default on existing projects so you can delay dealing with it until a time of your choosing. In the end you have more robust code. For cases where you know better than the compiler, you can use the ! operator (declaring, "Trust me, I'm a programmer.") like a cast.
- Nullable types don't have any semantic impact, they only issue warnings.

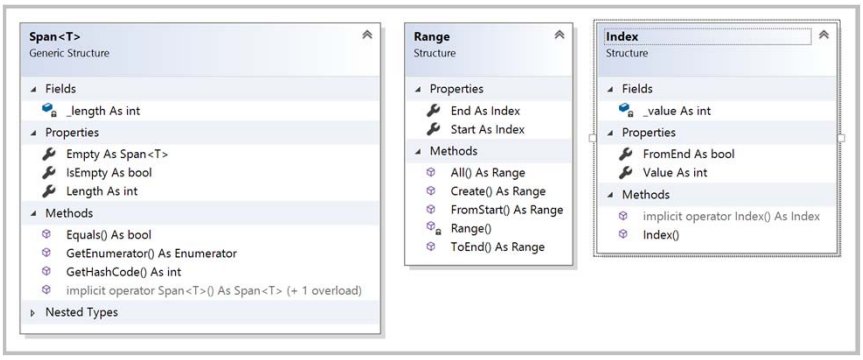
Index

```
// Initialize new int[]{0, 1, 2, 3, 4, 5, 6, 7, 8}
int[] array = Enumerable.Range(0, 9).ToArray();

lastItem = array[(array.Length - 1)];
Assert.AreEqual(8, lastItem);

lastItem = array[new Index(1, true)];
Assert.AreEqual(8, lastItem);

lastItem = array[^1];
Assert.AreEqual(8, lastItem);
```

Index

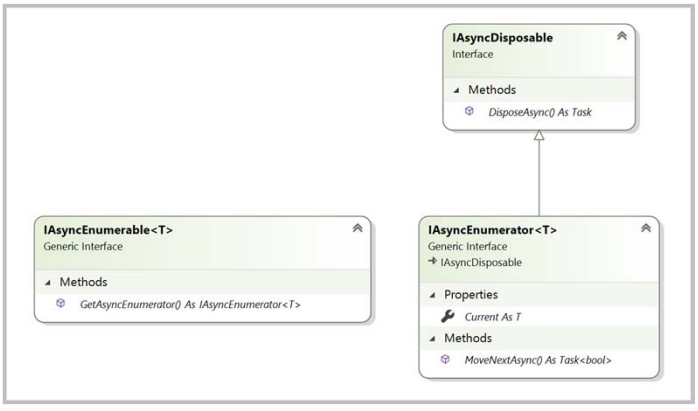
```
Span<int> span;

span = array[Range.Create(4, new Index(2, true))];
Assert.AreEquivalent(new int[]{4, 5, 6}, span);

span = array[4..^2];   // array[Range.Create(4, new Index(2, true))]
Assert.AreEquivalent(new int[]{4, 5, 6}, span);

span = array[..^3];    // array[Range.ToEnd(new Index(3, true))]
Assert.AreEquivalent(new int[]{0, 1, 2, 3, 4, 5}, span);

span = array[2..]; // array[Range.FromStart(2)]
Assert.AreEquivalent(new int[]{2, 3, 4, 5, 6, 7, 8}, span);

span = array[Range.All()]; // array[Range.All()]
Assert.AreEquivalent(new int[]{0, 1, 2, 3, 4, 5, 6, 7, 8}, span);
```

System.Span<T>, System.Index, System.Range



Async Streams

Enabling LINQ Over Events



Async. Streams

```
IAsyncEnumerator<T> enumerator = enumerable.GetAsyncEnumerator();
try
{
    while (await enumerator.WaitForNextAsync())
    {
        while (true)
        {
            int item = enumerator.TryGetNext(
             out bool success);
            if (!success) break;
            Use(item);
        }
    }
}
finally { await enumerator.DisposeAsync(); }
```

With Syntax

```
foreach await (T item in enumerable)
{
    Use(item);
}
```

Default Interface Implementation

```
interface ITraceable
{
    static public int IndentationCount
        { get; set; }

    public string GetMessage() =>
        this.ToString();
}
```

- Explicit access modifiers would be permissible: `private`, `protected`, `internal`, `public` (the default is `public`).
- You could not have fields.
- Static methods, properties, indexers, and events would also be allowable.
- Modifiers `virtual`, `abstract`, `override`, `sealed`, and `extern` would be supported.

```
return switch (person)
 {
    Professor(_, var lastName, var subject) item =>
            $"Dr. { lastName} teaching {subject}",
    Student { FirstName: var firstName,
        Advisor { LastName: var advisorLastName } } =>
            $"",
    (string firstName, _)
        { EnrollmentStatus: EnrollmentStatus.Enrolled } =>
            $"",
    { } => "Enrollment has passed.  See you next year.",
    null => "Oh No!!"
}
```

What else…?

Null Coalescing Assignment

- Support `a??=b` in place of `if(a==null) a=b`

Readonly Instance Members:

- Provide a way to specify individual instance members on a struct do not modify state, in the same way that specifies no instance members modify state.

Target-typed new expressions:

- Allow field initialization without duplicating the type.

```
Dictionary<string, List<int>> field =
      new() { { "item1", new() { 1, 2, 3 } } };
```

- Allow omitting the type when it can be inferred from usage.

```
XmlReader.Create(reader, new() { IgnoreWhitespace = true });
```

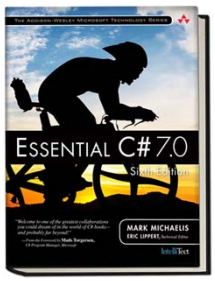
Records

- A new, simplified declaration form for C# class and struct types

```
public class Person(string Name, DateTime DateOfBirth);
```


Mark Michaelis

Chief Technical Architect,
Author, Trainer
mark@IntelliTect.com
Twitter: @MarkMichaelis,
fb.com/MarkMichaelis



Microsoft® Most Valuable Professional

Microsoft Regional Director

Professional Scrum Master II

@IntelliTect, fb.com/IntelliTect