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


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ESSENTIAL C# 7.0
Sixth Edition
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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.

Demo

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.

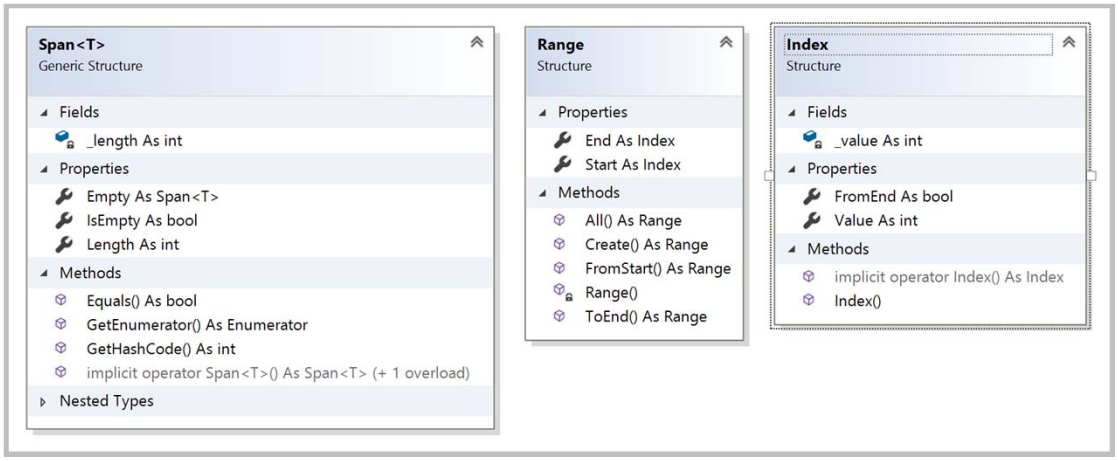
Index

```
// 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

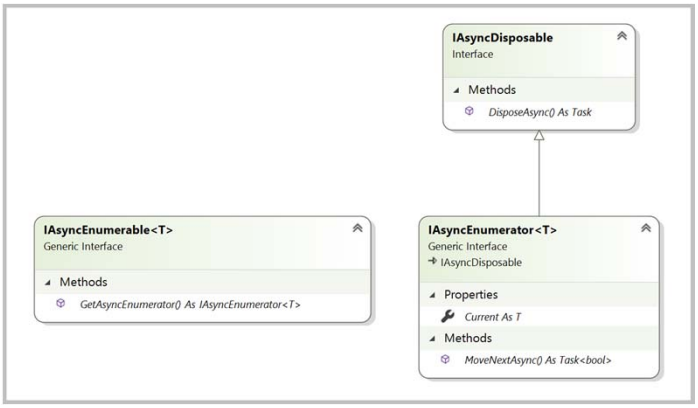
```
Span<int> span;

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 Interfaces

```
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);
```

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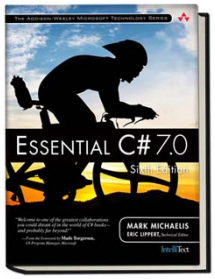

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