

# LinksPlatform's Platform.Unsafe Class Library

## ./Platform.Unsafe/ByteArrayExtensions.cs

```

1  using Platform.Exceptions;
2  using Platform.Collections;
3  using System.Runtime.CompilerServices;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Unsafe
8  {
9      public unsafe static class ByteArrayExtensions
10     {
11         [MethodImpl(MethodImplOptions.AggressiveInlining)]
12         public static TStruct ToStructure<TStruct>(this byte[] bytes)
13             where TStruct : struct
14         {
15             Ensure.OnDebug.ArgumentNotEmpty(bytes, nameof(bytes));
16             var structureSize = System.Runtime.CompilerServices.Unsafe.SizeOf<TStruct>();
17             Ensure.OnDebug.ArgumentMeetsCriteria(bytes, array => array.Length == structureSize,
18                 ↳ nameof(bytes), "Bytes array should be the same length as struct size.");
19             TStruct structure = default;
20             fixed (byte* pointer = bytes)
21             {
22                 System.Runtime.CompilerServices.Unsafe.Copy(ref structure, pointer);
23             }
24             return structure;
25         }
26     }

```

## ./Platform.Unsafe/IntPtr.cs

```

1  using System;
2  using System.Reflection;
3  using System.Runtime.InteropServices;
4  using Platform.Reflection;
5
6  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
7
8  namespace Platform.Unsafe
9  {
10     /// <remarks>
11     /// Please use System.Runtime.CompilerServices.Unsafe instead.
12     /// </remarks>
13     public static class IntPtr<T>
14     {
15         public static readonly Func<IntPtr, T> GetValue;
16         public static readonly Action<IntPtr, T> SetValue;
17
18         static IntPtr()
19         {
20             GetValue = CompileGetValueDelegate();
21             SetValue = CompileSetValueDelegate();
22         }
23
24         static private Func<IntPtr, T> CompileGetValueDelegate()
25         {
26             return DelegateHelpers.Compile<Func<IntPtr, T>>(emitter =>
27             {
28                 if (NumericType<T>.IsNumeric)
29                 {
30                     emitter.LoadArgument(0);
31                     emitter.LoadIndirect<T>();
32                     emitter.Return();
33                 }
34                 else
35                 {
36                     emitter.LoadArguments(0);
37                     emitter.Call(typeof(Marshal).GetGenericMethod(nameof(Marshal.PtrToStructure),
38                         ↳ Types<T>.Array, Types<IntPtr, Type, bool>.Array));
39                     emitter.Return();
40                 }
41             });
42         }
43
44         static private Action<IntPtr, T> CompileSetValueDelegate()
45         {
46             return DelegateHelpers.Compile<Action<IntPtr, T>>(emitter =>
47             {
48                 if (NumericType<T>.IsNumeric)

```

```

48         {
49             emitter.LoadArguments(0, 1);
50             emitter.StoreIndirect<T>();
51             emitter.Return();
52         }
53         else
54         {
55             emitter.LoadArguments(0, 1);
56             emitter.LoadConstant(true);
57             emitter.Call(typeof(Marshal).GetTypeInfo().GetMethod(nameof(Marshal.Structure_
                ↳ IntPtr), Types<object, IntPtr,
                ↳ bool>.Array));
58             emitter.Return();
59         }
60     });
61 }
62 }
63 }

```

#### ./Platform.Unsafe/IntPtrExtensions.cs

```

1  using System;
2  using System.Runtime.CompilerServices;
3  using Platform.Numbers;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Unsafe
8  {
9      /// <remarks>
10     /// Please use System.Runtime.CompilerServices.Unsafe instead.
11     /// </remarks>
12     public static class IntPtrExtensions
13     {
14         [Obsolete("GetValue method is deprecated, please use
        ↳ System.Runtime.CompilerServices.Unsafe.Read method instead.")]
15         [MethodImpl(MethodImplOptions.AggressiveInlining)]
16         public static TElement GetValue<TElement>(this IntPtr pointer) =>
            ↳ IntPtr<TElement>.GetValue(pointer);
17
18         [Obsolete("SetValue method is deprecated, please use
        ↳ System.Runtime.CompilerServices.Unsafe.Write method instead.")]
19         [MethodImpl(MethodImplOptions.AggressiveInlining)]
20         public static void SetValue<TElement>(this IntPtr pointer, TElement value) =>
            ↳ IntPtr<TElement>.SetValue(pointer, value);
21
22         [Obsolete("GetElement method is deprecated, please use
        ↳ System.Runtime.CompilerServices.Unsafe.Add method instead.")]
23         [MethodImpl(MethodImplOptions.AggressiveInlining)]
24         public static IntPtr GetElement(this IntPtr pointer, int elementSize, int index) =>
            ↳ pointer + (elementSize * index);
25
26         [Obsolete("GetElement method is deprecated, please use
        ↳ System.Runtime.CompilerServices.Unsafe.Add method instead.")]
27         [MethodImpl(MethodImplOptions.AggressiveInlining)]
28         public static unsafe IntPtr GetElement(this IntPtr pointer, long elementSize, long
            ↳ index) => new IntPtr((byte*)pointer.ToPointer() + (elementSize * index));
29
30         [Obsolete("GetElement method is deprecated, please use
        ↳ System.Runtime.CompilerServices.Unsafe.Add method instead.")]
31         [MethodImpl(MethodImplOptions.AggressiveInlining)]
32         public static IntPtr GetElement<TIndex>(this IntPtr pointer, int elementSize, TIndex
            ↳ index) => pointer.GetElement((long)elementSize, (Integer)(Integer<TIndex>)index);
33     }
34 }

```

#### ./Platform.Unsafe/MemoryBlock.cs

```

1  using System.Collections.Concurrent;
2  using System.Threading.Tasks;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Unsafe
7  {
8      public static unsafe class MemoryBlock
9      {
10         public static void Zero(void* pointer, long capacity)
11         {
12             Parallel.ForEach(Partitioner.Create(0, capacity), range =>

```

```

13         {
14             var from = range.Item1;
15             var offset = (void*)((byte*)pointer + from);
16             var length = (uint)(range.Item2 - from);
17             System.Runtime.CompilerServices.Unsafe.InitBlock(offset, 0, length);
18         });
19     }
20 }
21 }

```

#### ./Platform.Unsafe/Structure.cs

```

1 using System;
2 using System.Runtime.InteropServices;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6 namespace Platform.Unsafe
7 {
8     public static class Structure<TStruct>
9         where TStruct : struct
10     {
11         /// <summary>
12         /// <para>
13         /// Returns the size of an unmanaged type in bytes.
14         /// This property do this without throwing exceptions for generic types as <see
15         ↪ cref="Marshal.SizeOf{T}()" /> and <see cref="Marshal.SizeOf(Type)" /> do.
16         /// </para>
17         /// <para>
18         /// Возвращает размер неуправляемого типа в байтах.
19         /// Этот свойство делает это без выбрасывания исключений для универсальных типов, как
20         ↪ это делают <see cref="Marshal.SizeOf{T}()" /> и <see cref="Marshal.SizeOf(Type)" />.
21         /// </para>
22         /// </summary>
23         public static int Size { get; } =
24             ↪ System.Runtime.CompilerServices.Unsafe.SizeOf<TStruct>();
25     }
26 }

```

#### ./Platform.Unsafe/StructureExtensions.cs

```

1 using System.Runtime.CompilerServices;
2
3 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5 namespace Platform.Unsafe
6 {
7     public unsafe static class StructureExtensions
8     {
9         [MethodImpl(MethodImplOptions.AggressiveInlining)]
10         public static byte[] ToBytes<TStruct>(this ref TStruct obj)
11             where TStruct : struct
12         {
13             var structureSize = System.Runtime.CompilerServices.Unsafe.SizeOf<TStruct>();
14             var bytes = new byte[structureSize];
15             fixed (byte* pointer = bytes)
16             {
17                 System.Runtime.CompilerServices.Unsafe.Copy(pointer, ref obj);
18             }
19             return bytes;
20         }
21     }
22 }

```

#### ./Platform.Unsafe.Tests/IntPtrExtensionsTests.cs

```

1 using System;
2 using System.Runtime.InteropServices;
3 using Xunit;
4 using Xunit.Abstractions;
5 using Platform.Diagnostics;
6
7 namespace Platform.Unsafe.Tests
8 {
9     public unsafe class IntPtrExtensionsTests
10     {
11         private const int N = 10000000;
12
13         private readonly ITestOutputHelper _output;
14
15         public IntPtrExtensionsTests(ITestOutputHelper output)
16         {

```

```

17     _output = output;
18 }
19
20 [Fact]
21 public void ReadAndWriteOperationsForPointerValuesDelegatesTest()
22 {
23     var pointer = Marshal.AllocHGlobal(sizeof(ulong));
24     ulong result = default;
25     for (var i = 0; i < N; i++)
26     {
27         result = Delegates(pointer);
28     }
29     Assert.Equal(42UL, result);
30     Marshal.FreeHGlobal(pointer);
31 }
32
33 private ulong Delegates(IntPtr pointer)
34 {
35     ulong result;
36     IntPtr<ulong>.SetValue(pointer, 42UL);
37     result = IntPtr<ulong>.GetValue(pointer);
38     return result;
39 }
40
41 [Fact]
42 public void ReadAndWriteOperationsForPointerValuesExtensionMethodsTest()
43 {
44     var pointer = Marshal.AllocHGlobal(sizeof(ulong));
45     ulong result = default;
46     for (var i = 0; i < N; i++)
47     {
48         result = ExtensionMethods(pointer);
49     }
50     Assert.Equal(42UL, result);
51     Marshal.FreeHGlobal(pointer);
52 }
53
54 private ulong ExtensionMethods(IntPtr pointer)
55 {
56     ulong result;
57     pointer.SetValue(42UL);
58     result = pointer.GetValue<ulong>();
59     return result;
60 }
61
62 [Fact]
63 public void ReadAndWriteOperationsForPointerValuesUnsafeClassMethodsTest()
64 {
65     void* pointer = (void*)Marshal.AllocHGlobal(sizeof(ulong));
66     ulong result = default;
67     for (var i = 0; i < N; i++)
68     {
69         result = ReadAndWriteMethods(pointer);
70     }
71     Assert.Equal(42UL, result);
72     Marshal.FreeHGlobal((IntPtr)pointer);
73 }
74
75 private ulong ReadAndWriteMethods(void* pointer)
76 {
77     ulong result;
78     System.Runtime.CompilerServices.Unsafe.Write(pointer, 42UL);
79     result = System.Runtime.CompilerServices.Unsafe.Read<ulong>(pointer);
80     return result;
81 }
82
83 [Fact]
84 public void ReadAndWriteOperationsComparisionTest()
85 {
86     var t1 = Performance.Measure(ReadAndWriteOperationsForPointerValuesDelegatesTest);
87     var t2 =
88         ↪ Performance.Measure(ReadAndWriteOperationsForPointerValuesExtensionMethodsTest);
89     var t3 = Performance.Measure(ReadAndWriteOperationsForPointerValuesUnsafeClassMethod
90         ↪ sTest);
91
92     var message = $"{t1} {t2} {t3}";
93     _output.WriteLine(message);
94 }

```

```

94 [Fact]
95 public void ElementOffsetOperationsForPointerValuesExtensionMethods()
96 {
97     var pointer = Marshal.AllocHGlobal(sizeof(ulong) * 10);
98     ulong result = default;
99     for (var i = 0; i < N; i++)
100     {
101         result = GetElementExtensionMethods(pointer);
102     }
103     Assert.Equal(5UL * 8UL, result - (ulong)pointer);
104     Marshal.FreeHGlobal(pointer);
105 }
106
107 private ulong GetElementExtensionMethods(IntPtr pointer)
108 {
109     ulong result;
110     result = (ulong)pointer.GetElement(8, 5);
111     return result;
112 }
113
114 [Fact]
115 public void ElementOffsetOperationsForPointerValuesUnsafeClassMethodsTest()
116 {
117     void* pointer = (void*)Marshal.AllocHGlobal(sizeof(ulong) * 10);
118     ulong result = default;
119     for (var i = 0; i < N; i++)
120     {
121         result = GetElementMethods(pointer);
122     }
123     Assert.Equal(5UL * 8UL, result - (ulong)pointer);
124     Marshal.FreeHGlobal((IntPtr)pointer);
125 }
126
127 private ulong GetElementMethods(void* pointer)
128 {
129     ulong result;
130     result = (ulong)System.Runtime.CompilerServices.Unsafe.Add<ulong>(pointer, 5);
131     return result;
132 }
133
134 [Fact]
135 public void GetElementOperationsComparisionTest()
136 {
137     var t1 =
138         ↪ Performance.Measure(ElementOffsetOperationsForPointerValuesExtensionMethods);
139     var t2 = Performance.Measure(ElementOffsetOperationsForPointerValuesUnsafeClassMetho_
140         ↪ dsTest);
141
142     var message = $"{t1} {t2}";
143     _output.WriteLine(message);
144 }

```

./Platform.Unsafe.Tests/SizeOfTests.cs

```

1 using System.Runtime.InteropServices;
2 using Xunit;
3
4 namespace Platform.Unsafe.Tests
5 {
6     public class SizeOfTests
7     {
8         public struct X<T>
9         {
10             public readonly T F1;
11             public readonly T F2;
12         }
13
14         [Fact]
15         public void UnsafeClassSizeOfTest()
16         {
17             var size = System.Runtime.CompilerServices.Unsafe.SizeOf<X<int>>();
18             Assert.Equal(8, size);
19         }
20
21         [Fact]
22         public void MarshalSizeOfTest()
23         {
24             var size = Marshal.SizeOf(default(X<int>));

```

```

25         Assert.Equal(8, size);
26     }
27
28     [Fact]
29     public void StructurePropertyTest()
30     {
31         var size = Structure<X<int>>.Size;
32         Assert.Equal(8, size);
33     }
34 }
35 }

```

./Platform.Unsafe.Tests/StructAndBytesConversionTests.cs

```

1  using Xunit;
2
3  namespace Platform.Unsafe.Tests
4  {
5      public class StructAndBytesConversionTests
6      {
7          [Fact]
8          public void StructToBytesTest()
9          {
10             ulong source = ulong.MaxValue;
11             var result = source.ToBytes();
12             for (int i = 0; i < result.Length; i++)
13             {
14                 Assert.Equal(byte.MaxValue, result[i]);
15             }
16         }
17
18         [Fact]
19         public void BytesToStructTest()
20         {
21             byte[] bytes = new[] { byte.MaxValue, byte.MaxValue, byte.MaxValue, byte.MaxValue,
22                                     ↵ byte.MaxValue, byte.MaxValue, byte.MaxValue, byte.MaxValue };
23             ulong result = bytes.ToStructure<ulong>();
24             Assert.Equal(ulong.MaxValue, result);
25         }
26     }
27 }

```

./Platform.Unsafe.Tests/ZeroMemoryTests.cs

```

1  using Xunit;
2
3  namespace Platform.Unsafe.Tests
4  {
5      public unsafe class ZeroMemoryTests
6      {
7          [Fact]
8          public void ZeroMemoryTest()
9          {
10             var bytes = new byte[1024];
11             for (int i = 0; i < bytes.Length; i++)
12             {
13                 bytes[i] = unchecked((byte)i);
14             }
15             fixed (byte* pointer = bytes)
16             {
17                 MemoryBlock.Zero(pointer, bytes.Length);
18             }
19             for (int i = 0; i < bytes.Length; i++)
20             {
21                 Assert.Equal(0, bytes[i]);
22             }
23         }
24     }
25 }

```

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