

LinksPlatform's Platform.Unsafe Class Library

1.1 ./Platform.Unsafe/ByteArrayExtensions.cs

```
1 using Platform.Exceptions;
2 using Platform.Collections;
3 using System.Runtime.CompilerServices;
4 using static System.Runtime.CompilerServices.Unsafe;
5
6 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
7
8 namespace Platform.Unsafe
9 {
10     public unsafe static class ByteArrayExtensions
11     {
12         [MethodImpl(MethodImplOptions.AggressiveInlining)]
13         public static TStruct ToStructure<TStruct>(this byte[] bytes)
14             where TStruct : struct
15         {
16             Ensure.OnDebug.ArgumentNotEmpty(bytes, nameof(bytes));
17             Ensure.OnDebug.ArgumentMeetsCriteria(bytes, SameSizeAs<TStruct>, nameof(bytes),
18                 ↪ "Bytes array should be the same length as struct size.");
19             TStruct structure = default;
20             fixed (byte* pointer = bytes)
21             {
22                 Copy(ref structure, pointer);
23             }
24             return structure;
25         }
26
27         private static bool SameSizeAs<TStruct>(byte[] array) where TStruct : struct =>
28             ↪ array.Length == Structure<TStruct>.Size;
29     }
30 }
```

1.2 ./Platform.Unsafe/IntPtr.cs

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

```

45         if (NumericType<T>.IsNumeric)
46         {
47             emitter.LoadArguments(0, 1);
48             emitter.StoreIndirect<T>();
49             emitter.Return();
50         }
51         else
52         {
53             emitter.LoadArguments(0, 1);
54             emitter.LoadConstant(true);
55             emitter.Call(typeof(Marshal).GetTypeInfo().GetMethod(nameof(Marshal.Structure_
               ↳ IntPtr), Types<object, IntPtr,
               ↳ bool>.Array));
56             emitter.Return();
57         }
58     });
59 }
60 }
61 }

```

1.3 ./Platform.Unsafe/IntPtrExtensions.cs

```

1  using System;
2  using System.Runtime.CompilerServices;
3  using Platform.Numbers;
4  using static System.Runtime.CompilerServices.Unsafe;
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 unsafe static class IntPtrExtensions
14     {
15         [Obsolete("GetValue method is deprecated, please use
               ↳ System.Runtime.CompilerServices.Unsafe.Read method instead.")]
16         [MethodImpl(MethodImplOptions.AggressiveInlining)]
17         public static TElement GetValue<TElement>(this IntPtr pointer) =>
               ↳ IntPtr<TElement>.GetValue(pointer);
18
19         [Obsolete("SetValue method is deprecated, please use
               ↳ System.Runtime.CompilerServices.Unsafe.Write method instead.")]
20         [MethodImpl(MethodImplOptions.AggressiveInlining)]
21         public static void SetValue<TElement>(this IntPtr pointer, TElement value) =>
               ↳ IntPtr<TElement>.SetValue(pointer, value);
22
23         [Obsolete("GetElement method is deprecated, please use
               ↳ System.Runtime.CompilerServices.Unsafe.Add method instead.")]
24         [MethodImpl(MethodImplOptions.AggressiveInlining)]
25         public static IntPtr GetElement(this IntPtr pointer, int elementSize, int index) =>
               ↳ pointer + (elementSize * index);
26
27         [Obsolete("GetElement method is deprecated, please use
               ↳ System.Runtime.CompilerServices.Unsafe.Add method instead.")]
28         [MethodImpl(MethodImplOptions.AggressiveInlining)]
29         public static IntPtr GetElement(this IntPtr pointer, long elementSize, long index) =>
               ↳ new IntPtr((byte*)pointer.ToPointer() + (elementSize * index));
30
31         [Obsolete("GetElement method is deprecated, please use
               ↳ System.Runtime.CompilerServices.Unsafe.Add method instead.")]
32         [MethodImpl(MethodImplOptions.AggressiveInlining)]
33         public static IntPtr GetElement<TIndex>(this IntPtr pointer, int elementSize, TIndex
               ↳ index) => pointer.GetElement((long)elementSize, (Integer)(Integer<TIndex>)index);
34
35         [MethodImpl(MethodImplOptions.AggressiveInlining)]
36         public static void WriteElementValue<TValue>(this IntPtr pointer, long index, TValue
               ↳ value) => Write((byte*)pointer + (SizeOf<TValue>() * index), value);
37
38         [MethodImpl(MethodImplOptions.AggressiveInlining)]
39         public static TValue ReadElementValue<TValue>(this IntPtr pointer, long index) =>
               ↳ Read<TValue>((byte*)pointer + (SizeOf<TValue>() * index));
40     }
41 }

```

1.4 ./Platform.Unsafe/MemoryBlock.cs

```

1  using System;
2  using System.Collections.Concurrent;

```

```

3 using System.Runtime.CompilerServices;
4 using System.Threading.Tasks;
5 using static System.Runtime.CompilerServices.Unsafe;
6
7 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
8
9 namespace Platform.Unsafe
10 {
11     public static unsafe class MemoryBlock
12     {
13         [MethodImpl(MethodImplOptions.AggressiveInlining)]
14         public static void Zero(void* pointer, long capacity)
15         {
16             var threads = Environment.ProcessorCount / 2;
17             if (threads <= 1)
18             {
19                 InitBlock(pointer, 0, (uint)capacity);
20             }
21             else
22             {
23                 threads = 2;
24                 Parallel.ForEach(Partitioner.Create(OL, capacity), new ParallelOptions {
25                     ↪ MaxDegreeOfParallelism = threads }, range => ZeroBlock(pointer, range.Item1,
26                     ↪ range.Item2));
27             }
28
29             [MethodImpl(MethodImplOptions.AggressiveInlining)]
30             private static void ZeroBlock(void* pointer, long from, long to)
31             {
32                 var offset = (void*)((byte*)pointer + from);
33                 var length = (uint)(to - from);
34                 InitBlock(offset, 0, length);
35             }
36 }

```

1.5 ./Platform.Unsafe/Structure.cs

```

1 using System;
2 using System.Runtime.CompilerServices;
3 using System.Runtime.InteropServices;
4 using static System.Runtime.CompilerServices.Unsafe;
5
6 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
7
8 namespace Platform.Unsafe
9 {
10     public static class Structure<TStruct>
11         where TStruct : struct
12     {
13         /// <summary>
14         /// <para>
15         /// Returns the size of an unmanaged type in bytes.
16         /// This property do this without throwing exceptions for generic types as <see
17         ↪ cref="Marshal.SizeOf{T}()" /> and <see cref="Marshal.SizeOf(Type)" /> do.
18         /// </para>
19         /// <para>
20         /// Возвращает размер неуправляемого типа в байтах.
21         /// Этот свойство делает это без выбрасывания исключений для универсальных типов, как
22         ↪ это делают <see cref="Marshal.SizeOf{T}()" /> и <see cref="Marshal.SizeOf(Type)" />.
23         /// </para>
24         /// </summary>
25         public static int Size
26         {
27             [MethodImpl(MethodImplOptions.AggressiveInlining)]
28             get;
29             } = SizeOf<TStruct>();
30     }
31 }

```

1.6 ./Platform.Unsafe/StructureExtensions.cs

```

1 using System.Runtime.CompilerServices;
2 using Platform.Hardware.Cpu;
3 using static System.Runtime.CompilerServices.Unsafe;
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 StructureExtensions
10    {
11        [MethodImpl(MethodImplOptions.AggressiveInlining)]
12        public static byte[] ToBytes<TStruct>(this ref TStruct obj)
13            where TStruct : struct
14        {
15            var structureSize = Structure<ulong>.Size;
16            var bytes = new byte[structureSize];
17            fixed (byte* pointer = bytes)
18            {
19                obj.CopyTo(pointer, structureSize);
20            }
21            return bytes;
22        }
23
24        [MethodImpl(MethodImplOptions.AggressiveInlining)]
25        public static void CopyTo<TStruct>(this ref TStruct source, void* destination) where
26            ↳ TStruct : struct => CopyTo(ref source, destination, Structure<ulong>.Size);
27
28        [MethodImpl(MethodImplOptions.AggressiveInlining)]
29        public static void CopyTo<TStruct>(this ref TStruct source, void* destination, int size)
30            where TStruct : struct
31        {
32            if (CacheLine.Size >= size)
33            {
34                Copy(destination, ref source);
35            }
36            else
37            {
38                CopyBlock(destination, AsPointer(ref source), (uint)size);
39            }
40        }
41    }

```

1.7 ./Platform.Unsafe.Tests/IntPtrExtensionsTests.cs

```

1  using System;
2  using System.Runtime.InteropServices;
3  using Xunit;
4  using static System.Runtime.CompilerServices.Unsafe;
5
6  namespace Platform.Unsafe.Tests
7  {
8      public unsafe class IntPtrExtensionsTests
9      {
10         [Fact]
11         public void ReadAndWriteOperationsForPointerValuesUnsafeClassMethodsTest()
12         {
13             void* pointer = (void*)Marshal.AllocHGlobal(sizeof(ulong));
14             Write(pointer, 42UL);
15             Assert.Equal(42UL, Read<ulong>(pointer));
16             Marshal.FreeHGlobal((IntPtr)pointer);
17         }
18
19         [Fact]
20         public void ElementOffsetOperationsForPointerValuesTest()
21         {
22             void* pointer = (void*)Marshal.AllocHGlobal(sizeof(ulong) * 10);
23             ulong result = (ulong)Add<ulong>(pointer, 5);
24             Assert.Equal(5UL * 8UL, result - (ulong)pointer);
25             Marshal.FreeHGlobal((IntPtr)pointer);
26         }
27     }
28 }

```

1.8 ./Platform.Unsafe.Tests/SizeOfTests.cs

```

1  using System.Runtime.InteropServices;
2  using Xunit;
3
4  namespace Platform.Unsafe.Tests
5  {
6      public static 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 static void UnsafeClassSizeOfTest()
16     {
17         var size = System.Runtime.CompilerServices.Unsafe.SizeOf<X<int>>();
18         Assert.Equal(8, size);
19     }
20
21     [Fact]
22     public static void MarshalSizeOfTest()
23     {
24         var size = Marshal.SizeOf(default(X<int>));
25         Assert.Equal(8, size);
26     }
27
28     [Fact]
29     public static void StructurePropertyTest()
30     {
31         var size = Structure<X<int>>.Size;
32         Assert.Equal(8, size);
33     }
34 }
35 }

```

1.9 ./Platform.Unsafe.Tests/StructAndBytesConversionTests.cs

```

1  using Xunit;
2
3  namespace Platform.Unsafe.Tests
4  {
5      public static class StructAndBytesConversionTests
6      {
7          [Fact]
8          public static 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 static 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 }

```

1.10 ./Platform.Unsafe.Tests/ZeroMemoryTests.cs

```

1  using Xunit;
2
3  namespace Platform.Unsafe.Tests
4  {
5      public static unsafe class ZeroMemoryTests
6      {
7          [Fact]
8          public static 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 }

```

Index

- ./Platform.Unsafe.Tests/IntPtrExtensionsTests.cs, 4
- ./Platform.Unsafe.Tests/SizeOfTests.cs, 4
- ./Platform.Unsafe.Tests/StructAndBytesConversionTests.cs, 5
- ./Platform.Unsafe.Tests/ZeroMemoryTests.cs, 5
- ./Platform.Unsafe/ByteArrayExtensions.cs, 1
- ./Platform.Unsafe/IntPtr.cs, 1
- ./Platform.Unsafe/IntPtrExtensions.cs, 2
- ./Platform.Unsafe/MemoryBlock.cs, 2
- ./Platform.Unsafe/Structure.cs, 3
- ./Platform.Unsafe/StructureExtensions.cs, 3