

## LinksPlatform's Platform.Data.Doublets Class Library

### 1.1 ./csharp/Platform.Data.Doublets/CriterionMatchers/TargetMatcher.cs

```
1 using System.Collections.Generic;
2 using System.Runtime.CompilerServices;
3 using Platform.Interfaces;
4
5 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7 namespace Platform.Data.Doublets.CriterionMatchers
8 {
9     /// <summary>
10    /// <para>
11    /// Represents the target matcher.
12    /// </para>
13    /// <para></para>
14    /// </summary>
15    /// <seealso cref="LinksOperatorBase{TLink}" />
16    /// <seealso cref="ICriterionMatcher{TLink}" />
17    public class TargetMatcher<TLink> : LinksOperatorBase<TLink>, ICriterionMatcher<TLink>
18    {
19        /// <summary>
20        /// <para>
21        /// The default.
22        /// </para>
23        /// <para></para>
24        /// </summary>
25        private static readonly EqualityComparer<TLink> _equalityComparer =
26            ↪ EqualityComparer<TLink>.Default;
27
28        /// <summary>
29        /// <para>
30        /// The target to match.
31        /// </para>
32        /// <para></para>
33        /// </summary>
34        private readonly TLink _targetToMatch;
35
36        /// <summary>
37        /// <para>
38        /// Initializes a new <see cref="TargetMatcher" /> instance.
39        /// </para>
40        /// <para></para>
41        /// </summary>
42        /// <param name="links">
43        /// <para>A links.</para>
44        /// <para></para>
45        /// </param>
46        /// <param name="targetToMatch">
47        /// <para>A target to match.</para>
48        /// <para></para>
49        /// </param>
50        [MethodImpl(MethodImplOptions.AggressiveInlining)]
51        public TargetMatcher(ILinks<TLink> links, TLink targetToMatch) : base(links) =>
52            ↪ _targetToMatch = targetToMatch;
53
54        /// <summary>
55        /// <para>
56        /// Determines whether this instance is matched.
57        /// </para>
58        /// <para></para>
59        /// </summary>
60        /// <param name="link">
61        /// <para>The link.</para>
62        /// <para></para>
63        /// </param>
64        /// <returns>
65        /// <para>The bool</para>
66        /// <para></para>
67        /// </returns>
68        [MethodImpl(MethodImplOptions.AggressiveInlining)]
69        public bool IsMatched(TLink link) => _equalityComparer.Equals(_links.GetTarget(link),
70            ↪ _targetToMatch);
71    }
72 }
```

### 1.2 ./csharp/Platform.Data.Doublets/Decorators/LinksCascadeUniquenessAndUsagesResolver.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.Data.Doublets.Decorators
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the links cascade uniqueness and usages resolver.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="LinksUniquenessResolver{TLink}"/>
14     public class LinksCascadeUniquenessAndUsagesResolver<TLink> : LinksUniquenessResolver<TLink>
15     {
16         /// <summary>
17         /// <para>
18         /// Initializes a new <see cref="LinksCascadeUniquenessAndUsagesResolver"/> instance.
19         /// </para>
20         /// <para></para>
21         /// </summary>
22         /// <param name="links">
23         /// <para>A links.</para>
24         /// <para></para>
25         /// </param>
26         [MethodImpl(MethodImplOptions.AggressiveInlining)]
27         public LinksCascadeUniquenessAndUsagesResolver(ILinks<TLink> links) : base(links) { }
28
29         /// <summary>
30         /// <para>
31         /// Resolves the address change conflict using the specified old link address.
32         /// </para>
33         /// <para></para>
34         /// </summary>
35         /// <param name="oldLinkAddress">
36         /// <para>The old link address.</para>
37         /// <para></para>
38         /// </param>
39         /// <param name="newLinkAddress">
40         /// <para>The new link address.</para>
41         /// <para></para>
42         /// </param>
43         /// <returns>
44         /// <para>The link</para>
45         /// <para></para>
46         /// </returns>
47         [MethodImpl(MethodImplOptions.AggressiveInlining)]
48         protected override TLink ResolveAddressChangeConflict(TLink oldLinkAddress, TLink
         ↪ newLinkAddress)
49         {
50             // Use Facade (the last decorator) to ensure recursion working correctly
51             _facade.MergeUsages(oldLinkAddress, newLinkAddress);
52             return base.ResolveAddressChangeConflict(oldLinkAddress, newLinkAddress);
53         }
54     }
55 }

```

### 1.3 ./csharp/Platform.Data.Doublets.Decorators/LinksCascadeUsagesResolver.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Decorators
7  {
8      /// <remarks>
9      /// <para>Must be used in conjunction with NonNullContentsLinkDeletionResolver.</para>
10     /// <para>Должен использоваться вместе с NonNullContentsLinkDeletionResolver.</para>
11     /// </remarks>
12     public class LinksCascadeUsagesResolver<TLink> : LinksDecoratorBase<TLink>
13     {
14         /// <summary>
15         /// <para>
16         /// Initializes a new <see cref="LinksCascadeUsagesResolver"/> instance.
17         /// </para>
18         /// <para></para>
19         /// </summary>
20         /// <param name="links">
21         /// <para>A links.</para>
22         /// <para></para>

```

```

23     /// </param>
24     [MethodImpl(MethodImplOptions.AggressiveInlining)]
25     public LinksCascadeUsagesResolver(ILinks<TLink> links) : base(links) { }
26
27     /// <summary>
28     /// <para>
29     /// Deletes the restrictions.
30     /// </para>
31     /// <para></para>
32     /// </summary>
33     /// <param name="restrictions">
34     /// <para>The restrictions.</para>
35     /// <para></para>
36     /// </param>
37     [MethodImpl(MethodImplOptions.AggressiveInlining)]
38     public override void Delete(IList<TLink> restrictions)
39     {
40         var linkIndex = restrictions[_constants.IndexPart];
41         // Use Facade (the last decorator) to ensure recursion working correctly
42         _facade.DeleteAllUsages(linkIndex);
43         _links.Delete(linkIndex);
44     }
45 }
46 }

```

#### 1.4 ./csharp/Platform.Data.Doublets/Decorators/LinksDecoratorBase.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Doublets.Decorators
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the links decorator base.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     /// <seealso cref="LinksOperatorBase{TLink}" />
16     /// <seealso cref="ILinks{TLink}" />
17     public abstract class LinksDecoratorBase<TLink> : LinksOperatorBase<TLink>, ILinks<TLink>
18     {
19         /// <summary>
20         /// <para>
21         /// The constants.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         protected readonly LinksConstants<TLink> _constants;
26
27         /// <summary>
28         /// <para>
29         /// Gets the constants value.
30         /// </para>
31         /// <para></para>
32         /// </summary>
33         public LinksConstants<TLink> Constants
34         {
35             [MethodImpl(MethodImplOptions.AggressiveInlining)]
36             get => _constants;
37         }
38
39         /// <summary>
40         /// <para>
41         /// The facade.
42         /// </para>
43         /// <para></para>
44         /// </summary>
45         protected ILinks<TLink> _facade;
46
47         /// <summary>
48         /// <para>
49         /// Gets or sets the facade value.
50         /// </para>
51         /// <para></para>
52         /// </summary>
53         public ILinks<TLink> Facade

```

```

54 {
55     [MethodImpl(MethodImplOptions.AggressiveInlining)]
56     get => _facade;
57     [MethodImpl(MethodImplOptions.AggressiveInlining)]
58     set
59     {
60         _facade = value;
61         if (_links is LinksDecoratorBase<TLink> decorator)
62         {
63             decorator.Facade = value;
64         }
65     }
66 }
67
68 /// <summary>
69 /// <para>
70 /// Initializes a new <see cref="LinksDecoratorBase"/> instance.
71 /// </para>
72 /// <para></para>
73 /// </summary>
74 /// <param name="links">
75 /// <para>A links.</para>
76 /// <para></para>
77 /// </param>
78 [MethodImpl(MethodImplOptions.AggressiveInlining)]
79 protected LinksDecoratorBase(ILinks<TLink> links) : base(links)
80 {
81     _constants = links.Constants;
82     Facade = this;
83 }
84
85 /// <summary>
86 /// <para>
87 /// Counts the restrictions.
88 /// </para>
89 /// <para></para>
90 /// </summary>
91 /// <param name="restrictions">
92 /// <para>The restrictions.</para>
93 /// <para></para>
94 /// </param>
95 /// <returns>
96 /// <para>The link</para>
97 /// <para></para>
98 /// </returns>
99 [MethodImpl(MethodImplOptions.AggressiveInlining)]
100 public virtual TLink Count(IList<TLink> restrictions) => _links.Count(restrictions);
101
102 /// <summary>
103 /// <para>
104 /// Eaches the handler.
105 /// </para>
106 /// <para></para>
107 /// </summary>
108 /// <param name="handler">
109 /// <para>The handler.</para>
110 /// <para></para>
111 /// </param>
112 /// <param name="restrictions">
113 /// <para>The restrictions.</para>
114 /// <para></para>
115 /// </param>
116 /// <returns>
117 /// <para>The link</para>
118 /// <para></para>
119 /// </returns>
120 [MethodImpl(MethodImplOptions.AggressiveInlining)]
121 public virtual TLink Each(Func<IList<TLink>, TLink> handler, IList<TLink> restrictions)
122     => _links.Each(handler, restrictions);
123
124 /// <summary>
125 /// <para>
126 /// Creates the restrictions.
127 /// </para>
128 /// <para></para>
129 /// </summary>
130 /// <param name="restrictions">
131 /// <para>The restrictions.</para>

```

```

131     /// <para></para>
132     /// </param>
133     /// <returns>
134     /// <para>The link</para>
135     /// <para></para>
136     /// </returns>
137     [MethodImpl(MethodImplOptions.AggressiveInlining)]
138     public virtual TLink Create(ICollection<TLink> restrictions) => _links.Create(restrictions);
139
140     /// <summary>
141     /// <para>
142     /// Updates the restrictions.
143     /// </para>
144     /// <para></para>
145     /// </summary>
146     /// <param name="restrictions">
147     /// <para>The restrictions.</para>
148     /// <para></para>
149     /// </param>
150     /// <param name="substitution">
151     /// <para>The substitution.</para>
152     /// <para></para>
153     /// </param>
154     /// <returns>
155     /// <para>The link</para>
156     /// <para></para>
157     /// </returns>
158     [MethodImpl(MethodImplOptions.AggressiveInlining)]
159     public virtual TLink Update(ICollection<TLink> restrictions, ICollection<TLink> substitution) =>
160         ↪ _links.Update(restrictions, substitution);
161
162     /// <summary>
163     /// <para>
164     /// Deletes the restrictions.
165     /// </para>
166     /// <para></para>
167     /// </summary>
168     /// <param name="restrictions">
169     /// <para>The restrictions.</para>
170     /// <para></para>
171     /// </param>
172     [MethodImpl(MethodImplOptions.AggressiveInlining)]
173     public virtual void Delete(ICollection<TLink> restrictions) => _links.Delete(restrictions);
174 }

```

## 1.5 ./csharp/Platform.Data.Doublets/Decorators/LinksDisposableDecoratorBase.cs

```

1 using System.Runtime.CompilerServices;
2 using Platform.Disposables;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5 #pragma warning disable CA1063 // Implement IDisposable Correctly
6
7 namespace Platform.Data.Doublets.Decorators
8 {
9     /// <summary>
10     /// <para>
11     /// Represents the links disposable decorator base.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     /// <seealso cref="LinksDecoratorBase{TLink}">
16     /// <seealso cref="ILinks{TLink}">
17     /// <seealso cref="System.IDisposable">
18     public abstract class LinksDisposableDecoratorBase<TLink> : LinksDecoratorBase<TLink>,
19         ↪ ILinks<TLink>, System.IDisposable
20     {
21         /// <summary>
22         /// <para>
23         /// Represents the disposable with multiple calls allowed.
24         /// </para>
25         /// <para></para>
26         /// </summary>
27         /// <seealso cref="Disposable">
28         protected class DisposableWithMultipleCallsAllowed : Disposable
29         {
30             /// <summary>
31             /// <para>

```

```

31     /// Initializes a new <see cref="DisposableWithMultipleCallsAllowed"/> instance.
32     /// </para>
33     /// <para></para>
34     /// </summary>
35     /// <param name="disposal">
36     /// <para>A disposal.</para>
37     /// <para></para>
38     /// </param>
39     [MethodImpl(MethodImplOptions.AggressiveInlining)]
40     public DisposableWithMultipleCallsAllowed(Disposal disposal) : base(disposal) { }
41
42     /// <summary>
43     /// <para>
44     /// Gets the allow multiple dispose calls value.
45     /// </para>
46     /// <para></para>
47     /// </summary>
48     protected override bool AllowMultipleDisposeCalls
49     {
50         [MethodImpl(MethodImplOptions.AggressiveInlining)]
51         get => true;
52     }
53 }
54
55     /// <summary>
56     /// <para>
57     /// The disposable.
58     /// </para>
59     /// <para></para>
60     /// </summary>
61     protected readonly DisposableWithMultipleCallsAllowed Disposable;
62
63     /// <summary>
64     /// <para>
65     /// Initializes a new <see cref="LinksDisposableDecoratorBase"/> instance.
66     /// </para>
67     /// <para></para>
68     /// </summary>
69     /// <param name="links">
70     /// <para>A links.</para>
71     /// <para></para>
72     /// </param>
73     [MethodImpl(MethodImplOptions.AggressiveInlining)]
74     protected LinksDisposableDecoratorBase(ILinks<TLink> links) : base(links) => Disposable
75     ↪ = new DisposableWithMultipleCallsAllowed(Dispose);
76
77     [MethodImpl(MethodImplOptions.AggressiveInlining)]
78     ~LinksDisposableDecoratorBase() => Disposable.Destruct();
79
80     /// <summary>
81     /// <para>
82     /// Disposes this instance.
83     /// </para>
84     /// <para></para>
85     /// </summary>
86     [MethodImpl(MethodImplOptions.AggressiveInlining)]
87     public void Dispose() => Disposable.Dispose();
88
89     /// <summary>
90     /// <para>
91     /// Disposes the manual.
92     /// </para>
93     /// <para></para>
94     /// </summary>
95     /// <param name="manual">
96     /// <para>The manual.</para>
97     /// <para></para>
98     /// </param>
99     /// <param name="wasDisposed">
100    /// <para>The was disposed.</para>
101    /// <para></para>
102    /// </param>
103    [MethodImpl(MethodImplOptions.AggressiveInlining)]
104    protected virtual void Dispose(bool manual, bool wasDisposed)
105    {
106        if (!wasDisposed)
107        {
108            _links.DisposeIfPossible();

```

```

108     }
109 }
110 }
111 }

```

## 1.6 ./csharp/Platform.Data.Doublets/Decorators/LinksInnerReferenceExistenceValidator.cs

```

1 using System;
2 using System.Collections.Generic;
3 using System.Runtime.CompilerServices;
4
5 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7 namespace Platform.Data.Doublets.Decorators
8 {
9     // TODO: Make LinksExternalReferenceValidator. A layer that checks each link to exist or to
10     // ↳ be external (hybrid link's raw number).
11     /// <summary>
12     /// <para>
13     /// Represents the links inner reference existence validator.
14     /// </para>
15     /// <para></para>
16     /// </summary>
17     /// <seealso cref="LinksDecoratorBase{TLink}" />
18     public class LinksInnerReferenceExistenceValidator<TLink> : LinksDecoratorBase<TLink>
19     {
20         /// <summary>
21         /// <para>
22         /// Initializes a new <see cref="LinksInnerReferenceExistenceValidator" /> instance.
23         /// </para>
24         /// <para></para>
25         /// </summary>
26         /// <param name="links">
27         /// <para>A links.</para>
28         /// <para></para>
29         /// </param>
30         [MethodImpl(MethodImplOptions.AggressiveInlining)]
31         public LinksInnerReferenceExistenceValidator(ILinks<TLink> links) : base(links) { }
32
33         /// <summary>
34         /// <para>
35         /// Eaches the handler.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         /// <param name="handler">
40         /// <para>The handler.</para>
41         /// <para></para>
42         /// </param>
43         /// <param name="restrictions">
44         /// <para>The restrictions.</para>
45         /// <para></para>
46         /// </param>
47         /// <returns>
48         /// <para>The link</para>
49         /// <para></para>
50         /// </returns>
51         [MethodImpl(MethodImplOptions.AggressiveInlining)]
52         public override TLink Each(Func<IList<TLink>, TLink> handler, IList<TLink> restrictions)
53         {
54             var links = _links;
55             links.EnsureInnerReferenceExists(restrictions, nameof(restrictions));
56             return links.Each(handler, restrictions);
57         }
58
59         /// <summary>
60         /// <para>
61         /// Updates the restrictions.
62         /// </para>
63         /// <para></para>
64         /// </summary>
65         /// <param name="restrictions">
66         /// <para>The restrictions.</para>
67         /// <para></para>
68         /// </param>
69         /// <param name="substitution">
70         /// <para>The substitution.</para>
71         /// <para></para>
72         /// </param>

```

```

72     /// <returns>
73     /// <para>The link</para>
74     /// <para></para>
75     /// </returns>
76     [MethodImpl(MethodImplOptions.AggressiveInlining)]
77     public override TLink Update(IList<TLink> restrictions, IList<TLink> substitution)
78     {
79         // TODO: Possible values: null, ExistentLink or NonExistentHybrid(ExternalReference)
80         var links = _links;
81         links.EnsureInnerReferenceExists(restrictions, nameof(restrictions));
82         links.EnsureInnerReferenceExists(substitution, nameof(substitution));
83         return links.Update(restrictions, substitution);
84     }
85
86     /// <summary>
87     /// <para>
88     /// Deletes the restrictions.
89     /// </para>
90     /// <para></para>
91     /// </summary>
92     /// <param name="restrictions">
93     /// <para>The restrictions.</para>
94     /// <para></para>
95     /// </param>
96     [MethodImpl(MethodImplOptions.AggressiveInlining)]
97     public override void Delete(IList<TLink> restrictions)
98     {
99         var link = restrictions[_constants.IndexPart];
100         var links = _links;
101         links.EnsureLinkExists(link, nameof(link));
102         links.Delete(link);
103     }
104 }
105 }

```

## 1.7 ./csharp/Platform.Data.Doublets/Decorators/LinksItselfConstantToSelfReferenceResolver.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Doublets.Decorators
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the links itself constant to self reference resolver.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     /// <seealso cref="LinksDecoratorBase{TLink}" />
16     public class LinksItselfConstantToSelfReferenceResolver<TLink> : LinksDecoratorBase<TLink>
17     {
18         /// <summary>
19         /// <para>
20         /// The default.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         private static readonly EqualityComparer<TLink> _equalityComparer =
25             ↪ EqualityComparer<TLink>.Default;
26
27         /// <summary>
28         /// <para>
29         /// Initializes a new <see cref="LinksItselfConstantToSelfReferenceResolver" /> instance.
30         /// </para>
31         /// <para></para>
32         /// </summary>
33         /// <param name="links">
34         /// <para>A links.</para>
35         /// <para></para>
36         /// </param>
37         [MethodImpl(MethodImplOptions.AggressiveInlining)]
38         public LinksItselfConstantToSelfReferenceResolver(ILinks<TLink> links) : base(links) { }
39
40         /// <summary>
41         /// <para>
42         /// Eaches the handler.
43         /// </para>

```



```

43     /// <para></para>
44     /// </summary>
45     /// <param name="handler">
46     /// <para>The handler.</para>
47     /// <para></para>
48     /// </param>
49     /// <param name="restrictions">
50     /// <para>The restrictions.</para>
51     /// <para></para>
52     /// </param>
53     /// <returns>
54     /// <para>The link</para>
55     /// <para></para>
56     /// </returns>
57     [MethodImpl(MethodImplOptions.AggressiveInlining)]
58     public override TLink Each(Func<IList<TLink>, TLink> handler, IList<TLink> restrictions)
59     {
60         var constants = _constants;
61         var itselfConstant = constants.Itself;
62         if (!_equalityComparer.Equals(constants.Any, itselfConstant) &&
63             ↪ restrictions.Contains(itselfConstant))
64         {
65             // Itself constant is not supported for Each method right now, skipping execution
66             return constants.Continue;
67         }
68         return _links.Each(handler, restrictions);
69     }
70     /// <summary>
71     /// <para>
72     /// Updates the restrictions.
73     /// </para>
74     /// <para></para>
75     /// </summary>
76     /// <param name="restrictions">
77     /// <para>The restrictions.</para>
78     /// <para></para>
79     /// </param>
80     /// <param name="substitution">
81     /// <para>The substitution.</para>
82     /// <para></para>
83     /// </param>
84     /// <returns>
85     /// <para>The link</para>
86     /// <para></para>
87     /// </returns>
88     [MethodImpl(MethodImplOptions.AggressiveInlining)]
89     public override TLink Update(IList<TLink> restrictions, IList<TLink> substitution) =>
90         ↪ _links.Update(restrictions, _links.ResolveConstantAsSelfReference(_constants.Itself,
91         ↪ restrictions, substitution));
92     }
93 }

```

## 1.8 ./csharp/Platform.Data.Doublets/Decorators/LinksNonExistentDependenciesCreator.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Decorators
7  {
8      /// <remarks>
9      /// Not practical if newSource and newTarget are too big.
10     /// To be able to use practical version we should allow to create link at any specific
11     ↪ location inside ResizableDirectMemoryLinks.
12     /// This in turn will require to implement not a list of empty links, but a list of ranges
13     ↪ to store it more efficiently.
14     /// </remarks>
15     public class LinksNonExistentDependenciesCreator<TLink> : LinksDecoratorBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="LinksNonExistentDependenciesCreator"/> instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="links">
24         /// <para>A links.</para>

```

```

23     /// <para></para>
24     /// </param>
25     [MethodImpl(MethodImplOptions.AggressiveInlining)]
26     public LinksNonExistentDependenciesCreator(ILinks<TLink> links) : base(links) { }
27
28     /// <summary>
29     /// <para>
30     /// Updates the restrictions.
31     /// </para>
32     /// <para></para>
33     /// </summary>
34     /// <param name="restrictions">
35     /// <para>The restrictions.</para>
36     /// <para></para>
37     /// </param>
38     /// <param name="substitution">
39     /// <para>The substitution.</para>
40     /// <para></para>
41     /// </param>
42     /// <returns>
43     /// <para>The link</para>
44     /// <para></para>
45     /// </returns>
46     [MethodImpl(MethodImplOptions.AggressiveInlining)]
47     public override TLink Update(IList<TLink> restrictions, IList<TLink> substitution)
48     {
49         var constants = _constants;
50         var links = _links;
51         links.EnsureCreated(substitution[constants.SourcePart],
52             ↪ substitution[constants.TargetPart]);
53         return links.Update(restrictions, substitution);
54     }
55 }

```

## 1.9 ./csharp/Platform.Data.Doublets/Decorators/LinksNullConstantToSelfReferenceResolver.cs

```

1 using System.Collections.Generic;
2 using System.Runtime.CompilerServices;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6 namespace Platform.Data.Doublets.Decorators
7 {
8     /// <summary>
9     /// <para>
10     /// Represents the links null constant to self reference resolver.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="LinksDecoratorBase{TLink}">
15     public class LinksNullConstantToSelfReferenceResolver<TLink> : LinksDecoratorBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="LinksNullConstantToSelfReferenceResolver"/> instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="links">
24         /// <para>A links.</para>
25         /// <para></para>
26         /// </param>
27         [MethodImpl(MethodImplOptions.AggressiveInlining)]
28         public LinksNullConstantToSelfReferenceResolver(ILinks<TLink> links) : base(links) { }
29
30         /// <summary>
31         /// <para>
32         /// Creates the restrictions.
33         /// </para>
34         /// <para></para>
35         /// </summary>
36         /// <param name="restrictions">
37         /// <para>The restrictions.</para>
38         /// <para></para>
39         /// </param>
40         /// <returns>
41         /// <para>The link</para>
42         /// <para></para>

```

```

43     /// </returns>
44     [MethodImpl(MethodImplOptions.AggressiveInlining)]
45     public override TLink Create(ICollection<TLink> restrictions) => _links.CreatePoint();
46
47     /// <summary>
48     /// <para>
49     /// Updates the restrictions.
50     /// </para>
51     /// <para></para>
52     /// </summary>
53     /// <param name="restrictions">
54     /// <para>The restrictions.</para>
55     /// <para></para>
56     /// </param>
57     /// <param name="substitution">
58     /// <para>The substitution.</para>
59     /// <para></para>
60     /// </param>
61     /// <returns>
62     /// <para>The link</para>
63     /// <para></para>
64     /// </returns>
65     [MethodImpl(MethodImplOptions.AggressiveInlining)]
66     public override TLink Update(ICollection<TLink> restrictions, ICollection<TLink> substitution) =>
        ↪ _links.Update(restrictions, _links.ResolveConstantAsSelfReference(_constants.Null,
        ↪ restrictions, substitution));
67 }
68 }

```

## 1.10 ./csharp/Platform.Data.Doublets/Decorators/LinksUniquenessResolver.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Decorators
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the links uniqueness resolver.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="LinksDecoratorBase{TLink}" />
15     public class LinksUniquenessResolver<TLink> : LinksDecoratorBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// The default.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         private static readonly EqualityComparer<TLink> _equalityComparer =
            ↪ EqualityComparer<TLink>.Default;
24
25         /// <summary>
26         /// <para>
27         /// Initializes a new <see cref="LinksUniquenessResolver" /> instance.
28         /// </para>
29         /// <para></para>
30         /// </summary>
31         /// <param name="links">
32         /// <para>A links.</para>
33         /// <para></para>
34         /// </param>
35         [MethodImpl(MethodImplOptions.AggressiveInlining)]
36         public LinksUniquenessResolver(ICollection<TLink> links) : base(links) { }
37
38         /// <summary>
39         /// <para>
40         /// Updates the restrictions.
41         /// </para>
42         /// <para></para>
43         /// </summary>
44         /// <param name="restrictions">
45         /// <para>The restrictions.</para>
46         /// <para></para>
47         /// </param>

```

```

48     /// <param name="substitution">
49     /// <para>The substitution.</para>
50     /// <para></para>
51     /// </param>
52     /// <returns>
53     /// <para>The link</para>
54     /// <para></para>
55     /// </returns>
56     [MethodImpl(MethodImplOptions.AggressiveInlining)]
57     public override TLink Update(IList<TLink> restrictions, IList<TLink> substitution)
58     {
59         var constants = _constants;
60         var links = _links;
61         var newLinkAddress = links.SearchOrDefault(substitution[constants.SourcePart],
62             ↪ substitution[constants.TargetPart]);
63         if (_equalityComparer.Equals(newLinkAddress, default))
64         {
65             return links.Update(restrictions, substitution);
66         }
67         return ResolveAddressChangeConflict(restrictions[constants.IndexPart],
68             ↪ newLinkAddress);
69     }
70     /// <summary>
71     /// <para>
72     /// Resolves the address change conflict using the specified old link address.
73     /// </para>
74     /// <para></para>
75     /// </summary>
76     /// <param name="oldLinkAddress">
77     /// <para>The old link address.</para>
78     /// <para></para>
79     /// </param>
80     /// <param name="newLinkAddress">
81     /// <para>The new link address.</para>
82     /// <para></para>
83     /// </param>
84     /// <returns>
85     /// <para>The new link address.</para>
86     /// <para></para>
87     /// </returns>
88     [MethodImpl(MethodImplOptions.AggressiveInlining)]
89     protected virtual TLink ResolveAddressChangeConflict(TLink oldLinkAddress, TLink
90         ↪ newLinkAddress)
91     {
92         if (!_equalityComparer.Equals(oldLinkAddress, newLinkAddress) &&
93             ↪ _links.Exists(oldLinkAddress))
94         {
95             _facade.Delete(oldLinkAddress);
96         }
97         return newLinkAddress;
98     }
99 }

```

## 1.11 ./csharp/Platform.Data.Doublets/Decorators/LinksUniquenessValidator.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Decorators
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the links uniqueness validator.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="LinksDecoratorBase{TLink}" />
15     public class LinksUniquenessValidator<TLink> : LinksDecoratorBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="LinksUniquenessValidator" /> instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>

```

```

23     /// <param name="links">
24     /// <para>A links.</para>
25     /// <para></para>
26     /// </param>
27     [MethodImpl(MethodImplOptions.AggressiveInlining)]
28     public LinksUniquenessValidator(ILinks<TLink> links) : base(links) { }
29
30     /// <summary>
31     /// <para>
32     /// Updates the restrictions.
33     /// </para>
34     /// <para></para>
35     /// </summary>
36     /// <param name="restrictions">
37     /// <para>The restrictions.</para>
38     /// <para></para>
39     /// </param>
40     /// <param name="substitution">
41     /// <para>The substitution.</para>
42     /// <para></para>
43     /// </param>
44     /// <returns>
45     /// <para>The link</para>
46     /// <para></para>
47     /// </returns>
48     [MethodImpl(MethodImplOptions.AggressiveInlining)]
49     public override TLink Update(IList<TLink> restrictions, IList<TLink> substitution)
50     {
51         var links = _links;
52         var constants = _constants;
53         links.EnsureDoesNotExists(substitution[constants.SourcePart],
54             ↪ substitution[constants.TargetPart]);
55         return links.Update(restrictions, substitution);
56     }
57 }

```

## 1.12 ./csharp/Platform.Data.Doublets/Decorators/LinksUsagesValidator.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Decorators
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the links usages validator.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="LinksDecoratorBase{TLink}" />
15     public class LinksUsagesValidator<TLink> : LinksDecoratorBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="LinksUsagesValidator" /> instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="links">
24         /// <para>A links.</para>
25         /// <para></para>
26         /// </param>
27         [MethodImpl(MethodImplOptions.AggressiveInlining)]
28         public LinksUsagesValidator(ILinks<TLink> links) : base(links) { }
29
30         /// <summary>
31         /// <para>
32         /// Updates the restrictions.
33         /// </para>
34         /// <para></para>
35         /// </summary>
36         /// <param name="restrictions">
37         /// <para>The restrictions.</para>
38         /// <para></para>
39         /// </param>
40         /// <param name="substitution">

```

```

41     /// <para>The substitution.</para>
42     /// <para></para>
43     /// </param>
44     /// <returns>
45     /// <para>The link</para>
46     /// <para></para>
47     /// </returns>
48     [MethodImpl(MethodImplOptions.AggressiveInlining)]
49     public override TLink Update(IList<TLink> restrictions, IList<TLink> substitution)
50     {
51         var links = _links;
52         links.EnsureNoUsages(restrictions[_constants.IndexPart]);
53         return links.Update(restrictions, substitution);
54     }
55
56     /// <summary>
57     /// <para>
58     /// Deletes the restrictions.
59     /// </para>
60     /// <para></para>
61     /// </summary>
62     /// <param name="restrictions">
63     /// <para>The restrictions.</para>
64     /// <para></para>
65     /// </param>
66     [MethodImpl(MethodImplOptions.AggressiveInlining)]
67     public override void Delete(IList<TLink> restrictions)
68     {
69         var link = restrictions[_constants.IndexPart];
70         var links = _links;
71         links.EnsureNoUsages(link);
72         links.Delete(link);
73     }
74 }
75 }

```

### 1.13 ./csharp/Platform.Data.Doublets/Decorators/NonNullContentsLinkDeletionResolver.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Decorators
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the non null contents link deletion resolver.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="LinksDecoratorBase{TLink}"/>
15     public class NonNullContentsLinkDeletionResolver<TLink> : LinksDecoratorBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="NonNullContentsLinkDeletionResolver"/> instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="links">
24         /// <para>A links.</para>
25         /// <para></para>
26         /// </param>
27         [MethodImpl(MethodImplOptions.AggressiveInlining)]
28         public NonNullContentsLinkDeletionResolver(ILinks<TLink> links) : base(links) { }
29
30         /// <summary>
31         /// <para>
32         /// Deletes the restrictions.
33         /// </para>
34         /// <para></para>
35         /// </summary>
36         /// <param name="restrictions">
37         /// <para>The restrictions.</para>
38         /// <para></para>
39         /// </param>
40         [MethodImpl(MethodImplOptions.AggressiveInlining)]
41         public override void Delete(IList<TLink> restrictions)
42         {

```

```

43         var linkIndex = restrictions[_constants.IndexPart];
44         var links = _links;
45         links.EnforceResetValues(linkIndex);
46         links.Delete(linkIndex);
47     }
48 }
49 }

```

#### 1.14 ./csharp/Platform.Data.Doublets/Decorators/UInt32Links.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3  using TLink = System.UInt32;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Doublets.Decorators
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the int 32 links.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     /// <seealso cref="LinksDisposableDecoratorBase{TLink}"/>
16     public class UInt32Links : LinksDisposableDecoratorBase<TLink>
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see cref="UInt32Links"/> instance.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         /// <param name="links">
25         /// <para>A links.</para>
26         /// <para></para>
27         /// </param>
28         [MethodImpl(MethodImplOptions.AggressiveInlining)]
29         public UInt32Links(ILinks<TLink> links) : base(links) { }
30
31         /// <summary>
32         /// <para>
33         /// Creates the restrictions.
34         /// </para>
35         /// <para></para>
36         /// </summary>
37         /// <param name="restrictions">
38         /// <para>The restrictions.</para>
39         /// <para></para>
40         /// </param>
41         /// <returns>
42         /// <para>The link</para>
43         /// <para></para>
44         /// </returns>
45         [MethodImpl(MethodImplOptions.AggressiveInlining)]
46         public override TLink Create(IList<TLink> restrictions) => _links.CreatePoint();
47
48         /// <summary>
49         /// <para>
50         /// Updates the restrictions.
51         /// </para>
52         /// <para></para>
53         /// </summary>
54         /// <param name="restrictions">
55         /// <para>The restrictions.</para>
56         /// <para></para>
57         /// </param>
58         /// <param name="substitution">
59         /// <para>The substitution.</para>
60         /// <para></para>
61         /// </param>
62         /// <returns>
63         /// <para>The link</para>
64         /// <para></para>
65         /// </returns>
66         [MethodImpl(MethodImplOptions.AggressiveInlining)]
67         public override TLink Update(IList<TLink> restrictions, IList<TLink> substitution)
68         {
69             var constants = _constants;
70             var indexPartConstant = constants.IndexPart;

```

```

71     var sourcePartConstant = constants.SourcePart;
72     var targetPartConstant = constants.TargetPart;
73     var nullConstant = constants.Null;
74     var itselfConstant = constants.Itself;
75     var existedLink = nullConstant;
76     var updatedLink = restrictions[indexPartConstant];
77     var newSource = substitution[sourcePartConstant];
78     var newTarget = substitution[targetPartConstant];
79     var links = _links;
80     if (newSource != itselfConstant && newTarget != itselfConstant)
81     {
82         existedLink = links.SearchOrDefault(newSource, newTarget);
83     }
84     if (existedLink == nullConstant)
85     {
86         var before = links.GetLink(updatedLink);
87         if (before[sourcePartConstant] != newSource || before[targetPartConstant] !=
            ↪ newTarget)
88         {
89             links.Update(updatedLink, newSource == itselfConstant ? updatedLink :
            ↪ newSource,
90                               newTarget == itselfConstant ? updatedLink :
            ↪ newTarget);
91         }
92         return updatedLink;
93     }
94     else
95     {
96         return _facade.MergeAndDelete(updatedLink, existedLink);
97     }
98 }
99
100 /// <summary>
101 /// <para>
102 /// Deletes the restrictions.
103 /// </para>
104 /// <para></para>
105 /// </summary>
106 /// <param name="restrictions">
107 /// <para>The restrictions.</para>
108 /// <para></para>
109 /// </param>
110 [MethodImpl(MethodImplOptions.AggressiveInlining)]
111 public override void Delete(ICollection<TLink> restrictions)
112 {
113     var linkIndex = restrictions[_constants.IndexPart];
114     var links = _links;
115     links.EnforceResetValues(linkIndex);
116     _facade.DeleteAllUsages(linkIndex);
117     links.Delete(linkIndex);
118 }
119 }
120 }

```

## 1.15 ./csharp/Platform.Data.Doublets/Decorators/UInt64Links.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Decorators
7  {
8      /// <summary>
9      /// <para>Represents a combined decorator that implements the basic logic for interacting
            ↪ with the links storage for links with addresses represented as <see cref="System.UInt64"
            ↪ >.</para>
10     /// <para>Представляет комбинированный декоратор, реализующий основную логику по
            ↪ взаимодействию с хранилищем связей, для связей с адресами представленными в виде <see
            ↪ cref="System.UInt64"/>.</para>
11     /// </summary>
12     /// <remarks>
13     /// Возможные оптимизации:
14     /// Объединение в одном поле Source и Target с уменьшением до 32 бит.
15     /// + меньше объём БД
16     /// - меньше производительность
17     /// - больше ограничение на количество связей в БД)
18     /// Ленивое хранение размеров поддеревьев (расчитываемое по мере использования БД)
19     /// + меньше объём БД
20     /// - больше сложность

```



```

21 ///
22 /// Текущее теоретическое ограничение на индекс связи, из-за использования 5 бит в размере
    ↳ поддеревьев для AVL баланса и флагов нитей: 2 в степени (64 минус 5 равно 59 ) равно 576
    ↳ 460 752 303 423 488
23 /// Желательно реализовать поддержку переключения между деревьями и битовыми индексами
    ↳ (битовыми строками) - вариант матрицы (выстраиваемой лениво).
24 ///
25 /// Решить отключать ли проверки при компиляции под Release. Т.е. исключения будут
    ↳ выбрасываться только при #if DEBUG
26 /// </remarks>
27 public class UInt64Links : LinksDisposableDecoratorBase<ulong>
28 {
29     /// <summary>
30     /// <para>
31     /// Initializes a new <see cref="UInt64Links"/> instance.
32     /// </para>
33     /// <para></para>
34     /// </summary>
35     /// <param name="links">
36     /// <para>A links.</para>
37     /// <para></para>
38     /// </param>
39     [MethodImpl(MethodImplOptions.AggressiveInlining)]
40     public UInt64Links(ILinks<ulong> links) : base(links) { }
41
42     /// <summary>
43     /// <para>
44     /// Creates the restrictions.
45     /// </para>
46     /// <para></para>
47     /// </summary>
48     /// <param name="restrictions">
49     /// <para>The restrictions.</para>
50     /// <para></para>
51     /// </param>
52     /// <returns>
53     /// <para>The ulong</para>
54     /// <para></para>
55     /// </returns>
56     [MethodImpl(MethodImplOptions.AggressiveInlining)]
57     public override ulong Create(ICollection<ulong> restrictions) => _links.CreatePoint();
58
59     /// <summary>
60     /// <para>
61     /// Updates the restrictions.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     /// <param name="restrictions">
66     /// <para>The restrictions.</para>
67     /// <para></para>
68     /// </param>
69     /// <param name="substitution">
70     /// <para>The substitution.</para>
71     /// <para></para>
72     /// </param>
73     /// <returns>
74     /// <para>The ulong</para>
75     /// <para></para>
76     /// </returns>
77     [MethodImpl(MethodImplOptions.AggressiveInlining)]
78     public override ulong Update(ICollection<ulong> restrictions, ICollection<ulong> substitution)
79     {
80         var constants = _constants;
81         var indexPartConstant = constants.IndexPart;
82         var sourcePartConstant = constants.SourcePart;
83         var targetPartConstant = constants.TargetPart;
84         var nullConstant = constants.Null;
85         var itselfConstant = constants.Itself;
86         var existedLink = nullConstant;
87         var updatedLink = restrictions[indexPartConstant];
88         var newSource = substitution[sourcePartConstant];
89         var newTarget = substitution[targetPartConstant];
90         var links = _links;
91         if (newSource != itselfConstant && newTarget != itselfConstant)
92         {
93             existedLink = links.SearchOrDefault(newSource, newTarget);
94         }
95     }
96 }

```

```

95         if (existedLink == nullConstant)
96         {
97             var before = links.GetLink(updatedLink);
98             if (before[sourcePartConstant] != newSource || before[targetPartConstant] !=
99                 ↪ newTarget)
100             {
101                 links.Update(updatedLink, newSource == itselfConstant ? updatedLink :
102                     ↪ newSource,
103                     newTarget == itselfConstant ? updatedLink :
104                         ↪ newTarget);
105             }
106             return updatedLink;
107         }
108         else
109         {
110             return _facade.MergeAndDelete(updatedLink, existedLink);
111         }
112     }
113
114     /// <summary>
115     /// <para>
116     /// Deletes the restrictions.
117     /// </para>
118     /// <para></para>
119     /// </summary>
120     /// <param name="restrictions">
121     /// <para>The restrictions.</para>
122     /// <para></para>
123     /// </param>
124     [MethodImpl(MethodImplOptions.AggressiveInlining)]
125     public override void Delete(IList<ulong> restrictions)
126     {
127         var linkIndex = restrictions[_constants.IndexPart];
128         var links = _links;
129         links.EnforceResetValues(linkIndex);
130         _facade.DeleteAllUsages(linkIndex);
131         links.Delete(linkIndex);
132     }
133 }

```

## 1.16 ./csharp/Platform.Data.Doublets/Decorators/UniLinks.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Linq;
4  using Platform.Collections;
5  using Platform.Collections.Lists;
6  using Platform.Data.Universal;
7
8  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
9
10 namespace Platform.Data.Doublets.Decorators
11 {
12     /// <remarks>
13     /// What does empty pattern (for condition or substitution) mean? Nothing or Everything?
14     /// Now we go with nothing. And nothing is something one, but empty, and cannot be changed
15     ↪ by itself. But can cause creation (update from nothing) or deletion (update to nothing).
16     ///
17     /// TODO0: Decide to change to IDoubletLinks or not to change. (Better to create
18     ↪ DefaultUniLinksBase, that contains logic itself and can be implemented using both
19     ↪ IDoubletLinks and ILinks.)
20     /// </remarks>
21     internal class UniLinks<TLink> : LinksDecoratorBase<TLink>, IUniLinks<TLink>
22     {
23         /// <summary>
24         /// <para>
25         /// The default.
26         /// </para>
27         /// <para></para>
28         /// </summary>
29         private static readonly EqualityComparer<TLink> _equalityComparer =
30             ↪ EqualityComparer<TLink>.Default;
31
32         /// <summary>
33         /// <para>
34         /// Initializes a new <see cref="UniLinks"/> instance.
35         /// </para>
36         /// <para></para>
37         /// </summary>

```

```

34     /// <param name="links">
35     /// <para>A links.</para>
36     /// <para></para>
37     /// </param>
38     public UniLinks(ILinks<TLink> links) : base(links) { }
39
40     /// <summary>
41     /// <para>
42     /// The transition.
43     /// </para>
44     /// <para></para>
45     /// </summary>
46     private struct Transition
47     {
48         /// <summary>
49         /// <para>
50         /// The before.
51         /// </para>
52         /// <para></para>
53         /// </summary>
54         public IList<TLink> Before;
55         /// <summary>
56         /// <para>
57         /// The after.
58         /// </para>
59         /// <para></para>
60         /// </summary>
61         public IList<TLink> After;
62
63         /// <summary>
64         /// <para>
65         /// Initializes a new <see cref="Transition"/> instance.
66         /// </para>
67         /// <para></para>
68         /// </summary>
69         /// <param name="before">
70         /// <para>A before.</para>
71         /// <para></para>
72         /// </param>
73         /// <param name="after">
74         /// <para>A after.</para>
75         /// <para></para>
76         /// </param>
77         public Transition(IList<TLink> before, IList<TLink> after)
78         {
79             Before = before;
80             After = after;
81         }
82     }
83
84     //public static readonly TLink NullConstant = Use<LinksConstants<TLink>>.Single.Null;
85     //public static readonly IReadOnlyList<TLink> NullLink = new
86     ↪     ReadOnlyCollection<TLink>(new List<TLink> { NullConstant, NullConstant, NullConstant
87     ↪     });
88
89     // TODO: Подумать о том, как реализовать древовидный Restriction и Substitution
90     ↪     (Links-Expression)
91     /// <summary>
92     /// <para>
93     /// Triggers the restriction.
94     /// </para>
95     /// <para></para>
96     /// </summary>
97     /// <param name="restriction">
98     /// <para>The restriction.</para>
99     /// <para></para>
100    /// </param>
101    /// <param name="matchedHandler">
102    /// <para>The matched handler.</para>
103    /// <para></para>
104    /// </param>
105    /// <param name="substitution">
106    /// <para>The substitution.</para>
107    /// <para></para>
108    /// </param>
109    /// <param name="substitutedHandler">
110    /// <para>The substituted handler.</para>
111    /// <para></para>
112    /// </param>

```

```

109 /// </param>
110 /// <returns>
111 /// <para>The link</para>
112 /// <para></para>
113 /// </returns>
114 public TLink Trigger(IList<TLink> restriction, Func<IList<TLink>, IList<TLink>, TLink>
    ↳ matchedHandler, IList<TLink> substitution, Func<IList<TLink>, IList<TLink>, TLink>
    ↳ substitutedHandler)
115 {
116     ///List<Transition> transitions = null;
117     ///if (!restriction.IsNullOrEmpty())
118     ///{
119     ///    // Есть причина делать проход (чтение)
120     ///    if (matchedHandler != null)
121     ///    {
122     ///        if (!substitution.IsNullOrEmpty())
123     ///        {
124     ///            // restriction => { 0, 0, 0 } | { 0 } // Create
125     ///            // substitution => { itself, 0, 0 } | { itself, itself, itself } //
    ↳ Create / Update
126     ///            // substitution => { 0, 0, 0 } | { 0 } // Delete
127     ///            transitions = new List<Transition>();
128     ///            if (Equals(substitution[Constants.IndexPart], Constants.Null))
129     ///            {
130     ///                // If index is Null, that means we always ignore every other
    ↳ value (they are also Null by definition)
131     ///                var matchDecision = matchedHandler(, NullLink);
132     ///                if (Equals(matchDecision, Constants.Break))
133     ///                    return false;
134     ///                if (!Equals(matchDecision, Constants.Skip))
135     ///                    transitions.Add(new Transition(matchedLink, newValue));
136     ///            }
137     ///            else
138     ///            {
139     ///                Func<T, bool> handler;
140     ///                handler = link =>
141     ///                {
142     ///                    var matchedLink = Memory.GetLinkValue(link);
143     ///                    var newValue = Memory.GetLinkValue(link);
144     ///                    newValue[Constants.IndexPart] = Constants.Itself;
145     ///                    newValue[Constants.SourcePart] =
    ↳ Equals(substitution[Constants.SourcePart], Constants.Itself) ?
    ↳ matchedLink[Constants.IndexPart] : substitution[Constants.SourcePart];
146     ///                    newValue[Constants.TargetPart] =
    ↳ Equals(substitution[Constants.TargetPart], Constants.Itself) ?
    ↳ matchedLink[Constants.IndexPart] : substitution[Constants.TargetPart];
147     ///                    var matchDecision = matchedHandler(matchedLink, newValue);
148     ///                    if (Equals(matchDecision, Constants.Break))
149     ///                        return false;
150     ///                    if (!Equals(matchDecision, Constants.Skip))
151     ///                        transitions.Add(new Transition(matchedLink, newValue));
152     ///                    return true;
153     ///                };
154     ///                if (!Memory.Each(handler, restriction))
155     ///                    return Constants.Break;
156     ///            }
157     ///        }
158     ///        else
159     ///        {
160     ///            Func<T, bool> handler = link =>
161     ///            {
162     ///                var matchedLink = Memory.GetLinkValue(link);
163     ///                var matchDecision = matchedHandler(matchedLink, matchedLink);
164     ///                return !Equals(matchDecision, Constants.Break);
165     ///            };
166     ///            if (!Memory.Each(handler, restriction))
167     ///                return Constants.Break;
168     ///        }
169     ///    }
170     ///    else
171     ///    {
172     ///        if (substitution != null)
173     ///        {
174     ///            transitions = new List<IList<T>>();
175     ///            Func<T, bool> handler = link =>
176     ///            {
177     ///                var matchedLink = Memory.GetLinkValue(link);

```

```

178         transitions.Add(matchedLink);
179         return true;
180     };
181     if (!Memory.Each(handler, restriction))
182         return Constants.Break;
183     }
184     else
185     {
186         return Constants.Continue;
187     }
188 }
189 }
190 if (substitution != null)
191 {
192     // Есть причина делать замену (запись)
193     if (substitutedHandler != null)
194     {
195     }
196     else
197     {
198     }
199 }
200 return Constants.Continue;
201
202 //if (restriction.IsNullOrEmpty()) // Create
203 //{
204 //    substitution[Constants.IndexPart] = Memory.AllocateLink();
205 //    Memory.SetLinkValue(substitution);
206 //}
207 //else if (substitution.IsNullOrEmpty()) // Delete
208 //{
209 //    Memory.FreeLink(restriction[Constants.IndexPart]);
210 //}
211 //else if (restriction.EqualTo(substitution)) // Read or ("repeat" the state) // Each
212 //{
213 //    // No need to collect links to list
214 //    // Skip == Continue
215 //    // No need to check substitutedHandler
216 //    if (!Memory.Each(link => !Equals(matchedHandler(Memory.GetLinkValue(link)),
217 //        ↪ Constants.Break), restriction))
218 //        return Constants.Break;
219 //}
220 //else // Update
221 //{
222 //    //List<IList<T>> matchedLinks = null;
223 //    if (matchedHandler != null)
224 //    {
225 //        matchedLinks = new List<IList<T>>();
226 //        Func<T, bool> handler = link =>
227 //        {
228 //            var matchedLink = Memory.GetLinkValue(link);
229 //            var matchDecision = matchedHandler(matchedLink);
230 //            if (Equals(matchDecision, Constants.Break))
231 //                return false;
232 //            if (!Equals(matchDecision, Constants.Skip))
233 //                matchedLinks.Add(matchedLink);
234 //            return true;
235 //        };
236 //        if (!Memory.Each(handler, restriction))
237 //            return Constants.Break;
238 //    }
239 //    if (!matchedLinks.IsNullOrEmpty())
240 //    {
241 //        var totalMatchedLinks = matchedLinks.Count;
242 //        for (var i = 0; i < totalMatchedLinks; i++)
243 //        {
244 //            var matchedLink = matchedLinks[i];
245 //            if (substitutedHandler != null)
246 //            {
247 //                var newValue = new List<T>(); // TODO: Prepare value to update here
248 //                // TODO: Decide is it actually needed to use Before and After
249 //                ↪ substitution handling.
250 //                var substitutedDecision = substitutedHandler(matchedLink,
251 //                ↪ newValue);
252 //                if (Equals(substitutedDecision, Constants.Break))
253 //                    return Constants.Break;
254 //                if (Equals(substitutedDecision, Constants.Continue))

```

```

252         //          {
253         //              // Actual update here
254         //              Memory.SetLinkValue(newValue);
255         //          }
256         //          if (Equals(substitutedDecision, Constants.Skip))
257         //          {
258         //              // Cancel the update. TODO: decide use separate Cancel
259         //              ↪ constant or Skip is enough?
260         //          }
261         //      }
262         //  }
263     ///}
264     return _constants.Continue;
265 }
266
267 /// <summary>
268 /// <para>
269 /// Triggers the pattern or condition.
270 /// </para>
271 /// <para></para>
272 /// </summary>
273 /// <param name="patternOrCondition">
274 /// <para>The pattern or condition.</para>
275 /// <para></para>
276 /// </param>
277 /// <param name="matchHandler">
278 /// <para>The match handler.</para>
279 /// <para></para>
280 /// </param>
281 /// <param name="substitution">
282 /// <para>The substitution.</para>
283 /// <para></para>
284 /// </param>
285 /// <param name="substitutionHandler">
286 /// <para>The substitution handler.</para>
287 /// <para></para>
288 /// </param>
289 /// <exception cref="NotImplementedException">
290 /// <para></para>
291 /// <para></para>
292 /// </exception>
293 /// <exception cref="NotSupportedException">
294 /// <para></para>
295 /// <para></para>
296 /// </exception>
297 /// <exception cref="NotSupportedException">
298 /// <para></para>
299 /// <para></para>
300 /// </exception>
301 /// <exception cref="NotSupportedException">
302 /// <para></para>
303 /// <para></para>
304 /// </exception>
305 /// <exception cref="NotSupportedException">
306 /// <para></para>
307 /// <para></para>
308 /// </exception>
309 /// <returns>
310 /// <para>The link</para>
311 /// <para></para>
312 /// </returns>
313 public TLink Trigger(IList<TLink> patternOrCondition, Func<IList<TLink>, TLink>
    ↪ matchHandler, IList<TLink> substitution, Func<IList<TLink>, IList<TLink>, TLink>
    ↪ substitutionHandler)
314 {
315     var constants = _constants;
316     if (patternOrCondition.IsNullOrEmpty() && substitution.IsNullOrEmpty())
317     {
318         return constants.Continue;
319     }
320     else if (patternOrCondition.EqualTo(substitution)) // Should be Each here TODO:
321     ↪ Check if it is a correct condition
322     {
323         // Or it only applies to trigger without matchHandler.
324         throw new NotImplementedException();
325     }
    else if (!substitution.IsNullOrEmpty()) // Creation

```

```

326 {
327     var before = Array.Empty<TLink>();
328     // Что должно означать False здесь? Остановиться (перестать идти) или пропустить
329     //   ↳ (пройти мимо) или пустить (взять)?
330     if (matchHandler != null && _equalityComparer.Equals(matchHandler(before),
331     //   ↳ constants.Break))
332     {
333         return constants.Break;
334     }
335     var after = (IList<TLink>)substitution.ToArray();
336     if (_equalityComparer.Equals(after[0], default))
337     {
338         var newLink = _links.Create();
339         after[0] = newLink;
340     }
341     if (substitution.Count == 1)
342     {
343         after = _links.GetLink(substitution[0]);
344     }
345     else if (substitution.Count == 3)
346     {
347         //Links.Create(after);
348     }
349     else
350     {
351         throw new NotSupportedException();
352     }
353     if (matchHandler != null)
354     {
355         return substitutionHandler(before, after);
356     }
357     return constants.Continue;
358 }
359 else if (!patternOrCondition.IsNullOrEmpty()) // Deletion
360 {
361     if (patternOrCondition.Count == 1)
362     {
363         var linkToDelete = patternOrCondition[0];
364         var before = _links.GetLink(linkToDelete);
365         if (matchHandler != null && _equalityComparer.Equals(matchHandler(before),
366         //   ↳ constants.Break))
367         {
368             return constants.Break;
369         }
370         var after = Array.Empty<TLink>();
371         _links.Update(linkToDelete, constants.Null, constants.Null);
372         _links.Delete(linkToDelete);
373         if (matchHandler != null)
374         {
375             return substitutionHandler(before, after);
376         }
377         return constants.Continue;
378     }
379     else
380     {
381         throw new NotSupportedException();
382     }
383 }
384 else // Replace / Update
385 {
386     if (patternOrCondition.Count == 1) //-V3125
387     {
388         var linkToUpdate = patternOrCondition[0];
389         var before = _links.GetLink(linkToUpdate);
390         if (matchHandler != null && _equalityComparer.Equals(matchHandler(before),
391         //   ↳ constants.Break))
392         {
393             return constants.Break;
394         }
395         var after = (IList<TLink>)substitution.ToArray(); //-V3125
396         if (_equalityComparer.Equals(after[0], default))
397         {
398             after[0] = linkToUpdate;
399         }
400         if (substitution.Count == 1)
401         {
402             if (!_equalityComparer.Equals(substitution[0], linkToUpdate))
403             {

```





```

11  /// <para>.</para>
12  /// <para>.</para>
13  /// </summary>
14  /// <typeparam>
15  /// <para>.</para>
16  /// <para>.</para>
17  /// </typeparam>
18  public struct Doublet<T> : IEquatable<Doublet<T>>
19  {
20      /// <summary>
21      /// <para>
22      /// The default.
23      /// </para>
24      /// <para></para>
25      /// </summary>
26      private static readonly EqualityComparer<T> _equalityComparer =
27          ↳ EqualityComparer<T>.Default;
28      /// <summary>
29      /// <para>.</para>
30      /// <para>.</para>
31      /// </summary>
32      /// <typeparam name="T">
33      /// <para>.</para>
34      /// <para>.</para>
35      /// </typeparam>
36      public readonly T Source;
37
38      /// <summary>
39      /// <para>.</para>
40      /// <para>.</para>
41      /// </summary>
42      /// <typeparam name="T">
43      /// <para>.</para>
44      /// <para>.</para>
45      /// </typeparam>
46      public readonly T Target;
47
48      /// <summary>
49      /// <para>.</para>
50      /// <para>.</para>
51      /// </summary>
52      /// <typeparam name="T">
53      /// <para>.</para>
54      /// <para>.</para>
55      /// </typeparam>
56      /// <param name="source">
57      /// <para>.</para>
58      /// <para>.</para>
59      /// </param>
60      /// <param name="target">
61      /// <para>.</para>
62      /// <para>.</para>
63      /// </param>
64      [MethodImpl(MethodImplOptions.AggressiveInlining)]
65      public Doublet(T source, T target)
66      {
67          Source = source;
68          Target = target;
69      }
70
71      /// <summary>
72      /// <para>.</para>
73      /// <para>.</para>
74      /// </summary>
75      /// <returns>
76      /// <para>.</para>
77      /// <para>.</para>
78      /// </returns>
79      [MethodImpl(MethodImplOptions.AggressiveInlining)]
80      public override string ToString() => $"{Source}->{Target}";
81
82      /// <summary>
83      /// <para>.</para>
84      /// <para>.</para>
85      /// </summary>
86      /// <typeparam>
87      /// <para>.</para>

```

```

88     /// <para>.</para>
89     /// </typeparam>
90     /// <param name="other">
91     /// <para>.</para>
92     /// <para>.</para>
93     /// </param>
94     /// <returns>
95     /// <para>.</para>
96     /// <para>.</para>
97     /// </returns>
98     [MethodImpl(MethodImplOptions.AggressiveInlining)]
99     public bool Equals(Doublet<T> other) => _equalityComparer.Equals(Source, other.Source)
    ↳ && _equalityComparer.Equals(Target, other.Target);

100
101     /// <summury>
102     /// <para>.</para>
103     /// <para>.</para>
104     /// </summury>
105     /// <typeparam>
106     /// <para>.</para>
107     /// <para>.</para>
108     /// </typeparam>
109     /// <param name="obj">
110     /// <para>.</para>
111     /// <para>.</para>
112     /// </param>
113     /// <returns>
114     /// <para>.</para>
115     /// <para>.</para>
116     /// </returns>
117     [MethodImpl(MethodImplOptions.AggressiveInlining)]
118     public override bool Equals(object obj) => obj is Doublet<T> doublet ?
    ↳ base.Equals(doublet) : false;

119
120     /// <summury>
121     /// <para>.</para>
122     /// <para>.</para>
123     /// </summury>
124     /// <returns>
125     /// <para>.</para>
126     /// <para>.</para>
127     /// </returns>
128     [MethodImpl(MethodImplOptions.AggressiveInlining)]
129     public override int GetHashCode() => (Source, Target).GetHashCode();

130
131     /// <summury>
132     /// <para>.</para>
133     /// <para>.</para>
134     /// </summury>
135     /// <param name="left">
136     /// <para>.</para>
137     /// <para>.</para>
138     /// </param>
139     /// <param name="right">
140     /// <para>.</para>
141     /// <para>.</para>
142     /// </param>
143     /// <returns>
144     /// <para>.</para>
145     /// <para>.</para>
146     /// </returns>
147     [MethodImpl(MethodImplOptions.AggressiveInlining)]
148     public static bool operator ==(Doublet<T> left, Doublet<T> right) => left.Equals(right);

149
150     /// <summury>
151     /// <para>.</para>
152     /// <para>.</para>
153     /// </summury>
154     /// <param name="left">
155     /// <para>.</para>
156     /// <para>.</para>
157     /// </param>
158     /// <param name="right">
159     /// <para>.</para>
160     /// <para>.</para>
161     /// </param>
162     /// <returns>
163     /// <para>.</para>

```

```

164     /// <para>.</para>
165     /// </returns>
166     [MethodImpl(MethodImplOptions.AggressiveInlining)]
167     public static bool operator !=(Doublet<T> left, Doublet<T> right) => !(left == right);
168 }
169 }

```

## 1.18 ./csharp/Platform.Data.Doublets/DoubletComparer.cs

```

1 using System.Collections.Generic;
2 using System.Runtime.CompilerServices;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6 namespace Platform.Data.Doublets
7 {
8     /// <remarks>
9     /// TODO: Может стоит попробовать ref во всех методах (IRefEqualityComparer)
10    /// 2x faster with comparer
11    /// </remarks>
12    public class DoubletComparer<T> : IEqualityComparer<Doublet<T>>
13    {
14        /// <summary>
15        /// <para>
16        /// The .
17        /// </para>
18        /// <para></para>
19        /// </summary>
20        public static readonly DoubletComparer<T> Default = new DoubletComparer<T>();
21
22        /// <summary>
23        /// <para>
24        /// Determines whether this instance equals.
25        /// </para>
26        /// <para></para>
27        /// </summary>
28        /// <param name="x">
29        /// <para>The .</para>
30        /// <para></para>
31        /// </param>
32        /// <param name="y">
33        /// <para>The .</para>
34        /// <para></para>
35        /// </param>
36        /// <returns>
37        /// <para>The bool</para>
38        /// <para></para>
39        /// </returns>
40        [MethodImpl(MethodImplOptions.AggressiveInlining)]
41        public bool Equals(Doublet<T> x, Doublet<T> y) => x.Equals(y);
42
43        /// <summary>
44        /// <para>
45        /// Gets the hash code using the specified obj.
46        /// </para>
47        /// <para></para>
48        /// </summary>
49        /// <param name="obj">
50        /// <para>The obj.</para>
51        /// <para></para>
52        /// </param>
53        /// <returns>
54        /// <para>The int</para>
55        /// <para></para>
56        /// </returns>
57        [MethodImpl(MethodImplOptions.AggressiveInlining)]
58        public int GetHashCode(Doublet<T> obj) => obj.GetHashCode();
59    }
60 }

```

## 1.19 ./csharp/Platform.Data.Doublets/ILinks.cs

```

1 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
2
3 using System.Collections.Generic;
4
5 namespace Platform.Data.Doublets
6 {
7     /// <summary>
8     /// <para>

```

```

9     /// Defines the links.
10    /// </para>
11    /// <para></para>
12    /// </summary>
13    /// <seealso cref="ILinks{TLink, LinksConstants{TLink}}"/>
14    public interface ILinks<TLink> : ILinks<TLink, LinksConstants<TLink>>
15    {
16    }
17 }

```

## 1.20 ./csharp/Platform.Data.Doublets/ILinksExtensions.cs

```

1  using System;
2  using System.Collections;
3  using System.Collections.Generic;
4  using System.Linq;
5  using System.Runtime.CompilerServices;
6  using Platform.Ranges;
7  using Platform.Collections.Arrays;
8  using Platform.Random;
9  using Platform.Setters;
10 using Platform.Converters;
11 using Platform.Numbers;
12 using Platform.Data.Exceptions;
13 using Platform.Data.Doublets.Decorators;
14
15 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
16
17 namespace Platform.Data.Doublets
18 {
19     /// <summary>
20     /// <para>
21     /// Represents the links extensions.
22     /// </para>
23     /// <para></para>
24     /// </summary>
25     public static class ILinksExtensions
26     {
27         /// <summary>
28         /// <para>
29         /// Runs the random creations using the specified links.
30         /// </para>
31         /// <para></para>
32         /// </summary>
33         /// <typeparam name="TLink">
34         /// <para>The link.</para>
35         /// <para></para>
36         /// </typeparam>
37         /// <param name="links">
38         /// <para>The links.</para>
39         /// <para></para>
40         /// </param>
41         /// <param name="amountOfCreations">
42         /// <para>The amount of creations.</para>
43         /// <para></para>
44         /// </param>
45         [MethodImpl(MethodImplOptions.AggressiveInlining)]
46         public static void RunRandomCreations<TLink>(this ILinks<TLink> links, ulong
47             ↪ amountOfCreations)
48         {
49             var random = RandomHelpers.Default;
50             var addressToUInt64Converter = UncheckedConverter<TLink, ulong>.Default;
51             var uint64ToAddressConverter = UncheckedConverter<ulong, TLink>.Default;
52             for (var i = 0UL; i < amountOfCreations; i++)
53             {
54                 var linksAddressRange = new Range<ulong>(0,
55                     ↪ addressToUInt64Converter.Convert(links.Count()));
56                 var source =
57                     ↪ uint64ToAddressConverter.Convert(random.NextUInt64(linksAddressRange));
58                 var target =
59                     ↪ uint64ToAddressConverter.Convert(random.NextUInt64(linksAddressRange));
60                 links.GetOrCreate(source, target);
61             }
62         }
63
64         /// <summary>
65         /// <para>
66         /// Runs the random searches using the specified links.
67         /// </para>
68         /// <para></para>
69         /// </summary>

```

```

65     /// </summary>
66     /// <typeparam name="TLink">
67     /// <para>The link.</para>
68     /// <para></para>
69     /// </typeparam>
70     /// <param name="links">
71     /// <para>The links.</para>
72     /// <para></para>
73     /// </param>
74     /// <param name="amountOfSearches">
75     /// <para>The amount of searches.</para>
76     /// <para></para>
77     /// </param>
78     [MethodImpl(MethodImplOptions.AggressiveInlining)]
79     public static void RunRandomSearches<TLink>(this ILinks<TLink> links, ulong
        ↳ amountOfSearches)
80     {
81         var random = RandomHelpers.Default;
82         var addressToUInt64Converter = UncheckedConverter<TLink, ulong>.Default;
83         var uint64ToAddressConverter = UncheckedConverter<ulong, TLink>.Default;
84         for (var i = 0UL; i < amountOfSearches; i++)
85         {
86             var linksAddressRange = new Range<ulong>(0,
        ↳ addressToUInt64Converter.Convert(links.Count()));
87             var source =
        ↳ uint64ToAddressConverter.Convert(random.NextUInt64(linksAddressRange));
88             var target =
        ↳ uint64ToAddressConverter.Convert(random.NextUInt64(linksAddressRange));
89             links.SearchOrDefault(source, target);
90         }
91     }
92
93     /// <summary>
94     /// <para>
95     /// Runs the random deletions using the specified links.
96     /// </para>
97     /// <para></para>
98     /// </summary>
99     /// <typeparam name="TLink">
100    /// <para>The link.</para>
101    /// <para></para>
102    /// </typeparam>
103    /// <param name="links">
104    /// <para>The links.</para>
105    /// <para></para>
106    /// </param>
107    /// <param name="amountOfDeletions">
108    /// <para>The amount of deletions.</para>
109    /// <para></para>
110    /// </param>
111    [MethodImpl(MethodImplOptions.AggressiveInlining)]
112    public static void RunRandomDeletions<TLink>(this ILinks<TLink> links, ulong
        ↳ amountOfDeletions)
113    {
114        var random = RandomHelpers.Default;
115        var addressToUInt64Converter = UncheckedConverter<TLink, ulong>.Default;
116        var uint64ToAddressConverter = UncheckedConverter<ulong, TLink>.Default;
117        var linksCount = addressToUInt64Converter.Convert(links.Count());
118        var min = amountOfDeletions > linksCount ? 0UL : linksCount - amountOfDeletions;
119        for (var i = 0UL; i < amountOfDeletions; i++)
120        {
121            linksCount = addressToUInt64Converter.Convert(links.Count());
122            if (linksCount <= min)
123            {
124                break;
125            }
126            var linksAddressRange = new Range<ulong>(min, linksCount);
127            var link =
        ↳ uint64ToAddressConverter.Convert(random.NextUInt64(linksAddressRange));
128            links.Delete(link);
129        }
130    }
131
132    /// <summary>
133    /// <para>
134    /// Deletes the links.
135    /// </para>
136    /// <para></para>

```

```

137     /// </summary>
138     /// <typeparam name="TLink">
139     /// <para>The link.</para>
140     /// <para></para>
141     /// </typeparam>
142     /// <param name="links">
143     /// <para>The links.</para>
144     /// <para></para>
145     /// </param>
146     /// <param name="linkToDelete">
147     /// <para>The link to delete.</para>
148     /// <para></para>
149     /// </param>
150     [MethodImpl(MethodImplOptions.AggressiveInlining)]
151     public static void Delete<TLink>(this ILinks<TLink> links, TLink linkToDelete)
152     {
153         if (links.Exists(linkToDelete))
154         {
155             links.EnforceResetValues(linkToDelete);
156             links.Delete(new LinkAddress<TLink>(linkToDelete));
157         }
158     }
159
160     /// <remarks>
161     /// TODO: Возможно есть очень простой способ это сделать.
162     /// (Например просто удалить файл, или изменить его размер таким образом,
163     /// чтобы удалился весь контент)
164     /// Например через _header->AllocatedLinks в ResizableDirectMemoryLinks
165     /// </remarks>
166     [MethodImpl(MethodImplOptions.AggressiveInlining)]
167     public static void DeleteAll<TLink>(this ILinks<TLink> links)
168     {
169         var equalityComparer = EqualityComparer<TLink>.Default;
170         var comparer = Comparer<TLink>.Default;
171         for (var i = links.Count(); comparer.Compare(i, default) > 0; i =
172             ↪ Arithmetic.Decrement(i))
173         {
174             links.Delete(i);
175             if (!equalityComparer.Equals(links.Count(), Arithmetic.Decrement(i)))
176             {
177                 i = links.Count();
178             }
179         }
180
181         /// <summary>
182         /// <para>
183         /// Firsts the links.
184         /// </para>
185         /// <para></para>
186         /// </summary>
187         /// <typeparam name="TLink">
188         /// <para>The link.</para>
189         /// <para></para>
190         /// </typeparam>
191         /// <param name="links">
192         /// <para>The links.</para>
193         /// <para></para>
194         /// </param>
195         /// <exception cref="InvalidOperationException">
196         /// <para>В процессе поиска по хранилищу не было найдено связей.</para>
197         /// <para></para>
198         /// </exception>
199         /// <exception cref="InvalidOperationException">
200         /// <para>В хранилище нет связей.</para>
201         /// <para></para>
202         /// </exception>
203         /// <returns>
204         /// <para>The first link.</para>
205         /// <para></para>
206         /// </returns>
207     [MethodImpl(MethodImplOptions.AggressiveInlining)]
208     public static TLink First<TLink>(this ILinks<TLink> links)
209     {
210         TLink firstLink = default;
211         var equalityComparer = EqualityComparer<TLink>.Default;
212         if (equalityComparer.Equals(links.Count(), default))
213         {

```

```

214         throw new InvalidOperationException("В хранилище нет связей.");
215     }
216     links.Each(links.Constants.Any, links.Constants.Any, link =>
217     {
218         firstLink = link[links.Constants.IndexPart];
219         return links.Constants.Break;
220     });
221     if (equalityComparer.Equals(firstLink, default))
222     {
223         throw new InvalidOperationException("В процессе поиска по хранилищу не было
224             ↳ найдено связей.");
225     }
226     return firstLink;
227 }
228
229 /// <summary>
230 /// <para>
231 /// Singles the or default using the specified links.
232 /// </para>
233 /// <para></para>
234 /// </summary>
235 /// <typeparam name="TLink">
236 /// <para>The link.</para>
237 /// <para></para>
238 /// </typeparam>
239 /// <param name="links">
240 /// <para>The links.</para>
241 /// <para></para>
242 /// </param>
243 /// <param name="query">
244 /// <para>The query.</para>
245 /// <para></para>
246 /// </param>
247 /// <returns>
248 /// <para>The result.</para>
249 /// <para></para>
250 /// </returns>
251 [MethodImpl(MethodImplOptions.AggressiveInlining)]
252 public static IList<TLink> SingleOrDefault<TLink>(this ILinks<TLink> links, IList<TLink>
253     ↳ query)
254 {
255     IList<TLink> result = null;
256     var count = 0;
257     var constants = links.Constants;
258     var @continue = constants.Continue;
259     var @break = constants.Break;
260     links.Each(linkHandler, query);
261     return result;
262
263     TLink linkHandler(IList<TLink> link)
264     {
265         if (count == 0)
266         {
267             result = link;
268             count++;
269             return @continue;
270         }
271         else
272         {
273             result = null;
274             return @break;
275         }
276     }
277 }
278
279 #region Paths
280
281 /// <remarks>
282 /// TODO: Как так? Как то что ниже может быть корректно?
283 /// Скорее всего практически не применимо
284 /// Предполагалось, что можно было конвертировать формируемый в проходе через
285     ↳ SequenceWalker
286     Stack в конкретный путь из Source, Target до связи, но это не всегда так.
287     TODO: Возможно нужен метод, который именно выбрасывает исключения (EnsurePathExists)
288     </remarks>
289 [MethodImpl(MethodImplOptions.AggressiveInlining)]
290 public static bool CheckPathExistance<TLink>(this ILinks<TLink> links, params TLink[]
291     ↳ path)
292 {

```

```

289     var current = path[0];
290     //EnsureLinkExists(current, "path");
291     if (!links.Exists(current))
292     {
293         return false;
294     }
295     var equalityComparer = EqualityComparer<TLink>.Default;
296     var constants = links.Constants;
297     for (var i = 1; i < path.Length; i++)
298     {
299         var next = path[i];
300         var values = links.GetLink(current);
301         var source = values[constants.SourcePart];
302         var target = values[constants.TargetPart];
303         if (equalityComparer.Equals(source, target) && equalityComparer.Equals(source,
304             ↪ next))
305         {
306             //throw new InvalidOperationException(string.Format("Невозможно выбрать
307             ↪ путь, так как и Source и Target совпадают с элементом пути {0}.", next));
308             return false;
309         }
310         if (!equalityComparer.Equals(next, source) && !equalityComparer.Equals(next,
311             ↪ target))
312         {
313             //throw new InvalidOperationException(string.Format("Невозможно продолжить
314             ↪ путь через элемент пути {0}", next));
315             return false;
316         }
317         current = next;
318     }
319     return true;
320 }
321
322 /// <remarks>
323 /// Может потребовать дополнительного стека для PathElement's при использовании
324 ↪ SequenceWalker.
325 /// </remarks>
326 [MethodImpl(MethodImplOptions.AggressiveInlining)]
327 public static TLink GetByKeyes<TLink>(this ILinks<TLink> links, TLink root, params int[]
328 ↪ path)
329 {
330     links.EnsureLinkExists(root, "root");
331     var currentLink = root;
332     for (var i = 0; i < path.Length; i++)
333     {
334         currentLink = links.GetLink(currentLink)[path[i]];
335     }
336     return currentLink;
337 }
338
339 /// <summary>
340 /// <para>
341 /// Gets the square matrix sequence element by index using the specified links.
342 /// </para>
343 /// <para></para>
344 /// </summary>
345 /// <typeparam name="TLink">
346 /// <para>The link.</para>
347 /// <para></para>
348 /// </typeparam>
349 /// <param name="links">
350 /// <para>The links.</para>
351 /// <para></para>
352 /// </param>
353 /// <param name="root">
354 /// <para>The root.</para>
355 /// <para></para>
356 /// </param>
357 /// <param name="size">
358 /// <para>The size.</para>
359 /// <para></para>
360 /// </param>
361 /// <param name="index">
362 /// <para>The index.</para>
363 /// <para></para>
364 /// </param>
365 /// <exception cref="ArgumentOutOfRangeException">
366 /// <para>Sequences with sizes other than powers of two are not supported.</para>

```



```

361 /// <para></para>
362 /// </exception>
363 /// <returns>
364 /// <para>The current link.</para>
365 /// <para></para>
366 /// </returns>
367 [MethodImpl(MethodImplOptions.AggressiveInlining)]
368 public static TLink GetSquareMatrixSequenceElementByIndex<TLink>(this ILinks<TLink>
    ↳ links, TLink root, ulong size, ulong index)
369 {
370     var constants = links.Constants;
371     var source = constants.SourcePart;
372     var target = constants.TargetPart;
373     if (!Platform.Numbers.Math.IsPowerOfTwo(size))
374     {
375         throw new ArgumentOutOfRangeException(nameof(size), "Sequences with sizes other
            ↳ than powers of two are not supported.");
376     }
377     var path = new BitArray(BitConverter.GetBytes(index));
378     var length = Bit.GetLowestPosition(size);
379     links.EnsureLinkExists(root, "root");
380     var currentLink = root;
381     for (var i = length - 1; i >= 0; i--)
382     {
383         currentLink = links.GetLink(currentLink)[path[i] ? target : source];
384     }
385     return currentLink;
386 }
387
388 #endregion
389
390 /// <summary>
391 /// Возвращает индекс указанной связи.
392 /// </summary>
393 /// <param name="links">Хранилище связей.</param>
394 /// <param name="link">Связь представленная списком, состоящим из её адреса и
    ↳ содержимого.</param>
395 /// <returns>Индекс начальной связи для указанной связи.</returns>
396 [MethodImpl(MethodImplOptions.AggressiveInlining)]
397 public static TLink GetIndex<TLink>(this ILinks<TLink> links, IList<TLink> link) =>
    ↳ link[links.Constants.IndexPart];
398
399 /// <summary>
400 /// Возвращает индекс начальной (Source) связи для указанной связи.
401 /// </summary>
402 /// <param name="links">Хранилище связей.</param>
403 /// <param name="link">Индекс связи.</param>
404 /// <returns>Индекс начальной связи для указанной связи.</returns>
405 [MethodImpl(MethodImplOptions.AggressiveInlining)]
406 public static TLink GetSource<TLink>(this ILinks<TLink> links, TLink link) =>
    ↳ links.GetLink(link)[links.Constants.SourcePart];
407
408 /// <summary>
409 /// Возвращает индекс начальной (Source) связи для указанной связи.
410 /// </summary>
411 /// <param name="links">Хранилище связей.</param>
412 /// <param name="link">Связь представленная списком, состоящим из её адреса и
    ↳ содержимого.</param>
413 /// <returns>Индекс начальной связи для указанной связи.</returns>
414 [MethodImpl(MethodImplOptions.AggressiveInlining)]
415 public static TLink GetSource<TLink>(this ILinks<TLink> links, IList<TLink> link) =>
    ↳ link[links.Constants.SourcePart];
416
417 /// <summary>
418 /// Возвращает индекс конечной (Target) связи для указанной связи.
419 /// </summary>
420 /// <param name="links">Хранилище связей.</param>
421 /// <param name="link">Индекс связи.</param>
422 /// <returns>Индекс конечной связи для указанной связи.</returns>
423 [MethodImpl(MethodImplOptions.AggressiveInlining)]
424 public static TLink GetTarget<TLink>(this ILinks<TLink> links, TLink link) =>
    ↳ links.GetLink(link)[links.Constants.TargetPart];
425
426 /// <summary>
427 /// Возвращает индекс конечной (Target) связи для указанной связи.
428 /// </summary>
429 /// <param name="links">Хранилище связей.</param>

```

```

430 /// <param name="link">Связь представленная списком, состоящим из её адреса и
431   ↳ содержимого.</param>
432 /// <returns>Индекс конечной связи для указанной связи.</returns>
433 [MethodImpl(MethodImplOptions.AggressiveInlining)]
434 public static TLink GetTarget<TLink>(this ILinks<TLink> links, IList<TLink> link) =>
435   ↳ link[links.Constants.TargetPart];
436
437 /// <summary>
438 /// Выполняет проход по всем связям, соответствующим шаблону, вызывая обработчик
439   ↳ (handler) для каждой подходящей связи.
440 /// </summary>
441 /// <param name="links">Хранилище связей.</param>
442 /// <param name="handler">Обработчик каждой подходящей связи.</param>
443 /// <param name="restrictions">Ограничения на содержимое связей. Каждое ограничение
444   ↳ может иметь значения: Constants.Null - 0-я связь, обозначающая ссылку на пустоту,
445   ↳ Any - отсутствие ограничения, 1..∞ конкретный адрес связи.</param>
446 /// <returns>True, в случае если проход по связям не был прерван и False в обратном
447   ↳ случае.</returns>
448 [MethodImpl(MethodImplOptions.AggressiveInlining)]
449 public static bool Each<TLink>(this ILinks<TLink> links, Func<IList<TLink>, TLink>
450   ↳ handler, params TLink[] restrictions)
451   => EqualityComparer<TLink>.Default.Equals(links.Each(handler, restrictions),
452     ↳ links.Constants.Continue);
453
454 /// <summary>
455 /// Выполняет проход по всем связям, соответствующим шаблону, вызывая обработчик
456   ↳ (handler) для каждой подходящей связи.
457 /// </summary>
458 /// <param name="links">Хранилище связей.</param>
459 /// <param name="source">Значение, определяющее соответствующие шаблону связи.
460   ↳ (Constants.Null - 0-я связь, обозначающая ссылку на пустоту в качестве начала,
461   ↳ Constants.Any - любое начало, 1..∞ конкретное начало)</param>
462 /// <param name="target">Значение, определяющее соответствующие шаблону связи.
463   ↳ (Constants.Null - 0-я связь, обозначающая ссылку на пустоту в качестве конца,
464   ↳ Constants.Any - любой конец, 1..∞ конкретный конец)</param>
465 /// <param name="handler">Обработчик каждой подходящей связи.</param>
466 /// <returns>True, в случае если проход по связям не был прерван и False в обратном
467   ↳ случае.</returns>
468 [MethodImpl(MethodImplOptions.AggressiveInlining)]
469 public static bool Each<TLink>(this ILinks<TLink> links, TLink source, TLink target,
470   ↳ Func<TLink, bool> handler)
471 {
472     var constants = links.Constants;
473     return links.Each(link => handler(link[constants.IndexPart]) ? constants.Continue :
474       ↳ constants.Break, constants.Any, source, target);
475 }
476
477 /// <summary>
478 /// Выполняет проход по всем связям, соответствующим шаблону, вызывая обработчик
479   ↳ (handler) для каждой подходящей связи.
480 /// </summary>
481 /// <param name="links">Хранилище связей.</param>
482 /// <param name="source">Значение, определяющее соответствующие шаблону связи.
483   ↳ (Constants.Null - 0-я связь, обозначающая ссылку на пустоту в качестве начала,
484   ↳ Constants.Any - любое начало, 1..∞ конкретное начало)</param>
485 /// <param name="target">Значение, определяющее соответствующие шаблону связи.
486   ↳ (Constants.Null - 0-я связь, обозначающая ссылку на пустоту в качестве конца,
487   ↳ Constants.Any - любой конец, 1..∞ конкретный конец)</param>
488 /// <param name="handler">Обработчик каждой подходящей связи.</param>
489 /// <returns>True, в случае если проход по связям не был прерван и False в обратном
490   ↳ случае.</returns>
491 [MethodImpl(MethodImplOptions.AggressiveInlining)]
492 public static bool Each<TLink>(this ILinks<TLink> links, TLink source, TLink target,
493   ↳ Func<IList<TLink>, TLink> handler) => links.Each(handler, links.Constants.Any,
494   ↳ source, target);
495
496 /// <summary>
497 /// <para>
498 /// Alls the links.
499 /// </para>
500 /// <para></para>
501 /// </summary>
502 /// <typeparam name="TLink">
503 /// <para>The link.</para>
504 /// <para></para>
505 /// </typeparam>

```

```

482    /// <param name="links">
483    /// <para>The links.</para>
484    /// <para></para>
485    /// </param>
486    /// <param name="restrictions">
487    /// <para>The restrictions.</para>
488    /// <para></para>
489    /// </param>
490    /// <returns>
491    /// <para>A list of i list t link</para>
492    /// <para></para>
493    /// </returns>
494    [MethodImpl(MethodImplOptions.AggressiveInlining)]
495    public static IList<IList<TLink>> All<TLink>(this ILinks<TLink> links, params TLink[]
    ↪ restrictions)
496    {
497        var arraySize = CheckedConverter<TLink,
    ↪ ulong>.Default.Convert(links.Count(restrictions));
498        if (arraySize > 0)
499        {
500            var array = new IList<TLink>[arraySize];
501            var filler = new ArrayFiller<IList<TLink>, TLink>(array,
    ↪ links.Constants.Continue);
502            links.Each(filler.AddAndReturnConstant, restrictions);
503            return array;
504        }
505        else
506        {
507            return Array.Empty<IList<TLink>>();
508        }
509    }
510
511    /// <summary>
512    /// <para>
513    /// Alls the indices using the specified links.
514    /// </para>
515    /// <para></para>
516    /// </summary>
517    /// <typeparam name="TLink">
518    /// <para>The link.</para>
519    /// <para></para>
520    /// </typeparam>
521    /// <param name="links">
522    /// <para>The links.</para>
523    /// <para></para>
524    /// </param>
525    /// <param name="restrictions">
526    /// <para>The restrictions.</para>
527    /// <para></para>
528    /// </param>
529    /// <returns>
530    /// <para>A list of t link</para>
531    /// <para></para>
532    /// </returns>
533    [MethodImpl(MethodImplOptions.AggressiveInlining)]
534    public static IList<TLink> AllIndices<TLink>(this ILinks<TLink> links, params TLink[]
    ↪ restrictions)
535    {
536        var arraySize = CheckedConverter<TLink,
    ↪ ulong>.Default.Convert(links.Count(restrictions));
537        if (arraySize > 0)
538        {
539            var array = new TLink[arraySize];
540            var filler = new ArrayFiller<TLink, TLink>(array, links.Constants.Continue);
541            links.Each(filler.AddFirstAndReturnConstant, restrictions);
542            return array;
543        }
544        else
545        {
546            return Array.Empty<TLink>();
547        }
548    }
549
550    /// <summary>
551    /// Возвращает значение, определяющее существует ли связь с указанными началом и концом
    ↪ в хранилище связей.
552    /// </summary>
553    /// <param name="links">Хранилище связей.</param>

```

```

554 /// <param name="source">Начало связи.</param>
555 /// <param name="target">Конец связи.</param>
556 /// <returns>Значение, определяющее существует ли связь.</returns>
557 [MethodImpl(MethodImplOptions.AggressiveInlining)]
558 public static bool Exists<TLink>(this ILinks<TLink> links, TLink source, TLink target)
    ↳ => Comparer<TLink>.Default.Compare(links.Count(links.Constants.Any, source, target),
    ↳ default) > 0;

559
560 #region Ensure
561 // TODO: May be move to EnsureExtensions or make it both there and here
562
563 /// <summary>
564 /// <para>
565 /// Ensures the link exists using the specified links.
566 /// </para>
567 /// <para></para>
568 /// </summary>
569 /// <typeparam name="TLink">
570 /// <para>The link.</para>
571 /// <para></para>
572 /// </typeparam>
573 /// <param name="links">
574 /// <para>The links.</para>
575 /// <para></para>
576 /// </param>
577 /// <param name="restrictions">
578 /// <para>The restrictions.</para>
579 /// <para></para>
580 /// </param>
581 /// <exception cref="ArgumentLinkDoesNotExistsException{TLink}">
582 /// <para>sequence[{i}]</para>
583 /// <para></para>
584 /// </exception>
585 [MethodImpl(MethodImplOptions.AggressiveInlining)]
586 public static void EnsureLinkExists<TLink>(this ILinks<TLink> links, IList<TLink>
    ↳ restrictions)
587 {
588     for (var i = 0; i < restrictions.Count; i++)
589     {
590         if (!links.Exists(restrictions[i]))
591         {
592             throw new ArgumentLinkDoesNotExistsException<TLink>(restrictions[i],
    ↳ $"sequence[{i}]");
593         }
594     }
595 }
596
597 /// <summary>
598 /// <para>
599 /// Ensures the inner reference exists using the specified links.
600 /// </para>
601 /// <para></para>
602 /// </summary>
603 /// <typeparam name="TLink">
604 /// <para>The link.</para>
605 /// <para></para>
606 /// </typeparam>
607 /// <param name="links">
608 /// <para>The links.</para>
609 /// <para></para>
610 /// </param>
611 /// <param name="reference">
612 /// <para>The reference.</para>
613 /// <para></para>
614 /// </param>
615 /// <param name="argumentName">
616 /// <para>The argument name.</para>
617 /// <para></para>
618 /// </param>
619 /// <exception cref="ArgumentLinkDoesNotExistsException{TLink}">
620 /// <para></para>
621 /// <para></para>
622 /// </exception>
623 [MethodImpl(MethodImplOptions.AggressiveInlining)]
624 public static void EnsureInnerReferenceExists<TLink>(this ILinks<TLink> links, TLink
    ↳ reference, string argumentName)
625 {

```

```

626         if (links.Constants.IsInternalReference(reference) && !links.Exists(reference))
627         {
628             throw new ArgumentLinkDoesNotExistsException<TLink>(reference, argumentName);
629         }
630     }
631
632     /// <summary>
633     /// <para>
634     /// Ensures the inner reference exists using the specified links.
635     /// </para>
636     /// <para></para>
637     /// </summary>
638     /// <typeparam name="TLink">
639     /// <para>The link.</para>
640     /// <para></para>
641     /// </typeparam>
642     /// <param name="links">
643     /// <para>The links.</para>
644     /// <para></para>
645     /// </param>
646     /// <param name="restrictions">
647     /// <para>The restrictions.</para>
648     /// <para></para>
649     /// </param>
650     /// <param name="argumentName">
651     /// <para>The argument name.</para>
652     /// <para></para>
653     /// </param>
654     [MethodImpl(MethodImplOptions.AggressiveInlining)]
655     public static void EnsureInnerReferenceExists<TLink>(this ILinks<TLink> links,
656         ↳ IList<TLink> restrictions, string argumentName)
657     {
658         for (int i = 0; i < restrictions.Count; i++)
659         {
660             links.EnsureInnerReferenceExists(restrictions[i], argumentName);
661         }
662     }
663
664     /// <summary>
665     /// <para>
666     /// Ensures the link is any or exists using the specified links.
667     /// </para>
668     /// <para></para>
669     /// </summary>
670     /// <typeparam name="TLink">
671     /// <para>The link.</para>
672     /// <para></para>
673     /// </typeparam>
674     /// <param name="links">
675     /// <para>The links.</para>
676     /// <para></para>
677     /// </param>
678     /// <param name="restrictions">
679     /// <para>The restrictions.</para>
680     /// <para></para>
681     /// </param>
682     /// <exception cref="ArgumentLinkDoesNotExistsException{TLink}">
683     /// <para>sequence[{i}]</para>
684     /// <para></para>
685     /// </exception>
686     [MethodImpl(MethodImplOptions.AggressiveInlining)]
687     public static void EnsureLinkIsAnyOrExists<TLink>(this ILinks<TLink> links, IList<TLink>
688         ↳ restrictions)
689     {
690         var equalityComparer = EqualityComparer<TLink>.Default;
691         var any = links.Constants.Any;
692         for (var i = 0; i < restrictions.Count; i++)
693         {
694             if (!equalityComparer.Equals(restrictions[i], any) &&
695                 ↳ !links.Exists(restrictions[i]))
696             {
697                 throw new ArgumentLinkDoesNotExistsException<TLink>(restrictions[i],
698                     ↳ $"{sequence[{i}]"}");
699             }
700         }
701     }
702
703     /// <summary>

```

```

700    /// <para>
701    /// Ensures the link is any or exists using the specified links.
702    /// </para>
703    /// <para></para>
704    /// </summary>
705    /// <typeparam name="TLink">
706    /// <para>The link.</para>
707    /// <para></para>
708    /// </typeparam>
709    /// <param name="links">
710    /// <para>The links.</para>
711    /// <para></para>
712    /// </param>
713    /// <param name="link">
714    /// <para>The link.</para>
715    /// <para></para>
716    /// </param>
717    /// <param name="argumentName">
718    /// <para>The argument name.</para>
719    /// <para></para>
720    /// </param>
721    /// <exception cref="ArgumentLinkDoesNotExistsException{TLink}">
722    /// <para></para>
723    /// <para></para>
724    /// </exception>
725    [MethodImpl(MethodImplOptions.AggressiveInlining)]
726    public static void EnsureLinkIsAnyOrExists<TLink>(this ILinks<TLink> links, TLink link,
727    ↪ string argumentName)
728    {
729        var equalityComparer = EqualityComparer<TLink>.Default;
730        if (!equalityComparer.Equals(link, links.Constants.Any) && !links.Exists(link))
731        {
732            throw new ArgumentLinkDoesNotExistsException<TLink>(link, argumentName);
733        }
734    }
735    /// <summary>
736    /// <para>
737    /// Ensures the link is itself or exists using the specified links.
738    /// </para>
739    /// <para></para>
740    /// </summary>
741    /// <typeparam name="TLink">
742    /// <para>The link.</para>
743    /// <para></para>
744    /// </typeparam>
745    /// <param name="links">
746    /// <para>The links.</para>
747    /// <para></para>
748    /// </param>
749    /// <param name="link">
750    /// <para>The link.</para>
751    /// <para></para>
752    /// </param>
753    /// <param name="argumentName">
754    /// <para>The argument name.</para>
755    /// <para></para>
756    /// </param>
757    /// <exception cref="ArgumentLinkDoesNotExistsException{TLink}">
758    /// <para></para>
759    /// <para></para>
760    /// </exception>
761    [MethodImpl(MethodImplOptions.AggressiveInlining)]
762    public static void EnsureLinkIsItselfOrExists<TLink>(this ILinks<TLink> links, TLink
763    ↪ link, string argumentName)
764    {
765        var equalityComparer = EqualityComparer<TLink>.Default;
766        if (!equalityComparer.Equals(link, links.Constants.Itself) && !links.Exists(link))
767        {
768            throw new ArgumentLinkDoesNotExistsException<TLink>(link, argumentName);
769        }
770    }
771    /// <param name="links">Хранилище связей.</param>
772    [MethodImpl(MethodImplOptions.AggressiveInlining)]
773    public static void EnsureDoesNotExists<TLink>(this ILinks<TLink> links, TLink source,
774    ↪ TLink target)
775    {

```

```

775         if (links.Exists(source, target))
776         {
777             throw new LinkWithSameValueAlreadyExistsException();
778         }
779     }
780
781     /// <param name="links">Хранилище связей.</param>
782     [MethodImpl(MethodImplOptions.AggressiveInlining)]
783     public static void EnsureNoUsages<TLink>(this ILinks<TLink> links, TLink link)
784     {
785         if (links.HasUsages(link))
786         {
787             throw new ArgumentLinkHasDependenciesException<TLink>(link);
788         }
789     }
790
791     /// <param name="links">Хранилище связей.</param>
792     [MethodImpl(MethodImplOptions.AggressiveInlining)]
793     public static void EnsureCreated<TLink>(this ILinks<TLink> links, params TLink[]
794         ↪ addresses) => links.EnsureCreated(links.Create, addresses);
795
796     /// <param name="links">Хранилище связей.</param>
797     [MethodImpl(MethodImplOptions.AggressiveInlining)]
798     public static void EnsurePointsCreated<TLink>(this ILinks<TLink> links, params TLink[]
799         ↪ addresses) => links.EnsureCreated(links.CreatePoint, addresses);
800
801     /// <param name="links">Хранилище связей.</param>
802     [MethodImpl(MethodImplOptions.AggressiveInlining)]
803     public static void EnsureCreated<TLink>(this ILinks<TLink> links, Func<TLink> creator,
804         ↪ params TLink[] addresses)
805     {
806         var addressToUInt64Converter = CheckedConverter<TLink, ulong>.Default;
807         var uInt64ToAddressConverter = CheckedConverter<ulong, TLink>.Default;
808         var nonExistentAddresses = new HashSet<TLink>(addresses.Where(x =>
809             ↪ !links.Exists(x)));
810         if (nonExistentAddresses.Count > 0)
811         {
812             var max = nonExistentAddresses.Max();
813             max = uInt64ToAddressConverter.Convert(System.Math.Min(addressToUInt64Converter.
814                 ↪ Convert(max),
815                 ↪ addressToUInt64Converter.Convert(links.Constants.InternalReferencesRange.Max
816                 ↪ imum)));
817             var createdLinks = new List<TLink>();
818             var equalityComparer = EqualityComparer<TLink>.Default;
819             TLink createdLink = creator();
820             while (!equalityComparer.Equals(createdLink, max))
821             {
822                 createdLinks.Add(createdLink);
823             }
824             for (var i = 0; i < createdLinks.Count; i++)
825             {
826                 if (!nonExistentAddresses.Contains(createdLinks[i]))
827                 {
828                     links.Delete(createdLinks[i]);
829                 }
830             }
831         }
832     }
833
834 #endregion
835
836     /// <param name="links">Хранилище связей.</param>
837     [MethodImpl(MethodImplOptions.AggressiveInlining)]
838     public static TLink CountUsages<TLink>(this ILinks<TLink> links, TLink link)
839     {
840         var constants = links.Constants;
841         var values = links.GetLink(link);
842         TLink usagesAsSource = links.Count(new Link<TLink>(constants.Any, link,
843             ↪ constants.Any));
844         var equalityComparer = EqualityComparer<TLink>.Default;
845         if (equalityComparer.Equals(values[constants.SourcePart], link))
846         {
847             usagesAsSource = Arithmetic<TLink>.Decrement(usagesAsSource);
848         }
849         TLink usagesAsTarget = links.Count(new Link<TLink>(constants.Any, constants.Any,
850             ↪ link));
851         if (equalityComparer.Equals(values[constants.TargetPart], link))
852         {
853

```

```

844         usagesAsTarget = Arithmetic<TLink>.Decrement(usagesAsTarget);
845     }
846     return Arithmetic<TLink>.Add(usagesAsSource, usagesAsTarget);
847 }
848
849 /// <param name="links">Хранилище связей.</param>
850 [MethodImpl(MethodImplOptions.AggressiveInlining)]
851 public static bool HasUsages<TLink>(this ILinks<TLink> links, TLink link) =>
852     ⇨ Comparer<TLink>.Default.Compare(links.CountUsages(link), default) > 0;
853
854 /// <param name="links">Хранилище связей.</param>
855 [MethodImpl(MethodImplOptions.AggressiveInlining)]
856 public static bool Equals<TLink>(this ILinks<TLink> links, TLink link, TLink source,
857     ⇨ TLink target)
858 {
859     var constants = links.Constants;
860     var values = links.GetLink(link);
861     var equalityComparer = EqualityComparer<TLink>.Default;
862     return equalityComparer.Equals(values[constants.SourcePart], source) &&
863         ⇨ equalityComparer.Equals(values[constants.TargetPart], target);
864 }
865
866 /// <summary>
867 /// Выполняет поиск связи с указанными Source (началом) и Target (концом).
868 /// </summary>
869 /// <param name="links">Хранилище связей.</param>
870 /// <param name="source">Индекс связи, которая является началом для искомой
871     ⇨ связи.</param>
872 /// <param name="target">Индекс связи, которая является концом для искомой связи.</param>
873 /// <returns>Индекс искомой связи с указанными Source (началом) и Target
874     ⇨ (концом).</returns>
875 [MethodImpl(MethodImplOptions.AggressiveInlining)]
876 public static TLink SearchOrDefault<TLink>(this ILinks<TLink> links, TLink source, TLink
877     ⇨ target)
878 {
879     var constants = links.Constants;
880     var setter = new Setter<TLink, TLink>(constants.Continue, constants.Break, default);
881     links.Each(setter.SetFirstAndReturnFalse, constants.Any, source, target);
882     return setter.Result;
883 }
884
885 /// <param name="links">Хранилище связей.</param>
886 [MethodImpl(MethodImplOptions.AggressiveInlining)]
887 public static TLink Create<TLink>(this ILinks<TLink> links) => links.Create(null);
888
889 /// <param name="links">Хранилище связей.</param>
890 [MethodImpl(MethodImplOptions.AggressiveInlining)]
891 public static TLink CreatePoint<TLink>(this ILinks<TLink> links)
892 {
893     var link = links.Create();
894     return links.Update(link, link, link);
895 }
896
897 /// <param name="links">Хранилище связей.</param>
898 [MethodImpl(MethodImplOptions.AggressiveInlining)]
899 public static TLink CreateAndUpdate<TLink>(this ILinks<TLink> links, TLink source, TLink
900     ⇨ target) => links.Update(links.Create(), source, target);
901
902 /// <summary>
903 /// Обновляет связь с указанными началом (Source) и концом (Target)
904 /// на связь с указанными началом (NewSource) и концом (NewTarget).
905 /// </summary>
906 /// <param name="links">Хранилище связей.</param>
907 /// <param name="link">Индекс обновляемой связи.</param>
908 /// <param name="newSource">Индекс связи, которая является началом связи, на которую
909     ⇨ выполняется обновление.</param>
910 /// <param name="newTarget">Индекс связи, которая является концом связи, на которую
911     ⇨ выполняется обновление.</param>
912 /// <returns>Индекс обновлённой связи.</returns>
913 [MethodImpl(MethodImplOptions.AggressiveInlining)]
914 public static TLink Update<TLink>(this ILinks<TLink> links, TLink link, TLink newSource,
915     ⇨ TLink newTarget) => links.Update(new LinkAddress<TLink>(link), new Link<TLink>(link,
916     ⇨ newSource, newTarget));
917
918 /// <summary>
919 /// Обновляет связь с указанными началом (Source) и концом (Target)
920 /// на связь с указанными началом (NewSource) и концом (NewTarget).
921 /// </summary>

```



```

111  /// <param name="links">Хранилище связей.</param>
112  /// <param name="restrictions">Ограничения на содержимое связей. Каждое ограничение
    ↳ может иметь значения: Constants.Null - 0-я связь, обозначающая ссылку на пустоту,
    ↳ Itself - требование установить ссылку на себя, 1..∞ конкретный адрес другой
    ↳ связи.</param>
113  /// <returns>Индекс обновлённой связи.</returns>
114  [MethodImpl(MethodImplOptions.AggressiveInlining)]
115  public static TLink Update<TLink>(this ILinks<TLink> links, params TLink[] restrictions)
116  {
117      if (restrictions.Length == 2)
118      {
119          return links.MergeAndDelete(restrictions[0], restrictions[1]);
120      }
121      if (restrictions.Length == 4)
122      {
123          return links.UpdateOrCreateOrGet(restrictions[0], restrictions[1],
    ↳ restrictions[2], restrictions[3]);
124      }
125      else
126      {
127          return links.Update(new LinkAddress<TLink>(restrictions[0]), restrictions);
128      }
129  }
130
131  /// <summary>
132  /// <para>
133  /// Resolves the constant as self reference using the specified links.
134  /// </para>
135  /// <para></para>
136  /// </summary>
137  /// <typeparam name="TLink">
138  /// <para>The link.</para>
139  /// <para></para>
140  /// </typeparam>
141  /// <param name="links">
142  /// <para>The links.</para>
143  /// <para></para>
144  /// </param>
145  /// <param name="constant">
146  /// <para>The constant.</para>
147  /// <para></para>
148  /// </param>
149  /// <param name="restrictions">
150  /// <para>The restrictions.</para>
151  /// <para></para>
152  /// </param>
153  /// <param name="substitution">
154  /// <para>The substitution.</para>
155  /// <para></para>
156  /// </param>
157  /// <returns>
158  /// <para>A list of t link</para>
159  /// <para></para>
160  /// </returns>
161  [MethodImpl(MethodImplOptions.AggressiveInlining)]
162  public static IList<TLink> ResolveConstantAsSelfReference<TLink>(this ILinks<TLink>
    ↳ links, TLink constant, IList<TLink> restrictions, IList<TLink> substitution)
163  {
164      var equalityComparer = EqualityComparer<TLink>.Default;
165      var constants = links.Constants;
166      var restrictionsIndex = restrictions[constants.IndexPart];
167      var substitutionIndex = substitution[constants.IndexPart];
168      if (equalityComparer.Equals(substitutionIndex, default))
169      {
170          substitutionIndex = restrictionsIndex;
171      }
172      var source = substitution[constants.SourcePart];
173      var target = substitution[constants.TargetPart];
174      source = equalityComparer.Equals(source, constant) ? substitutionIndex : source;
175      target = equalityComparer.Equals(target, constant) ? substitutionIndex : target;
176      return new Link<TLink>(substitutionIndex, source, target);
177  }
178
179  /// <summary>
180  /// Создаёт связь (если она не существовала), либо возвращает индекс существующей связи
    ↳ с указанными Source (началом) и Target (концом).
181  /// </summary>
182  /// <param name="links">Хранилище связей.</param>

```

```

983     /// <param name="source">Индекс связи, которая является началом на создаваемой
984     ↪ связи.</param>
985     /// <param name="target">Индекс связи, которая является концом для создаваемой
986     ↪ связи.</param>
987     /// <returns>Индекс связи, с указанным Source (началом) и Target (концом)</returns>
988     [MethodImpl(MethodImplOptions.AggressiveInlining)]
989     public static TLink GetOrCreate<TLink>(this ILinks<TLink> links, TLink source, TLink
990     ↪ target)
991     {
992         var link = links.SearchOrDefault(source, target);
993         if (EqualityComparer<TLink>.Default.Equals(link, default))
994         {
995             link = links.CreateAndUpdate(source, target);
996         }
997         return link;
998     }
999
1000     /// <summary>
1001     /// Обновляет связь с указанными началом (Source) и концом (Target)
1002     /// на связь с указанными началом (NewSource) и концом (NewTarget).
1003     /// </summary>
1004     /// <param name="links">Хранилище связей.</param>
1005     /// <param name="source">Индекс связи, которая является началом обновляемой
1006     ↪ связи.</param>
1007     /// <param name="target">Индекс связи, которая является концом обновляемой связи.</param>
1008     /// <param name="newSource">Индекс связи, которая является началом связи, на которую
1009     ↪ выполняется обновление.</param>
1010     /// <param name="newTarget">Индекс связи, которая является концом связи, на которую
1011     ↪ выполняется обновление.</param>
1012     /// <returns>Индекс обновлённой связи.</returns>
1013     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1014     public static TLink UpdateOrCreateOrGet<TLink>(this ILinks<TLink> links, TLink source,
1015     ↪ TLink target, TLink newSource, TLink newTarget)
1016     {
1017         var equalityComparer = EqualityComparer<TLink>.Default;
1018         var link = links.SearchOrDefault(source, target);
1019         if (equalityComparer.Equals(link, default))
1020         {
1021             return links.CreateAndUpdate(newSource, newTarget);
1022         }
1023         if (equalityComparer.Equals(newSource, source) && equalityComparer.Equals(newTarget,
1024     ↪ target))
1025         {
1026             return link;
1027         }
1028         return links.Update(link, newSource, newTarget);
1029     }
1030
1031     /// <summary>Удаляет связь с указанными началом (Source) и концом (Target).</summary>
1032     /// <param name="links">Хранилище связей.</param>
1033     /// <param name="source">Индекс связи, которая является началом удаляемой связи.</param>
1034     /// <param name="target">Индекс связи, которая является концом удаляемой связи.</param>
1035     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1036     public static TLink DeleteIfExists<TLink>(this ILinks<TLink> links, TLink source, TLink
1037     ↪ target)
1038     {
1039         var link = links.SearchOrDefault(source, target);
1040         if (!EqualityComparer<TLink>.Default.Equals(link, default))
1041         {
1042             links.Delete(link);
1043             return link;
1044         }
1045         return default;
1046     }
1047
1048     /// <summary>Удаляет несколько связей.</summary>
1049     /// <param name="links">Хранилище связей.</param>
1050     /// <param name="deletedLinks">Список адресов связей к удалению.</param>
1051     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1052     public static void DeleteMany<TLink>(this ILinks<TLink> links, IList<TLink> deletedLinks)
1053     {
1054         for (int i = 0; i < deletedLinks.Count; i++)
1055         {
1056             links.Delete(deletedLinks[i]);
1057         }
1058     }

```

```

1051 /// <remarks>Before execution of this method ensure that deleted link is detached (all
1052 ↪ values - source and target are reset to null) or it might enter into infinite
1053 ↪ recursion.</remarks>
1054 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1055 public static void DeleteAllUsages<TLink>(this ILinks<TLink> links, TLink linkIndex)
1056 {
1057     var any = links.Constants.Any;
1058     var usagesAsSourceQuery = new Link<TLink>(any, linkIndex, any);
1059     links.DeleteByQuery(usagesAsSourceQuery);
1060     var usagesAsTargetQuery = new Link<TLink>(any, any, linkIndex);
1061     links.DeleteByQuery(usagesAsTargetQuery);
1062 }
1063
1064 /// <summary>
1065 /// <para>
1066 /// Deletes the by query using the specified links.
1067 /// </para>
1068 /// <para></para>
1069 /// </summary>
1070 /// <typeparam name="TLink">
1071 /// <para>The link.</para>
1072 /// </typeparam>
1073 /// <param name="links">
1074 /// <para>The links.</para>
1075 /// </param>
1076 /// <param name="query">
1077 /// <para>The query.</para>
1078 /// </param>
1079 /// </param>
1080 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1081 public static void DeleteByQuery<TLink>(this ILinks<TLink> links, Link<TLink> query)
1082 {
1083     var count = CheckedConverter<TLink, long>.Default.Convert(links.Count(query));
1084     if (count > 0)
1085     {
1086         var queryResult = new TLink[count];
1087         var queryResultFiller = new ArrayFiller<TLink, TLink>(queryResult,
1088             ↪ links.Constants.Continue);
1089         links.Each(queryResultFiller.AddFirstAndReturnConstant, query);
1090         for (var i = count - 1; i >= 0; i--)
1091         {
1092             links.Delete(queryResult[i]);
1093         }
1094     }
1095 }
1096
1097 // TODO: Move to Platform.Data
1098 /// <summary>
1099 /// <para>
1100 /// Determines whether are values reset.
1101 /// </para>
1102 /// <para></para>
1103 /// </summary>
1104 /// <typeparam name="TLink">
1105 /// <para>The link.</para>
1106 /// </typeparam>
1107 /// <param name="links">
1108 /// <para>The links.</para>
1109 /// </param>
1110 /// <param name="linkIndex">
1111 /// <para>The link index.</para>
1112 /// </param>
1113 /// </param>
1114 /// <returns>
1115 /// <para>The bool</para>
1116 /// <para></para>
1117 /// </returns>
1118 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1119 public static bool AreValuesReset<TLink>(this ILinks<TLink> links, TLink linkIndex)
1120 {
1121     var nullConstant = links.Constants.Null;
1122     var equalityComparer = EqualityComparer<TLink>.Default;
1123     var link = links.GetLink(linkIndex);
1124     for (int i = 1; i < link.Count; i++)
1125 
```

```

1126     {
1127         if (!equalityComparer.Equals(link[i], nullConstant))
1128         {
1129             return false;
1130         }
1131     }
1132     return true;
1133 }
1134
1135 // TODO: Create a universal version of this method in Platform.Data (with using of for
1136 → loop)
1137 /// <summary>
1138 /// <para>
1139 /// Resets the values using the specified links.
1140 /// </para>
1141 /// <para></para>
1142 /// </summary>
1143 /// <typeparam name="TLink">
1144 /// <para>The link.</para>
1145 /// <para></para>
1146 /// </typeparam>
1147 /// <param name="links">
1148 /// <para>The links.</para>
1149 /// <para></para>
1150 /// </param>
1151 /// <param name="linkIndex">
1152 /// <para>The link index.</para>
1153 /// <para></para>
1154 /// </param>
1155 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1156 public static void ResetValues<TLink>(this ILinks<TLink> links, TLink linkIndex)
1157 {
1158     var nullConstant = links.Constants.Null;
1159     var updateRequest = new Link<TLink>(linkIndex, nullConstant, nullConstant);
1160     links.Update(updateRequest);
1161 }
1162
1163 // TODO: Create a universal version of this method in Platform.Data (with using of for
1164 → loop)
1165 /// <summary>
1166 /// <para>
1167 /// Enforces the reset values using the specified links.
1168 /// </para>
1169 /// <para></para>
1170 /// </summary>
1171 /// <typeparam name="TLink">
1172 /// <para>The link.</para>
1173 /// <para></para>
1174 /// </typeparam>
1175 /// <param name="links">
1176 /// <para>The links.</para>
1177 /// <para></para>
1178 /// </param>
1179 /// <param name="linkIndex">
1180 /// <para>The link index.</para>
1181 /// <para></para>
1182 /// </param>
1183 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1184 public static void EnforceResetValues<TLink>(this ILinks<TLink> links, TLink linkIndex)
1185 {
1186     if (!links.AreValuesReset(linkIndex))
1187     {
1188         links.ResetValues(linkIndex);
1189     }
1190 }
1191
1192 /// <summary>
1193 /// Merging two usages graphs, all children of old link moved to be children of new link
1194 → or deleted.
1195 /// </summary>
1196 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1197 public static TLink MergeUsages<TLink>(this ILinks<TLink> links, TLink oldLinkIndex,
1198 → TLink newLinkIndex)
1199 {
1200     var addressToInt64Converter = CheckedConverter<TLink, long>.Default;
1201     var equalityComparer = EqualityComparer<TLink>.Default;
1202     if (!equalityComparer.Equals(oldLinkIndex, newLinkIndex))
1203     {

```

```

1200     var constants = links.Constants;
1201     var usagesAsSourceQuery = new Link<TLink>(constants.Any, oldLinkIndex,
1202         ↪ constants.Any);
1203     var usagesAsSourceCount =
1204         ↪ addressToInt64Converter.Convert(links.Count(usagesAsSourceQuery));
1205     var usagesAsTargetQuery = new Link<TLink>(constants.Any, constants.Any,
1206         ↪ oldLinkIndex);
1207     var usagesAsTargetCount =
1208         ↪ addressToInt64Converter.Convert(links.Count(usagesAsTargetQuery));
1209     var isStandalonePoint = Point<TLink>.IsFullPoint(links.GetLink(oldLinkIndex)) &&
1210         ↪ usagesAsSourceCount == 1 && usagesAsTargetCount == 1;
1211     if (!isStandalonePoint)
1212     {
1213         var totalUsages = usagesAsSourceCount + usagesAsTargetCount;
1214         if (totalUsages > 0)
1215         {
1216             var usages = ArrayPool.Allocate<TLink>(totalUsages);
1217             var usagesFiller = new ArrayFiller<TLink, TLink>(usages,
1218                 ↪ links.Constants.Continue);
1219             var i = 0L;
1220             if (usagesAsSourceCount > 0)
1221             {
1222                 links.Each(usagesFiller.AddFirstAndReturnConstant,
1223                     ↪ usagesAsSourceQuery);
1224                 for (; i < usagesAsSourceCount; i++)
1225                 {
1226                     var usage = usages[i];
1227                     if (!equalityComparer.Equals(usage, oldLinkIndex))
1228                     {
1229                         links.Update(usage, newLinkIndex, links.GetTarget(usage));
1230                     }
1231                 }
1232             }
1233             if (usagesAsTargetCount > 0)
1234             {
1235                 links.Each(usagesFiller.AddFirstAndReturnConstant,
1236                     ↪ usagesAsTargetQuery);
1237                 for (; i < usages.Length; i++)
1238                 {
1239                     var usage = usages[i];
1240                     if (!equalityComparer.Equals(usage, oldLinkIndex))
1241                     {
1242                         links.Update(usage, links.GetSource(usage), newLinkIndex);
1243                     }
1244                 }
1245             }
1246             ArrayPool.Free(usages);
1247         }
1248     }
1249     return newLinkIndex;
1250 }
1251
1252 /// <summary>
1253 /// Replace one link with another (replaced link is deleted, children are updated or
1254 ↪ deleted).
1255 /// </summary>
1256 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1257 public static TLink MergeAndDelete<TLink>(this ILinks<TLink> links, TLink oldLinkIndex,
1258     ↪ TLink newLinkIndex)
1259 {
1260     var equalityComparer = EqualityComparer<TLink>.Default;
1261     if (!equalityComparer.Equals(oldLinkIndex, newLinkIndex))
1262     {
1263         links.MergeUsages(oldLinkIndex, newLinkIndex);
1264         links.Delete(oldLinkIndex);
1265     }
1266     return newLinkIndex;
1267 }
1268
1269 /// <summary>
1270 /// <para>
1271 /// Decorates the with automatic uniqueness and usages resolution using the specified
1272 ↪ links.
1273 /// </para>
1274 /// <para></para>
1275 /// </summary>

```

```

1266     /// <typeparam name="TLink">
1267     /// <para>The link.</para>
1268     /// <para></para>
1269     /// </typeparam>
1270     /// <param name="links">
1271     /// <para>The links.</para>
1272     /// <para></para>
1273     /// </param>
1274     /// <returns>
1275     /// <para>The links.</para>
1276     /// <para></para>
1277     /// </returns>
1278     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1279     public static ILinks<TLink>
1280     ↪ DecorateWithAutomaticUniquenessAndUsagesResolution<TLink>(this ILinks<TLink> links)
1281     {
1282         links = new LinksCascadeUsagesResolver<TLink>(links);
1283         links = new NonNullContentsLinkDeletionResolver<TLink>(links);
1284         links = new LinksCascadeUniquenessAndUsagesResolver<TLink>(links);
1285         return links;
1286     }
1287     /// <summary>
1288     /// <para>
1289     /// Formats the links.
1290     /// </para>
1291     /// <para></para>
1292     /// </summary>
1293     /// <typeparam name="TLink">
1294     /// <para>The link.</para>
1295     /// <para></para>
1296     /// </typeparam>
1297     /// <param name="links">
1298     /// <para>The links.</para>
1299     /// <para></para>
1300     /// </param>
1301     /// <param name="link">
1302     /// <para>The link.</para>
1303     /// <para></para>
1304     /// </param>
1305     /// <returns>
1306     /// <para>The string</para>
1307     /// <para></para>
1308     /// </returns>
1309     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1310     public static string Format<TLink>(this ILinks<TLink> links, IList<TLink> link)
1311     {
1312         var constants = links.Constants;
1313         return $"({link[constants.IndexPart]}: {link[constants.SourcePart]})
1314         ↪ {link[constants.TargetPart]}";
1315     }
1316     /// <summary>
1317     /// <para>
1318     /// Formats the links.
1319     /// </para>
1320     /// <para></para>
1321     /// </summary>
1322     /// <typeparam name="TLink">
1323     /// <para>The link.</para>
1324     /// <para></para>
1325     /// </typeparam>
1326     /// <param name="links">
1327     /// <para>The links.</para>
1328     /// <para></para>
1329     /// </param>
1330     /// <param name="link">
1331     /// <para>The link.</para>
1332     /// <para></para>
1333     /// </param>
1334     /// <returns>
1335     /// <para>The string</para>
1336     /// <para></para>
1337     /// </returns>
1338     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1339     public static string Format<TLink>(this ILinks<TLink> links, TLink link) =>
1340     ↪ links.Format(links.GetLink(link));

```

## 1.21 ./csharp/Platform.Data.Doublets/ISynchronizedLinks.cs

```

1  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
2
3  namespace Platform.Data.Doublets
4  {
5      /// <summary>
6      /// <para>
7      /// Defines the synchronized links.
8      /// </para>
9      /// <para></para>
10     /// </summary>
11     /// <seealso cref="ISynchronizedLinks{TLink, ILinks{TLink}}, LinksConstants{TLink}" />
12     /// <seealso cref="ILinks{TLink}" />
13     public interface ISynchronizedLinks<TLink> : ISynchronizedLinks<TLink, ILinks<TLink>,
14         ↳ LinksConstants<TLink>>, ILinks<TLink>
15     {
16     }

```

## 1.22 ./csharp/Platform.Data.Doublets/Link.cs

```

1  using Platform.Collections.Lists;
2  using Platform.Exceptions;
3  using Platform.Ranges;
4  using Platform.Singletons;
5  using System;
6  using System.Collections;
7  using System.Collections.Generic;
8  using System.Runtime.CompilerServices;
9
10 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
11
12 namespace Platform.Data.Doublets
13 {
14     /// <summary>
15     /// Структура описывающая уникальную связь.
16     /// </summary>
17     public struct Link<TLink> : IEquatable<Link<TLink>>, IReadOnlyList<TLink>, IList<TLink>
18     {
19         /// <summary>
20         /// <para>
21         /// The link.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         public static readonly Link<TLink> Null = new Link<TLink>();
26
27         /// <summary>
28         /// <para>
29         /// The instance.
30         /// </para>
31         /// <para></para>
32         /// </summary>
33         private static readonly LinksConstants<TLink> _constants =
34             ↳ Default<LinksConstants<TLink>>.Instance;
35         /// <summary>
36         /// <para>
37         /// The default.
38         /// </para>
39         /// <para></para>
40         /// </summary>
41         private static readonly EqualityComparer<TLink> _equalityComparer =
42             ↳ EqualityComparer<TLink>.Default;
43
44         /// <summary>
45         /// <para>
46         /// The length.
47         /// </para>
48         /// <para></para>
49         /// </summary>
50         private const int Length = 3;
51
52         /// <summary>
53         /// <para>
54         /// The index.
55         /// </para>
56         /// <para></para>
57         /// </summary>

```

```

56 public readonly TLink Index;
57 /// <summary>
58 /// <para>
59 /// The source.
60 /// </para>
61 /// <para></para>
62 /// </summary>
63 public readonly TLink Source;
64 /// <summary>
65 /// <para>
66 /// The target.
67 /// </para>
68 /// <para></para>
69 /// </summary>
70 public readonly TLink Target;
71
72 /// <summary>
73 /// <para>
74 /// Initializes a new <see cref="Link"/> instance.
75 /// </para>
76 /// <para></para>
77 /// </summary>
78 /// <param name="values">
79 /// <para>A values.</para>
80 /// <para></para>
81 /// </param>
82 [MethodImpl(MethodImplOptions.AggressiveInlining)]
83 public Link(params TLink[] values) => SetValues(values, out Index, out Source, out
    ↪ Target);
84
85 /// <summary>
86 /// <para>
87 /// Initializes a new <see cref="Link"/> instance.
88 /// </para>
89 /// <para></para>
90 /// </summary>
91 /// <param name="values">
92 /// <para>A values.</para>
93 /// <para></para>
94 /// </param>
95 [MethodImpl(MethodImplOptions.AggressiveInlining)]
96 public Link(IList<TLink> values) => SetValues(values, out Index, out Source, out Target);
97
98 /// <summary>
99 /// <para>
100 /// Initializes a new <see cref="Link"/> instance.
101 /// </para>
102 /// <para></para>
103 /// </summary>
104 /// <param name="other">
105 /// <para>A other.</para>
106 /// <para></para>
107 /// </param>
108 /// <exception cref="NotSupportedException">
109 /// <para></para>
110 /// <para></para>
111 /// </exception>
112 [MethodImpl(MethodImplOptions.AggressiveInlining)]
113 public Link(object other)
114 {
115     if (other is Link<TLink> otherLink)
116     {
117         SetValues(ref otherLink, out Index, out Source, out Target);
118     }
119     else if (other is IList<TLink> otherList)
120     {
121         SetValues(otherList, out Index, out Source, out Target);
122     }
123     else
124     {
125         throw new NotSupportedException();
126     }
127 }
128
129 /// <summary>
130 /// <para>
131 /// Initializes a new <see cref="Link"/> instance.
132 /// </para>

```



```

133     /// <para></para>
134     /// </summary>
135     /// <param name="other">
136     /// <para>A other.</para>
137     /// <para></para>
138     /// </param>
139     [MethodImpl(MethodImplOptions.AggressiveInlining)]
140     public Link(ref Link<TLink> other) => SetValues(ref other, out Index, out Source, out
        ↪ Target);
141
142     /// <summary>
143     /// <para>
144     /// Initializes a new <see cref="Link"/> instance.
145     /// </para>
146     /// <para></para>
147     /// </summary>
148     /// <param name="index">
149     /// <para>A index.</para>
150     /// <para></para>
151     /// </param>
152     /// <param name="source">
153     /// <para>A source.</para>
154     /// <para></para>
155     /// </param>
156     /// <param name="target">
157     /// <para>A target.</para>
158     /// <para></para>
159     /// </param>
160     [MethodImpl(MethodImplOptions.AggressiveInlining)]
161     public Link(TLink index, TLink source, TLink target)
162     {
163         Index = index;
164         Source = source;
165         Target = target;
166     }
167
168     /// <summary>
169     /// <para>
170     /// Sets the values using the specified other.
171     /// </para>
172     /// <para></para>
173     /// </summary>
174     /// <param name="other">
175     /// <para>The other.</para>
176     /// <para></para>
177     /// </param>
178     /// <param name="index">
179     /// <para>The index.</para>
180     /// <para></para>
181     /// </param>
182     /// <param name="source">
183     /// <para>The source.</para>
184     /// <para></para>
185     /// </param>
186     /// <param name="target">
187     /// <para>The target.</para>
188     /// <para></para>
189     /// </param>
190     [MethodImpl(MethodImplOptions.AggressiveInlining)]
191     private static void SetValues(ref Link<TLink> other, out TLink index, out TLink source,
        ↪ out TLink target)
192     {
193         index = other.Index;
194         source = other.Source;
195         target = other.Target;
196     }
197
198     /// <summary>
199     /// <para>
200     /// Sets the values using the specified values.
201     /// </para>
202     /// <para></para>
203     /// </summary>
204     /// <param name="values">
205     /// <para>The values.</para>
206     /// <para></para>
207     /// </param>
208     /// <param name="index">

```

```

209    /// <para>The index.</para>
210    /// <para></para>
211    /// </param>
212    /// <param name="source">
213    /// <para>The source.</para>
214    /// <para></para>
215    /// </param>
216    /// <param name="target">
217    /// <para>The target.</para>
218    /// <para></para>
219    /// </param>
220    [MethodImpl(MethodImplOptions.AggressiveInlining)]
221    private static void SetValues(ICollection<TLink> values, out TLink index, out TLink source,
    ↪ out TLink target)
222    {
223        switch (values.Count)
224        {
225            case 3:
226                index = values[0];
227                source = values[1];
228                target = values[2];
229                break;
230            case 2:
231                index = values[0];
232                source = values[1];
233                target = default;
234                break;
235            case 1:
236                index = values[0];
237                source = default;
238                target = default;
239                break;
240            default:
241                index = default;
242                source = default;
243                target = default;
244                break;
245        }
246    }
247
248    /// <summary>
249    /// <para>
250    /// Gets the hash code.
251    /// </para>
252    /// <para></para>
253    /// </summary>
254    /// <returns>
255    /// <para>The int</para>
256    /// <para></para>
257    /// </returns>
258    [MethodImpl(MethodImplOptions.AggressiveInlining)]
259    public override int GetHashCode() => (Index, Source, Target).GetHashCode();
260
261    /// <summary>
262    /// <para>
263    /// Determines whether this instance is null.
264    /// </para>
265    /// <para></para>
266    /// </summary>
267    /// <returns>
268    /// <para>The bool</para>
269    /// <para></para>
270    /// </returns>
271    [MethodImpl(MethodImplOptions.AggressiveInlining)]
272    public bool IsNull() => _equalityComparer.Equals(Index, _constants.Null)
273        && _equalityComparer.Equals(Source, _constants.Null)
274        && _equalityComparer.Equals(Target, _constants.Null);
275
276    /// <summary>
277    /// <para>
278    /// Determines whether this instance equals.
279    /// </para>
280    /// <para></para>
281    /// </summary>
282    /// <param name="other">
283    /// <para>The other.</para>
284    /// <para></para>
285    /// </param>
286    /// </returns>

```

```

287    /// <para>The bool</para>
288    /// <para></para>
289    /// </returns>
290    [MethodImpl(MethodImplOptions.AggressiveInlining)]
291    public override bool Equals(object other) => other is Link<TLink> &&
        ↳ Equals((Link<TLink>)other);

292
293    /// <summary>
294    /// <para>
295    /// Determines whether this instance equals.
296    /// </para>
297    /// <para></para>
298    /// </summary>
299    /// <param name="other">
300    /// <para>The other.</para>
301    /// <para></para>
302    /// </param>
303    /// <returns>
304    /// <para>The bool</para>
305    /// <para></para>
306    /// </returns>
307    [MethodImpl(MethodImplOptions.AggressiveInlining)]
308    public bool Equals(Link<TLink> other) => _equalityComparer.Equals(Index, other.Index)
309        && _equalityComparer.Equals(Source, other.Source)
310        && _equalityComparer.Equals(Target, other.Target);
311
312    /// <summary>
313    /// <para>
314    /// Returns the string using the specified index.
315    /// </para>
316    /// <para></para>
317    /// </summary>
318    /// <param name="index">
319    /// <para>The index.</para>
320    /// <para></para>
321    /// </param>
322    /// <param name="source">
323    /// <para>The source.</para>
324    /// <para></para>
325    /// </param>
326    /// <param name="target">
327    /// <para>The target.</para>
328    /// <para></para>
329    /// </param>
330    /// <returns>
331    /// <para>The string</para>
332    /// <para></para>
333    /// </returns>
334    [MethodImpl(MethodImplOptions.AggressiveInlining)]
335    public static string ToString(TLink index, TLink source, TLink target) => $"({index}:
        ↳ {source}->{target})";

336
337    /// <summary>
338    /// <para>
339    /// Returns the string using the specified source.
340    /// </para>
341    /// <para></para>
342    /// </summary>
343    /// <param name="source">
344    /// <para>The source.</para>
345    /// <para></para>
346    /// </param>
347    /// <param name="target">
348    /// <para>The target.</para>
349    /// <para></para>
350    /// </param>
351    /// <returns>
352    /// <para>The string</para>
353    /// <para></para>
354    /// </returns>
355    [MethodImpl(MethodImplOptions.AggressiveInlining)]
356    public static string ToString(TLink source, TLink target) => $"({source}->{target})";
357
358    [MethodImpl(MethodImplOptions.AggressiveInlining)]
359    public static implicit operator TLink[] (Link<TLink> link) => link.ToArray();
360
361    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

362 public static implicit operator Link<TLink>(TLink[] linkArray) => new
    ↳ Link<TLink>(linkArray);
363
364 /// <summary>
365 /// <para>
366 /// Returns the string.
367 /// </para>
368 /// <para></para>
369 /// </summary>
370 /// <returns>
371 /// <para>The string</para>
372 /// <para></para>
373 /// </returns>
374 [MethodImpl(MethodImplOptions.AggressiveInlining)]
375 public override string ToString() => _equalityComparer.Equals(Index, _constants.Null) ?
    ↳ ToString(Source, Target) : ToString(Index, Source, Target);
376
377 #region IList
378
379 /// <summary>
380 /// <para>
381 /// Gets the count value.
382 /// </para>
383 /// <para></para>
384 /// </summary>
385 public int Count
386 {
387     [MethodImpl(MethodImplOptions.AggressiveInlining)]
388     get => Length;
389 }
390
391 /// <summary>
392 /// <para>
393 /// Gets the is read only value.
394 /// </para>
395 /// <para></para>
396 /// </summary>
397 public bool IsReadOnly
398 {
399     [MethodImpl(MethodImplOptions.AggressiveInlining)]
400     get => true;
401 }
402
403 /// <summary>
404 /// <para>
405 /// The not supported exception.
406 /// </para>
407 /// <para></para>
408 /// </summary>
409 public TLink this[int index]
410 {
411     [MethodImpl(MethodImplOptions.AggressiveInlining)]
412     get
413     {
414         Ensure.OnDebug.ArgumentInRange(index, new Range<int>(0, Length - 1),
            ↳ nameof(index));
415         if (index == _constants.IndexPart)
416         {
417             return Index;
418         }
419         if (index == _constants.SourcePart)
420         {
421             return Source;
422         }
423         if (index == _constants.TargetPart)
424         {
425             return Target;
426         }
427         throw new NotSupportedException(); // Impossible path due to
            ↳ Ensure.ArgumentInRange
428     }
429     [MethodImpl(MethodImplOptions.AggressiveInlining)]
430     set => throw new NotSupportedException();
431 }
432
433 /// <summary>
434 /// <para>
435 /// Gets the enumerator.
436 /// </para>

```

```

437     /// <para></para>
438     /// </summary>
439     /// <returns>
440     /// <para>The enumerator</para>
441     /// <para></para>
442     /// </returns>
443     [MethodImpl(MethodImplOptions.AggressiveInlining)]
444     IEnumerator IEnumerable.GetEnumerator() => GetEnumerator();
445
446     /// <summary>
447     /// <para>
448     /// Gets the enumerator.
449     /// </para>
450     /// <para></para>
451     /// </summary>
452     /// <returns>
453     /// <para>An enumerator of t link</para>
454     /// <para></para>
455     /// </returns>
456     [MethodImpl(MethodImplOptions.AggressiveInlining)]
457     public IEnumerator<TLink> GetEnumerator()
458     {
459         yield return Index;
460         yield return Source;
461         yield return Target;
462     }
463
464     /// <summary>
465     /// <para>
466     /// Adds the item.
467     /// </para>
468     /// <para></para>
469     /// </summary>
470     /// <param name="item">
471     /// <para>The item.</para>
472     /// <para></para>
473     /// </param>
474     [MethodImpl(MethodImplOptions.AggressiveInlining)]
475     public void Add(TLink item) => throw new NotSupportedException();
476
477     /// <summary>
478     /// <para>
479     /// Clears this instance.
480     /// </para>
481     /// <para></para>
482     /// </summary>
483     [MethodImpl(MethodImplOptions.AggressiveInlining)]
484     public void Clear() => throw new NotSupportedException();
485
486     /// <summary>
487     /// <para>
488     /// Determines whether this instance contains.
489     /// </para>
490     /// <para></para>
491     /// </summary>
492     /// <param name="item">
493     /// <para>The item.</para>
494     /// <para></para>
495     /// </param>
496     /// <returns>
497     /// <para>The bool</para>
498     /// <para></para>
499     /// </returns>
500     [MethodImpl(MethodImplOptions.AggressiveInlining)]
501     public bool Contains(TLink item) => IndexOf(item) >= 0;
502
503     /// <summary>
504     /// <para>
505     /// Copies the to using the specified array.
506     /// </para>
507     /// <para></para>
508     /// </summary>
509     /// <param name="array">
510     /// <para>The array.</para>
511     /// <para></para>
512     /// </param>
513     /// <param name="arrayIndex">
514     /// <para>The array index.</para>

```

```

515     /// <para></para>
516     /// </param>
517     /// <exception cref="InvalidOperationException">
518     /// <para></para>
519     /// <para></para>
520     /// </exception>
521     [MethodImpl(MethodImplOptions.AggressiveInlining)]
522     public void CopyTo(TLink[] array, int arrayIndex)
523     {
524         Ensure.OnDebug.ArgumentNotNull(array, nameof(array));
525         Ensure.OnDebug.ArgumentInRange(arrayIndex, new Range<int>(0, array.Length - 1),
526             ↪   nameof(arrayIndex));
527         if (arrayIndex + Length > array.Length)
528         {
529             throw new InvalidOperationException();
530         }
531         array[arrayIndex++] = Index;
532         array[arrayIndex++] = Source;
533         array[arrayIndex] = Target;
534     }
535     /// <summary>
536     /// <para>
537     /// Determines whether this instance remove.
538     /// </para>
539     /// <para></para>
540     /// </summary>
541     /// <param name="item">
542     /// <para>The item.</para>
543     /// <para></para>
544     /// </param>
545     /// <returns>
546     /// <para>The bool</para>
547     /// <para></para>
548     /// </returns>
549     [MethodImpl(MethodImplOptions.AggressiveInlining)]
550     public bool Remove(TLink item) => Throw.A.NotSupportedExceptionAndReturn<bool>();
551
552     /// <summary>
553     /// <para>
554     /// Indexes the of using the specified item.
555     /// </para>
556     /// <para></para>
557     /// </summary>
558     /// <param name="item">
559     /// <para>The item.</para>
560     /// <para></para>
561     /// </param>
562     /// <returns>
563     /// <para>The int</para>
564     /// <para></para>
565     /// </returns>
566     [MethodImpl(MethodImplOptions.AggressiveInlining)]
567     public int IndexOf(TLink item)
568     {
569         if (_equalityComparer.Equals(Index, item))
570         {
571             return _constants.IndexPart;
572         }
573         if (_equalityComparer.Equals(Source, item))
574         {
575             return _constants.SourcePart;
576         }
577         if (_equalityComparer.Equals(Target, item))
578         {
579             return _constants.TargetPart;
580         }
581         return -1;
582     }
583
584     /// <summary>
585     /// <para>
586     /// Inserts the index.
587     /// </para>
588     /// <para></para>
589     /// </summary>
590     /// <param name="index">
591     /// <para>The index.</para>

```

```

592     /// <para></para>
593     /// </param>
594     /// <param name="item">
595     /// <para>The item.</para>
596     /// <para></para>
597     /// </param>
598     [MethodImpl(MethodImplOptions.AggressiveInlining)]
599     public void Insert(int index, TLink item) => throw new NotSupportedException();
600
601     /// <summary>
602     /// <para>
603     /// Removes the at using the specified index.
604     /// </para>
605     /// <para></para>
606     /// </summary>
607     /// <param name="index">
608     /// <para>The index.</para>
609     /// <para></para>
610     /// </param>
611     [MethodImpl(MethodImplOptions.AggressiveInlining)]
612     public void RemoveAt(int index) => throw new NotSupportedException();
613
614     [MethodImpl(MethodImplOptions.AggressiveInlining)]
615     public static bool operator ==(Link<TLink> left, Link<TLink> right) =>
        ↪ left.Equals(right);
616
617     [MethodImpl(MethodImplOptions.AggressiveInlining)]
618     public static bool operator !=(Link<TLink> left, Link<TLink> right) => !(left == right);
619
620     #endregion
621 }
622 }

```

### 1.23 ./csharp/Platform.Data.Doublets/LinkExtensions.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.Data.Doublets
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the link extensions.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     public static class LinkExtensions
14     {
15         /// <summary>
16         /// <para>
17         /// Determines whether is full point.
18         /// </para>
19         /// <para></para>
20         /// </summary>
21         /// <typeparam name="TLink">
22         /// <para>The link.</para>
23         /// <para></para>
24         /// </typeparam>
25         /// <param name="link">
26         /// <para>The link.</para>
27         /// <para></para>
28         /// </param>
29         /// <returns>
30         /// <para>The bool</para>
31         /// <para></para>
32         /// </returns>
33         [MethodImpl(MethodImplOptions.AggressiveInlining)]
34         public static bool IsFullPoint<TLink>(this Link<TLink> link) =>
            ↪ Point<TLink>.IsFullPoint(link);
35
36         /// <summary>
37         /// <para>
38         /// Determines whether is partial point.
39         /// </para>
40         /// <para></para>
41         /// </summary>
42         /// <typeparam name="TLink">
43         /// <para>The link.</para>

```

```

44     /// <para></para>
45     /// </typeparam>
46     /// <param name="link">
47     /// <para>The link.</para>
48     /// <para></para>
49     /// </param>
50     /// <returns>
51     /// <para>The bool</para>
52     /// <para></para>
53     /// </returns>
54     [MethodImpl(MethodImplOptions.AggressiveInlining)]
55     public static bool IsPartialPoint<TLink>(this Link<TLink> link) =>
        ↪ Point<TLink>.IsPartialPoint(link);
56 }
57 }

```

#### 1.24 ./csharp/Platform.Data.Doublets/LinksOperatorBase.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.Data.Doublets
6 {
7     /// <summary>
8     /// <para>
9     /// Represents the links operator base.
10    /// </para>
11    /// <para></para>
12    /// </summary>
13    public abstract class LinksOperatorBase<TLink>
14    {
15        /// <summary>
16        /// <para>
17        /// The links.
18        /// </para>
19        /// <para></para>
20        /// </summary>
21        protected readonly ILinks<TLink> _links;
22
23        /// <summary>
24        /// <para>
25        /// Gets the links value.
26        /// </para>
27        /// <para></para>
28        /// </summary>
29        public ILinks<TLink> Links
30        {
31            [MethodImpl(MethodImplOptions.AggressiveInlining)]
32            get => _links;
33        }
34
35        /// <summary>
36        /// <para>
37        /// Initializes a new <see cref="LinksOperatorBase"/> instance.
38        /// </para>
39        /// <para></para>
40        /// </summary>
41        /// <param name="links">
42        /// <para>A links.</para>
43        /// <para></para>
44        /// </param>
45        [MethodImpl(MethodImplOptions.AggressiveInlining)]
46        protected LinksOperatorBase(ILinks<TLink> links) => _links = links;
47    }
48 }

```

#### 1.25 ./csharp/Platform.Data.Doublets/Memory/ILinksListMethods.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.Data.Doublets.Memory
6 {
7     /// <summary>
8     /// <para>
9     /// Defines the links list methods.
10    /// </para>
11    /// <para></para>

```



```

12  /// </summary>
13  public interface ILinksListMethods<TLink>
14  {
15      /// <summary>
16      /// <para>
17      /// Detaches the free link.
18      /// </para>
19      /// <para></para>
20      /// </summary>
21      /// <param name="freeLink">
22      /// <para>The free link.</para>
23      /// <para></para>
24      /// </param>
25      [MethodImpl(MethodImplOptions.AggressiveInlining)]
26      void Detach(TLink freeLink);
27
28      /// <summary>
29      /// <para>
30      /// Attaches the as first using the specified link.
31      /// </para>
32      /// <para></para>
33      /// </summary>
34      /// <param name="link">
35      /// <para>The link.</para>
36      /// <para></para>
37      /// </param>
38      [MethodImpl(MethodImplOptions.AggressiveInlining)]
39      void AttachAsFirst(TLink link);
40  }
41  }

```

## 1.26 ./csharp/Platform.Data.Doublets/Memory/ILinksTreeMethods.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Doublets.Memory
8  {
9      /// <summary>
10     /// <para>
11     /// Defines the links tree methods.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     public interface ILinksTreeMethods<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Counts the usages using the specified root.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="root">
24         /// <para>The root.</para>
25         /// <para></para>
26         /// </param>
27         /// <returns>
28         /// <para>The link</para>
29         /// <para></para>
30         /// </returns>
31         [MethodImpl(MethodImplOptions.AggressiveInlining)]
32         TLink CountUsages(TLink root);
33
34         /// <summary>
35         /// <para>
36         /// Searches the source.
37         /// </para>
38         /// <para></para>
39         /// </summary>
40         /// <param name="source">
41         /// <para>The source.</para>
42         /// <para></para>
43         /// </param>
44         /// <param name="target">
45         /// <para>The target.</para>
46         /// <para></para>
47         /// </param>

```

```

48     /// <returns>
49     /// <para>The link</para>
50     /// <para></para>
51     /// </returns>
52     [MethodImpl(MethodImplOptions.AggressiveInlining)]
53     TLink Search(TLink source, TLink target);
54
55     /// <summary>
56     /// <para>
57     /// Eaches the usage using the specified root.
58     /// </para>
59     /// <para></para>
60     /// </summary>
61     /// <param name="root">
62     /// <para>The root.</para>
63     /// <para></para>
64     /// </param>
65     /// <param name="handler">
66     /// <para>The handler.</para>
67     /// <para></para>
68     /// </param>
69     /// <returns>
70     /// <para>The link</para>
71     /// <para></para>
72     /// </returns>
73     [MethodImpl(MethodImplOptions.AggressiveInlining)]
74     TLink EachUsage(TLink root, Func<IList<TLink>, TLink> handler);
75
76     /// <summary>
77     /// <para>
78     /// Detaches the root.
79     /// </para>
80     /// <para></para>
81     /// </summary>
82     /// <param name="root">
83     /// <para>The root.</para>
84     /// <para></para>
85     /// </param>
86     /// <param name="linkIndex">
87     /// <para>The link index.</para>
88     /// <para></para>
89     /// </param>
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     void Detach(ref TLink root, TLink linkIndex);
92
93     /// <summary>
94     /// <para>
95     /// Attaches the root.
96     /// </para>
97     /// <para></para>
98     /// </summary>
99     /// <param name="root">
100    /// <para>The root.</para>
101    /// <para></para>
102    /// </param>
103    /// <param name="linkIndex">
104    /// <para>The link index.</para>
105    /// <para></para>
106    /// </param>
107    [MethodImpl(MethodImplOptions.AggressiveInlining)]
108    void Attach(ref TLink root, TLink linkIndex);
109 }
110 }

```

## 1.27 ./csharp/Platform.Data.Doublets/Memory/IndexTreeType.cs

```

1  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
2
3  namespace Platform.Data.Doublets.Memory
4  {
5      /// <summary>
6      /// <para>
7      /// The index tree type enum.
8      /// </para>
9      /// <para></para>
10     /// </summary>
11     public enum IndexTreeType
12     {
13         /// <summary>

```

```

14     /// <para>
15     /// The default index tree type.
16     /// </para>
17     /// <para></para>
18     /// </summary>
19     Default = 0,
20     /// <summary>
21     /// <para>
22     /// The size balanced tree index tree type.
23     /// </para>
24     /// <para></para>
25     /// </summary>
26     SizeBalancedTree = 1,
27     /// <summary>
28     /// <para>
29     /// The recursionless size balanced tree index tree type.
30     /// </para>
31     /// <para></para>
32     /// </summary>
33     RecursionlessSizeBalancedTree = 2,
34     /// <summary>
35     /// <para>
36     /// The sized and threaded avl balanced tree index tree type.
37     /// </para>
38     /// <para></para>
39     /// </summary>
40     SizedAndThreadedAVLBalancedTree = 3
41 }
42 }

```

## 1.28 ./csharp/Platform.Data.Doublets/Memory/LinksHeader.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4  using Platform.Unsafe;
5
6  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
7
8  namespace Platform.Data.Doublets.Memory
9  {
10     /// <summary>
11     /// <para>
12     /// The links header.
13     /// </para>
14     /// <para></para>
15     /// </summary>
16     public struct LinksHeader<TLink> : IEquatable<LinksHeader<TLink>>
17     {
18         /// <summary>
19         /// <para>
20         /// The default.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         private static readonly EqualityComparer<TLink> _equalityComparer =
25             ⇨ EqualityComparer<TLink>.Default;
26
27         /// <summary>
28         /// <para>
29         /// The size.
30         /// </para>
31         /// <para></para>
32         /// </summary>
33         public static readonly long SizeInBytes = Structure<LinksHeader<TLink>>.Size;
34
35         /// <summary>
36         /// <para>
37         /// The allocated links.
38         /// </para>
39         /// <para></para>
40         /// </summary>
41         public TLink AllocatedLinks;
42
43         /// <summary>
44         /// <para>
45         /// The reserved links.
46         /// </para>
47         /// <para></para>
48         /// </summary>
49         public TLink ReservedLinks;
50     }
51 }

```

```

48     /// <summary>
49     /// <para>
50     /// The free links.
51     /// </para>
52     /// <para></para>
53     /// </summary>
54     public TLink FreeLinks;
55     /// <summary>
56     /// <para>
57     /// The first free link.
58     /// </para>
59     /// <para></para>
60     /// </summary>
61     public TLink FirstFreeLink;
62     /// <summary>
63     /// <para>
64     /// The root as source.
65     /// </para>
66     /// <para></para>
67     /// </summary>
68     public TLink RootAsSource;
69     /// <summary>
70     /// <para>
71     /// The root as target.
72     /// </para>
73     /// <para></para>
74     /// </summary>
75     public TLink RootAsTarget;
76     /// <summary>
77     /// <para>
78     /// The last free link.
79     /// </para>
80     /// <para></para>
81     /// </summary>
82     public TLink LastFreeLink;
83     /// <summary>
84     /// <para>
85     /// The reserved.
86     /// </para>
87     /// <para></para>
88     /// </summary>
89     public TLink Reserved8;
90
91     /// <summary>
92     /// <para>
93     /// Determines whether this instance equals.
94     /// </para>
95     /// <para></para>
96     /// </summary>
97     /// <param name="obj">
98     /// <para>The obj.</para>
99     /// <para></para>
100    /// </param>
101    /// <returns>
102    /// <para>The bool</para>
103    /// <para></para>
104    /// </returns>
105    [MethodImpl(MethodImplOptions.AggressiveInlining)]
106    public override bool Equals(object obj) => obj is LinksHeader<TLink> linksHeader ?
    ↪ Equals(linksHeader) : false;
107
108    /// <summary>
109    /// <para>
110    /// Determines whether this instance equals.
111    /// </para>
112    /// <para></para>
113    /// </summary>
114    /// <param name="other">
115    /// <para>The other.</para>
116    /// <para></para>
117    /// </param>
118    /// <returns>
119    /// <para>The bool</para>
120    /// <para></para>
121    /// </returns>
122    [MethodImpl(MethodImplOptions.AggressiveInlining)]
123    public bool Equals(LinksHeader<TLink> other)
124    => _equalityComparer.Equals(AllocatedLinks, other.AllocatedLinks)

```

```

125         && _equalityComparer.Equals(ReservedLinks, other.ReservedLinks)
126         && _equalityComparer.Equals(FreeLinks, other.FreeLinks)
127         && _equalityComparer.Equals(FirstFreeLink, other.FirstFreeLink)
128         && _equalityComparer.Equals(RootAsSource, other.RootAsSource)
129         && _equalityComparer.Equals(RootAsTarget, other.RootAsTarget)
130         && _equalityComparer.Equals>LastFreeLink, other.LastFreeLink)
131         && _equalityComparer.Equals(Reserved8, other.Reserved8);
132
133     /// <summary>
134     /// <para>
135     /// Gets the hash code.
136     /// </para>
137     /// <para></para>
138     /// </summary>
139     /// <returns>
140     /// <para>The int</para>
141     /// <para></para>
142     /// </returns>
143     [MethodImpl(MethodImplOptions.AggressiveInlining)]
144     public override int GetHashCode() => (AllocatedLinks, ReservedLinks, FreeLinks,
145     ↪ FirstFreeLink, RootAsSource, RootAsTarget, LastFreeLink, Reserved8).GetHashCode();
146
147     [MethodImpl(MethodImplOptions.AggressiveInlining)]
148     public static bool operator ==(LinksHeader<TLink> left, LinksHeader<TLink> right) =>
149     ↪ left.Equals(right);
150
151     [MethodImpl(MethodImplOptions.AggressiveInlining)]
152     public static bool operator !=(LinksHeader<TLink> left, LinksHeader<TLink> right) =>
153     ↪ !(left == right);
154 }
155 }

```

## 1.29 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/ExternalLinksRecursionlessSizeBalancedTreeMethods

```

1 using System;
2 using System.Text;
3 using System.Collections.Generic;
4 using System.Runtime.CompilerServices;
5 using Platform.Collections.Methods.Trees;
6 using Platform.Converters;
7 using static System.Runtime.CompilerServices.Unsafe;
8
9 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
10
11 namespace Platform.Data.Doublets.Memory.Split.Generic
12 {
13     /// <summary>
14     /// <para>
15     /// Represents the external links recursionless size balanced tree methods base.
16     /// </para>
17     /// <para></para>
18     /// </summary>
19     /// <seealso cref="RecursionlessSizeBalancedTreeMethods{TLink}" />
20     /// <seealso cref="ILinksTreeMethods{TLink}" />
21     public unsafe abstract class ExternalLinksRecursionlessSizeBalancedTreeMethodsBase<TLink> :
22     ↪ RecursionlessSizeBalancedTreeMethods<TLink>, ILinksTreeMethods<TLink>
23     {
24         /// <summary>
25         /// <para>
26         /// The default.
27         /// </para>
28         /// <para></para>
29         /// </summary>
30         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
31         ↪ UncheckedConverter<TLink, long>.Default;
32
33         /// <summary>
34         /// <para>
35         /// The break.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         protected readonly TLink Break;
40
41         /// <summary>
42         /// <para>
43         /// The continue.
44         /// </para>
45         /// <para></para>
46         /// </summary>
47         protected readonly TLink Continue;

```

```

45     /// <summary>
46     /// <para>
47     /// The links data parts.
48     /// </para>
49     /// <para></para>
50     /// </summary>
51     protected readonly byte* LinksDataParts;
52     /// <summary>
53     /// <para>
54     /// The links index parts.
55     /// </para>
56     /// <para></para>
57     /// </summary>
58     protected readonly byte* LinksIndexParts;
59     /// <summary>
60     /// <para>
61     /// The header.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     protected readonly byte* Header;
66
67     /// <summary>
68     /// <para>
69     /// Initializes a new <see
70     ↪ cref="ExternalLinksRecursionlessSizeBalancedTreeMethodsBase"/> instance.
71     /// </para>
72     /// <para></para>
73     /// </summary>
74     /// <param name="constants">
75     /// <para>A constants.</para>
76     /// </param>
77     /// <param name="linksDataParts">
78     /// <para>A links data parts.</para>
79     /// </param>
80     /// <param name="linksIndexParts">
81     /// <para>A links index parts.</para>
82     /// </param>
83     /// <param name="header">
84     /// <para>A header.</para>
85     /// </param>
86     [MethodImpl(MethodImplOptions.AggressiveInlining)]
87     protected ExternalLinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<TLink>
88     ↪ constants, byte* linksDataParts, byte* linksIndexParts, byte* header)
89     {
90         LinksDataParts = linksDataParts;
91         LinksIndexParts = linksIndexParts;
92         Header = header;
93         Break = constants.Break;
94         Continue = constants.Continue;
95     }
96
97     /// <summary>
98     /// <para>
99     /// Gets the tree root.
100    /// </para>
101    /// <para></para>
102    /// </summary>
103    /// <returns>
104    /// <para>The link</para>
105    /// <para></para>
106    /// </returns>
107    [MethodImpl(MethodImplOptions.AggressiveInlining)]
108    protected abstract TLink GetTreeRoot();
109
110    /// <summary>
111    /// <para>
112    /// Gets the base part value using the specified link.
113    /// </para>
114    /// <para></para>
115    /// </summary>
116    /// <param name="link">
117    /// <para>The link.</para>
118    /// </param>
119    /// <para></para>
120

```

```

121     /// </param>
122     /// <returns>
123     /// <para>The link</para>
124     /// <para></para>
125     /// </returns>
126     [MethodImpl(MethodImplOptions.AggressiveInlining)]
127     protected abstract TLink GetBasePartValue(TLink link);
128
129     /// <summary>
130     /// <para>
131     /// Determines whether this instance first is to the right of second.
132     /// </para>
133     /// <para></para>
134     /// </summary>
135     /// <param name="source">
136     /// <para>The source.</para>
137     /// <para></para>
138     /// </param>
139     /// <param name="target">
140     /// <para>The target.</para>
141     /// <para></para>
142     /// </param>
143     /// <param name="rootSource">
144     /// <para>The root source.</para>
145     /// <para></para>
146     /// </param>
147     /// <param name="rootTarget">
148     /// <para>The root target.</para>
149     /// <para></para>
150     /// </param>
151     /// <returns>
152     /// <para>The bool</para>
153     /// <para></para>
154     /// </returns>
155     [MethodImpl(MethodImplOptions.AggressiveInlining)]
156     protected abstract bool FirstIsToTheRightOfSecond(TLink source, TLink target, TLink
        ↪ rootSource, TLink rootTarget);
157
158     /// <summary>
159     /// <para>
160     /// Determines whether this instance first is to the left of second.
161     /// </para>
162     /// <para></para>
163     /// </summary>
164     /// <param name="source">
165     /// <para>The source.</para>
166     /// <para></para>
167     /// </param>
168     /// <param name="target">
169     /// <para>The target.</para>
170     /// <para></para>
171     /// </param>
172     /// <param name="rootSource">
173     /// <para>The root source.</para>
174     /// <para></para>
175     /// </param>
176     /// <param name="rootTarget">
177     /// <para>The root target.</para>
178     /// <para></para>
179     /// </param>
180     /// <returns>
181     /// <para>The bool</para>
182     /// <para></para>
183     /// </returns>
184     [MethodImpl(MethodImplOptions.AggressiveInlining)]
185     protected abstract bool FirstIsToTheLeftOfSecond(TLink source, TLink target, TLink
        ↪ rootSource, TLink rootTarget);
186
187     /// <summary>
188     /// <para>
189     /// Gets the header reference.
190     /// </para>
191     /// <para></para>
192     /// </summary>
193     /// <returns>
194     /// <para>A ref links header of t link</para>
195     /// <para></para>
196     /// </returns>

```

```

197 [MethodImpl(MethodImplOptions.AggressiveInlining)]
198 protected virtual ref LinksHeader<TLink> GetHeaderReference() => ref
    ↳ AsRef<LinksHeader<TLink>>(Header);
199
200 /// <summary>
201 /// <para>
202 /// Gets the link data part reference using the specified link.
203 /// </para>
204 /// <para></para>
205 /// </summary>
206 /// <param name="link">
207 /// <para>The link.</para>
208 /// <para></para>
209 /// </param>
210 /// <returns>
211 /// <para>A ref raw link data part of t link</para>
212 /// <para></para>
213 /// </returns>
214 [MethodImpl(MethodImplOptions.AggressiveInlining)]
215 protected virtual ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) => ref
    ↳ AsRef<RawLinkDataPart<TLink>>(LinksDataParts + (RawLinkDataPart<TLink>.SizeInBytes *
    ↳ _addressToInt64Converter.Convert(link)));
216
217 /// <summary>
218 /// <para>
219 /// Gets the link index part reference using the specified link.
220 /// </para>
221 /// <para></para>
222 /// </summary>
223 /// <param name="link">
224 /// <para>The link.</para>
225 /// <para></para>
226 /// </param>
227 /// <returns>
228 /// <para>A ref raw link index part of t link</para>
229 /// <para></para>
230 /// </returns>
231 [MethodImpl(MethodImplOptions.AggressiveInlining)]
232 protected virtual ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
    ↳ ref AsRef<RawLinkIndexPart<TLink>>(LinksIndexParts +
    ↳ (RawLinkIndexPart<TLink>.SizeInBytes * _addressToInt64Converter.Convert(link)));
233
234 /// <summary>
235 /// <para>
236 /// Gets the link values using the specified link index.
237 /// </para>
238 /// <para></para>
239 /// </summary>
240 /// <param name="linkIndex">
241 /// <para>The link index.</para>
242 /// <para></para>
243 /// </param>
244 /// <returns>
245 /// <para>A list of t link</para>
246 /// <para></para>
247 /// </returns>
248 [MethodImpl(MethodImplOptions.AggressiveInlining)]
249 protected virtual IList<TLink> GetLinkValues(TLink linkIndex)
250 {
251     ref var link = ref GetLinkDataPartReference(linkIndex);
252     return new Link<TLink>(linkIndex, link.Source, link.Target);
253 }
254
255 /// <summary>
256 /// <para>
257 /// Determines whether this instance first is to the left of second.
258 /// </para>
259 /// <para></para>
260 /// </summary>
261 /// <param name="first">
262 /// <para>The first.</para>
263 /// <para></para>
264 /// </param>
265 /// <param name="second">
266 /// <para>The second.</para>
267 /// <para></para>
268 /// </param>
269 /// <returns>

```



```

270 /// <para>The bool</para>
271 /// <para></para>
272 /// </returns>
273 [MethodImpl(MethodImplOptions.AggressiveInlining)]
274 protected override bool FirstIsToTheLeftOfSecond(TLink first, TLink second)
275 {
276     ref var firstLink = ref GetLinkDataPartReference(first);
277     ref var secondLink = ref GetLinkDataPartReference(second);
278     return FirstIsToTheLeftOfSecond(firstLink.Source, firstLink.Target,
279         ↪ secondLink.Source, secondLink.Target);
280 }
281
282 /// <summary>
283 /// <para>
284 /// Determines whether this instance first is to the right of second.
285 /// </para>
286 /// <para></para>
287 /// </summary>
288 /// <param name="first">
289 /// <para>The first.</para>
290 /// <para></para>
291 /// </param>
292 /// <param name="second">
293 /// <para>The second.</para>
294 /// <para></para>
295 /// </param>
296 /// <returns>
297 /// <para>The bool</para>
298 /// <para></para>
299 /// </returns>
300 [MethodImpl(MethodImplOptions.AggressiveInlining)]
301 protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second)
302 {
303     ref var firstLink = ref GetLinkDataPartReference(first);
304     ref var secondLink = ref GetLinkDataPartReference(second);
305     return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
306         ↪ secondLink.Source, secondLink.Target);
307 }
308
309 /// <summary>
310 /// <para>
311 /// The zero.
312 /// </para>
313 /// <para></para>
314 /// </summary>
315 public TLink this[TLink index]
316 {
317     [MethodImpl(MethodImplOptions.AggressiveInlining)]
318     get
319     {
320         var root = GetTreeRoot();
321         if (GreaterOrEqualThan(index, GetSize(root)))
322         {
323             return Zero;
324         }
325         while (!EqualToZero(root))
326         {
327             var left = GetLeftOrDefault(root);
328             var leftSize = GetSizeOrZero(left);
329             if (LessThan(index, leftSize))
330             {
331                 root = left;
332                 continue;
333             }
334             if (AreEqual(index, leftSize))
335             {
336                 return root;
337             }
338             root = GetRightOrDefault(root);
339             index = Subtract(index, Increment(leftSize));
340         }
341         return Zero; // TODO: Impossible situation exception (only if tree structure
342             ↪ broken)
343     }
344 }
345
346 /// <summary>

```

```

344    /// Выполняет поиск и возвращает индекс связи с указанными Source (началом) и Target
345    ↪ (концом).
346    /// </summary>
347    /// <param name="source">Индекс связи, которая является началом на искомой связи.</param>
348    /// <param name="target">Индекс связи, которая является концом на искомой связи.</param>
349    /// <returns>Индекс искомой связи.</returns>
350    [MethodImpl(MethodImplOptions.AggressiveInlining)]
351    public TLink Search(TLink source, TLink target)
352    {
353        var root = GetTreeRoot();
354        while (!EqualToZero(root))
355        {
356            ref var rootLink = ref GetLinkDataPartReference(root);
357            var rootSource = rootLink.Source;
358            var rootTarget = rootLink.Target;
359            if (FirstIsToTheLeftOfSecond(source, target, rootSource, rootTarget)) //
360                ↪ node.Key < root.Key
361            {
362                root = GetLeftOrDefault(root);
363            }
364            else if (FirstIsToTheRightOfSecond(source, target, rootSource, rootTarget)) //
365                ↪ node.Key > root.Key
366            {
367                root = GetRightOrDefault(root);
368            }
369            else // node.Key == root.Key
370            {
371                return root;
372            }
373        }
374        return Zero;
375    }
376
377    /// TODO: Return indices range instead of references count
378    /// <summary>
379    /// <para>
380    /// Counts the usages using the specified link.
381    /// </para>
382    /// <para></para>
383    /// </summary>
384    /// <param name="link">
385    /// <para>The link.</para>
386    /// <para></para>
387    /// </param>
388    /// <returns>
389    /// <para>The link</para>
390    /// <para></para>
391    /// </returns>
392    [MethodImpl(MethodImplOptions.AggressiveInlining)]
393    public TLink CountUsages(TLink link)
394    {
395        var root = GetTreeRoot();
396        var total = GetSize(root);
397        var totalRightIgnore = Zero;
398        while (!EqualToZero(root))
399        {
400            var @base = GetBasePartValue(root);
401            if (LessOrEqualThan(@base, link))
402            {
403                root = GetRightOrDefault(root);
404            }
405            else
406            {
407                totalRightIgnore = Add(totalRightIgnore, Increment(GetRightSize(root)));
408                root = GetLeftOrDefault(root);
409            }
410        }
411        root = GetTreeRoot();
412        var totalLeftIgnore = Zero;
413        while (!EqualToZero(root))
414        {
415            var @base = GetBasePartValue(root);
416            if (GreaterOrEqualThan(@base, link))
417            {
418                root = GetLeftOrDefault(root);
419            }
420            else
421            {
422                totalLeftIgnore = Add(totalLeftIgnore, Increment(GetLeftSize(root)));
423                root = GetRightOrDefault(root);
424            }
425        }
426        return total - totalLeftIgnore - totalRightIgnore;
427    }

```

```

419         totalLeftIgnore = Add(totalLeftIgnore, Increment(GetLeftSize(root)));
420         root = GetRightOrDefault(root);
421     }
422 }
423 return Subtract(Subtract(total, totalRightIgnore), totalLeftIgnore);
424 }
425
426 /// <summary>
427 /// <para>
428 /// Eaches the usage using the specified base.
429 /// </para>
430 /// <para></para>
431 /// </summary>
432 /// <param name="@base">
433 /// <para>The base.</para>
434 /// <para></para>
435 /// </param>
436 /// <param name="handler">
437 /// <para>The handler.</para>
438 /// <para></para>
439 /// </param>
440 /// <returns>
441 /// <para>The link</para>
442 /// <para></para>
443 /// </returns>
444 [MethodImpl(MethodImplOptions.AggressiveInlining)]
445 public TLink EachUsage(TLink @base, Func<IList<TLink>, TLink> handler) =>
446     ↳ EachUsageCore(@base, GetTreeRoot(), handler);
447
448 // TODO: 1. Move target, handler to separate object. 2. Use stack or walker 3. Use
449 ↳ low-level MSIL stack.
450 /// <summary>
451 /// <para>
452 /// Eaches the usage core using the specified base.
453 /// </para>
454 /// <para></para>
455 /// </summary>
456 /// <param name="@base">
457 /// <para>The base.</para>
458 /// <para></para>
459 /// </param>
460 /// <param name="link">
461 /// <para>The link.</para>
462 /// <para></para>
463 /// </param>
464 /// <param name="handler">
465 /// <para>The handler.</para>
466 /// <para></para>
467 /// </param>
468 /// <returns>
469 /// <para>The continue.</para>
470 /// <para></para>
471 /// </returns>
472 [MethodImpl(MethodImplOptions.AggressiveInlining)]
473 private TLink EachUsageCore(TLink @base, TLink link, Func<IList<TLink>, TLink> handler)
474 {
475     var @continue = Continue;
476     if (EqualToZero(link))
477     {
478         return @continue;
479     }
480     var linkBasePart = GetBasePartValue(link);
481     var @break = Break;
482     if (GreaterThan(linkBasePart, @base))
483     {
484         if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
485         {
486             return @break;
487         }
488     }
489     else if (LessThan(linkBasePart, @base))
490     {
491         if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
492         {
493             return @break;
494         }
495     }
496     else //if (linkBasePart == @base)

```

```

495     {
496         if (AreEqual(handler(GetLinkValues(link)), @break))
497         {
498             return @break;
499         }
500         if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
501         {
502             return @break;
503         }
504         if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
505         {
506             return @break;
507         }
508     }
509     return @continue;
510 }
511
512 /// <summary>
513 /// <para>
514 /// Prints the node value using the specified node.
515 /// </para>
516 /// <para></para>
517 /// </summary>
518 /// <param name="node">
519 /// <para>The node.</para>
520 /// <para></para>
521 /// </param>
522 /// <param name="sb">
523 /// <para>The sb.</para>
524 /// <para></para>
525 /// </param>
526 [MethodImpl(MethodImplOptions.AggressiveInlining)]
527 protected override void PrintNodeValue(TLink node, StringBuilder sb)
528 {
529     ref var link = ref GetLinkDataPartReference(node);
530     sb.Append(' ');
531     sb.Append(link.Source);
532     sb.Append('-');
533     sb.Append('>');
534     sb.Append(link.Target);
535 }
536 }
537 }

```

### 1.30 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/ExternalLinksSizeBalancedTreeMethodsBase.cs

```

1  using System;
2  using System.Text;
3  using System.Collections.Generic;
4  using System.Runtime.CompilerServices;
5  using Platform.Collections.Methods.Trees;
6  using Platform.Converters;
7  using static System.Runtime.CompilerServices.Unsafe;
8
9  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
10
11 namespace Platform.Data.Doublets.Memory.Split.Generic
12 {
13     /// <summary>
14     /// <para>
15     /// Represents the external links size balanced tree methods base.
16     /// </para>
17     /// <para></para>
18     /// </summary>
19     /// <seealso cref="SizeBalancedTreeMethods{TLink}" />
20     /// <seealso cref="ILinksTreeMethods{TLink}" />
21     public unsafe abstract class ExternalLinksSizeBalancedTreeMethodsBase<TLink> :
22     ↪ SizeBalancedTreeMethods<TLink>, ILinksTreeMethods<TLink>
23     {
24         /// <summary>
25         /// <para>
26         /// The default.
27         /// </para>
28         /// <para></para>
29         /// </summary>
30         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
31         ↪ UncheckedConverter<TLink, long>.Default;
32
33         /// <summary>
34         /// <para>

```

```

33     /// The break.
34     /// </para>
35     /// <para></para>
36     /// </summary>
37     protected readonly TLink Break;
38     /// <summary>
39     /// <para>
40     /// The continue.
41     /// </para>
42     /// <para></para>
43     /// </summary>
44     protected readonly TLink Continue;
45     /// <summary>
46     /// <para>
47     /// The links data parts.
48     /// </para>
49     /// <para></para>
50     /// </summary>
51     protected readonly byte* LinksDataParts;
52     /// <summary>
53     /// <para>
54     /// The links index parts.
55     /// </para>
56     /// <para></para>
57     /// </summary>
58     protected readonly byte* LinksIndexParts;
59     /// <summary>
60     /// <para>
61     /// The header.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     protected readonly byte* Header;
66
67     /// <summary>
68     /// <para>
69     /// Initializes a new <see cref="ExternalLinksSizeBalancedTreeMethodsBase"/> instance.
70     /// </para>
71     /// <para></para>
72     /// </summary>
73     /// <param name="constants">
74     /// <para>A constants.</para>
75     /// <para></para>
76     /// </param>
77     /// <param name="linksDataParts">
78     /// <para>A links data parts.</para>
79     /// <para></para>
80     /// </param>
81     /// <param name="linksIndexParts">
82     /// <para>A links index parts.</para>
83     /// <para></para>
84     /// </param>
85     /// <param name="header">
86     /// <para>A header.</para>
87     /// <para></para>
88     /// </param>
89     [MethodImpl(MethodImplOptions.AggressiveInlining)]
90     protected ExternalLinksSizeBalancedTreeMethodsBase(LinksConstants<TLink> constants,
91     ↪ byte* linksDataParts, byte* linksIndexParts, byte* header)
92     {
93         LinksDataParts = linksDataParts;
94         LinksIndexParts = linksIndexParts;
95         Header = header;
96         Break = constants.Break;
97         Continue = constants.Continue;
98     }
99     /// <summary>
100    /// <para>
101    /// Gets the tree root.
102    /// </para>
103    /// <para></para>
104    /// </summary>
105    /// <returns>
106    /// <para>The link</para>
107    /// <para></para>
108    /// </returns>
109    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

110     protected abstract TLink GetTreeRoot();
111
112     /// <summary>
113     /// <para>
114     /// Gets the base part value using the specified link.
115     /// </para>
116     /// <para></para>
117     /// </summary>
118     /// <param name="link">
119     /// <para>The link.</para>
120     /// <para></para>
121     /// </param>
122     /// <returns>
123     /// <para>The link</para>
124     /// <para></para>
125     /// </returns>
126     [MethodImpl(MethodImplOptions.AggressiveInlining)]
127     protected abstract TLink GetBasePartValue(TLink link);
128
129     /// <summary>
130     /// <para>
131     /// Determines whether this instance first is to the right of second.
132     /// </para>
133     /// <para></para>
134     /// </summary>
135     /// <param name="source">
136     /// <para>The source.</para>
137     /// <para></para>
138     /// </param>
139     /// <param name="target">
140     /// <para>The target.</para>
141     /// <para></para>
142     /// </param>
143     /// <param name="rootSource">
144     /// <para>The root source.</para>
145     /// <para></para>
146     /// </param>
147     /// <param name="rootTarget">
148     /// <para>The root target.</para>
149     /// <para></para>
150     /// </param>
151     /// <returns>
152     /// <para>The bool</para>
153     /// <para></para>
154     /// </returns>
155     [MethodImpl(MethodImplOptions.AggressiveInlining)]
156     protected abstract bool FirstIsToTheRightOfSecond(TLink source, TLink target, TLink
        ↪ rootSource, TLink rootTarget);
157
158     /// <summary>
159     /// <para>
160     /// Determines whether this instance first is to the left of second.
161     /// </para>
162     /// <para></para>
163     /// </summary>
164     /// <param name="source">
165     /// <para>The source.</para>
166     /// <para></para>
167     /// </param>
168     /// <param name="target">
169     /// <para>The target.</para>
170     /// <para></para>
171     /// </param>
172     /// <param name="rootSource">
173     /// <para>The root source.</para>
174     /// <para></para>
175     /// </param>
176     /// <param name="rootTarget">
177     /// <para>The root target.</para>
178     /// <para></para>
179     /// </param>
180     /// <returns>
181     /// <para>The bool</para>
182     /// <para></para>
183     /// </returns>
184     [MethodImpl(MethodImplOptions.AggressiveInlining)]
185     protected abstract bool FirstIsToTheLeftOfSecond(TLink source, TLink target, TLink
        ↪ rootSource, TLink rootTarget);

```

```

186
187     /// <summary>
188     /// <para>
189     /// Gets the header reference.
190     /// </para>
191     /// <para></para>
192     /// </summary>
193     /// <returns>
194     /// <para>A ref links header of t link</para>
195     /// <para></para>
196     /// </returns>
197     [MethodImpl(MethodImplOptions.AggressiveInlining)]
198     protected virtual ref LinksHeader<TLink> GetHeaderReference() => ref
199     ↪ AsRef<LinksHeader<TLink>>(Header);
200
201     /// <summary>
202     /// <para>
203     /// Gets the link data part reference using the specified link.
204     /// </para>
205     /// <para></para>
206     /// </summary>
207     /// <param name="link">
208     /// <para>The link.</para>
209     /// <para></para>
210     /// </param>
211     /// <returns>
212     /// <para>A ref raw link data part of t link</para>
213     /// <para></para>
214     /// </returns>
215     [MethodImpl(MethodImplOptions.AggressiveInlining)]
216     protected virtual ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) => ref
217     ↪ AsRef<RawLinkDataPart<TLink>>(LinksDataParts + (RawLinkDataPart<TLink>.SizeInBytes *
218     ↪ _addressToInt64Converter.Convert(link)));
219
220     /// <summary>
221     /// <para>
222     /// Gets the link index part reference using the specified link.
223     /// </para>
224     /// <para></para>
225     /// </summary>
226     /// <param name="link">
227     /// <para>The link.</para>
228     /// <para></para>
229     /// </param>
230     /// <returns>
231     /// <para>A ref raw link index part of t link</para>
232     /// <para></para>
233     /// </returns>
234     [MethodImpl(MethodImplOptions.AggressiveInlining)]
235     protected virtual ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
236     ↪ ref AsRef<RawLinkIndexPart<TLink>>(LinksIndexParts +
237     ↪ (RawLinkIndexPart<TLink>.SizeInBytes * _addressToInt64Converter.Convert(link)));
238
239     /// <summary>
240     /// <para>
241     /// Gets the link values using the specified link index.
242     /// </para>
243     /// <para></para>
244     /// </summary>
245     /// <param name="linkIndex">
246     /// <para>The link index.</para>
247     /// <para></para>
248     /// </param>
249     /// <returns>
250     /// <para>A list of t link</para>
251     /// <para></para>
252     /// </returns>
253     [MethodImpl(MethodImplOptions.AggressiveInlining)]
254     protected virtual IList<TLink> GetLinkValues(TLink linkIndex)
255     {
256         ref var link = ref GetLinkDataPartReference(linkIndex);
257         return new Link<TLink>(linkIndex, link.Source, link.Target);
258     }
259
260     /// <summary>
261     /// <para>
262     /// Determines whether this instance first is to the left of second.
263     /// </para>

```

```

259    /// <para></para>
260    /// </summary>
261    /// <param name="first">
262    /// <para>The first.</para>
263    /// <para></para>
264    /// </param>
265    /// <param name="second">
266    /// <para>The second.</para>
267    /// <para></para>
268    /// </param>
269    /// <returns>
270    /// <para>The bool</para>
271    /// <para></para>
272    /// </returns>
273    [MethodImpl(MethodImplOptions.AggressiveInlining)]
274    protected override bool FirstIsToTheLeftOfSecond(TLink first, TLink second)
275    {
276        ref var firstLink = ref GetLinkDataPartReference(first);
277        ref var secondLink = ref GetLinkDataPartReference(second);
278        return FirstIsToTheLeftOfSecond(firstLink.Source, firstLink.Target,
279            ↪ secondLink.Source, secondLink.Target);
280    }
281    /// <summary>
282    /// <para>
283    /// Determines whether this instance first is to the right of second.
284    /// </para>
285    /// <para></para>
286    /// </summary>
287    /// <param name="first">
288    /// <para>The first.</para>
289    /// <para></para>
290    /// </param>
291    /// <param name="second">
292    /// <para>The second.</para>
293    /// <para></para>
294    /// </param>
295    /// <returns>
296    /// <para>The bool</para>
297    /// <para></para>
298    /// </returns>
299    [MethodImpl(MethodImplOptions.AggressiveInlining)]
300    protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second)
301    {
302        ref var firstLink = ref GetLinkDataPartReference(first);
303        ref var secondLink = ref GetLinkDataPartReference(second);
304        return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
305            ↪ secondLink.Source, secondLink.Target);
306    }
307    /// <summary>
308    /// <para>
309    /// The zero.
310    /// </para>
311    /// <para></para>
312    /// </summary>
313    public TLink this[TLink index]
314    {
315        [MethodImpl(MethodImplOptions.AggressiveInlining)]
316        get
317        {
318            var root = GetTreeRoot();
319            if (GreaterOrEqualThan(index, GetSize(root)))
320            {
321                return Zero;
322            }
323            while (!EqualToZero(root))
324            {
325                var left = GetLeftOrDefault(root);
326                var leftSize = GetSizeOrZero(left);
327                if (LessThan(index, leftSize))
328                {
329                    root = left;
330                    continue;
331                }
332                if (AreEqual(index, leftSize))
333                {
334                    return root;

```



```

335         }
336         root = GetRightOrDefault(root);
337         index = Subtract(index, Increment(leftSize));
338     }
339     return Zero; // TODO: Impossible situation exception (only if tree structure
    ↪ broken)
340 }
341 }
342
343 /// <summary>
344 /// Выполняет поиск и возвращает индекс связи с указанными Source (началом) и Target
    ↪ (концом).
345 /// </summary>
346 /// <param name="source">Индекс связи, которая является началом на искомой связи.</param>
347 /// <param name="target">Индекс связи, которая является концом на искомой связи.</param>
348 /// <returns>Индекс искомой связи.</returns>
349 [MethodImpl(MethodImplOptions.AggressiveInlining)]
350 public TLink Search(TLink source, TLink target)
351 {
352     var root = GetTreeRoot();
353     while (!EqualToZero(root))
354     {
355         ref var rootLink = ref GetLinkDataPartReference(root);
356         var rootSource = rootLink.Source;
357         var rootTarget = rootLink.Target;
358         if (FirstIsToTheLeftOfSecond(source, target, rootSource, rootTarget)) //
            ↪ node.Key < root.Key
359         {
360             root = GetLeftOrDefault(root);
361         }
362         else if (FirstIsToTheRightOfSecond(source, target, rootSource, rootTarget)) //
            ↪ node.Key > root.Key
363         {
364             root = GetRightOrDefault(root);
365         }
366         else // node.Key == root.Key
367         {
368             return root;
369         }
370     }
371     return Zero;
372 }
373
374 // TODO: Return indices range instead of references count
375 /// <summary>
376 /// <para>
377 /// Counts the usages using the specified link.
378 /// </para>
379 /// <para></para>
380 /// </summary>
381 /// <param name="link">
382 /// <para>The link.</para>
383 /// <para></para>
384 /// </param>
385 /// <returns>
386 /// <para>The link</para>
387 /// <para></para>
388 /// </returns>
389 [MethodImpl(MethodImplOptions.AggressiveInlining)]
390 public TLink CountUsages(TLink link)
391 {
392     var root = GetTreeRoot();
393     var total = GetSize(root);
394     var totalRightIgnore = Zero;
395     while (!EqualToZero(root))
396     {
397         var @base = GetBasePartValue(root);
398         if (LessOrEqualThan(@base, link))
399         {
400             root = GetRightOrDefault(root);
401         }
402         else
403         {
404             totalRightIgnore = Add(totalRightIgnore, Increment(GetRightSize(root)));
405             root = GetLeftOrDefault(root);
406         }
407     }
408     root = GetTreeRoot();

```

```

409     var totalLeftIgnore = Zero;
410     while (!EqualToZero(root))
411     {
412         var @base = GetBasePartValue(root);
413         if (GreaterOrEqualThan(@base, link))
414         {
415             root = GetLeftOrDefault(root);
416         }
417         else
418         {
419             totalLeftIgnore = Add(totalLeftIgnore, Increment(GetLeftSize(root)));
420             root = GetRightOrDefault(root);
421         }
422     }
423     return Subtract(Subtract(total, totalRightIgnore), totalLeftIgnore);
424 }
425
426 /// <summary>
427 /// <para>
428 /// Eaches the usage using the specified base.
429 /// </para>
430 /// <para></para>
431 /// </summary>
432 /// <param name="@base">
433 /// <para>The base.</para>
434 /// <para></para>
435 /// </param>
436 /// <param name="handler">
437 /// <para>The handler.</para>
438 /// <para></para>
439 /// </param>
440 /// <returns>
441 /// <para>The link</para>
442 /// <para></para>
443 /// </returns>
444 [MethodImpl(MethodImplOptions.AggressiveInlining)]
445 public TLink EachUsage(TLink @base, Func<IList<TLink>, TLink> handler) =>
446     ↳ EachUsageCore(@base, GetTreeRoot(), handler);
447
448 // TODO: 1. Move target, handler to separate object. 2. Use stack or walker 3. Use
449 ↳ low-level MSIL stack.
450 /// <summary>
451 /// <para>
452 /// Eaches the usage core using the specified base.
453 /// </para>
454 /// <para></para>
455 /// </summary>
456 /// <param name="@base">
457 /// <para>The base.</para>
458 /// <para></para>
459 /// </param>
460 /// <param name="link">
461 /// <para>The link.</para>
462 /// <para></para>
463 /// </param>
464 /// <param name="handler">
465 /// <para>The handler.</para>
466 /// <para></para>
467 /// </param>
468 /// <returns>
469 /// <para>The continue.</para>
470 /// <para></para>
471 /// </returns>
472 [MethodImpl(MethodImplOptions.AggressiveInlining)]
473 private TLink EachUsageCore(TLink @base, TLink link, Func<IList<TLink>, TLink> handler)
474 {
475     var @continue = Continue;
476     if (EqualToZero(link))
477     {
478         return @continue;
479     }
480     var linkBasePart = GetBasePartValue(link);
481     var @break = Break;
482     if (GreaterThan(linkBasePart, @base))
483     {
484         if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
485         {
486             return @break;
487         }
488     }
489 }

```

```

485     }
486 }
487 else if (LessThan(linkBasePart, @base))
488 {
489     if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
490     {
491         return @break;
492     }
493 }
494 else //if (linkBasePart == @base)
495 {
496     if (AreEqual(handler(GetLinkValues(link)), @break))
497     {
498         return @break;
499     }
500     if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
501     {
502         return @break;
503     }
504     if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
505     {
506         return @break;
507     }
508 }
509 return @continue;
510 }
511
512 /// <summary>
513 /// <para>
514 /// Prints the node value using the specified node.
515 /// </para>
516 /// <para></para>
517 /// </summary>
518 /// <param name="node">
519 /// <para>The node.</para>
520 /// <para></para>
521 /// </param>
522 /// <param name="sb">
523 /// <para>The sb.</para>
524 /// <para></para>
525 /// </param>
526 [MethodImpl(MethodImplOptions.AggressiveInlining)]
527 protected override void PrintNodeValue(TLink node, StringBuilder sb)
528 {
529     ref var link = ref GetLinkDataPartReference(node);
530     sb.Append(' ');
531     sb.Append(link.Source);
532     sb.Append('-');
533     sb.Append('>');
534     sb.Append(link.Target);
535 }
536 }
537 }

```

### 1.31 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/ExternalLinksSourcesRecursionlessSizeBalancedTree

```

1 using System.Runtime.CompilerServices;
2
3 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5 namespace Platform.Data.Doublets.Memory.Split.Generic
6 {
7     /// <summary>
8     /// <para>
9     /// Represents the external links sources recursionless size balanced tree methods.
10    /// </para>
11    /// <para></para>
12    /// </summary>
13    /// <seealso cref="ExternalLinksRecursionlessSizeBalancedTreeMethodsBase{TLink}"/>
14    public unsafe class ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods<TLink> :
15        ↪ ExternalLinksRecursionlessSizeBalancedTreeMethodsBase<TLink>
16    {
17        /// <summary>
18        /// <para>
19        /// Initializes a new <see
20        ↪ cref="ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods"/> instance.
21        /// </para>
22        /// <para></para>
23        /// </summary>

```

```

22     /// <param name="constants">
23     /// <para>A constants.</para>
24     /// </para>
25     /// </param>
26     /// <param name="linksDataParts">
27     /// <para>A links data parts.</para>
28     /// </para>
29     /// </param>
30     /// <param name="linksIndexParts">
31     /// <para>A links index parts.</para>
32     /// </para>
33     /// </param>
34     /// <param name="header">
35     /// <para>A header.</para>
36     /// </para>
37     /// </param>
38     [MethodImpl(MethodImplOptions.AggressiveInlining)]
39     public ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
        ↪ constants, byte* linksDataParts, byte* linksIndexParts, byte* header) :
        ↪ base(constants, linksDataParts, linksIndexParts, header) { }

40
41     /// <summary>
42     /// <para>
43     /// Gets the left reference using the specified node.
44     /// </para>
45     /// </summary>
46     /// <param name="node">
47     /// <para>The node.</para>
48     /// </para>
49     /// </param>
50     /// <returns>
51     /// <para>The ref link</para>
52     /// </returns>
53     [MethodImpl(MethodImplOptions.AggressiveInlining)]
54     protected override ref TLink GetLeftReference(TLink node) => ref
        ↪ GetLinkIndexPartReference(node).LeftAsSource;

55
56     /// <summary>
57     /// <para>
58     /// Gets the right reference using the specified node.
59     /// </para>
60     /// </summary>
61     /// <param name="node">
62     /// <para>The node.</para>
63     /// </para>
64     /// </param>
65     /// <returns>
66     /// <para>The ref link</para>
67     /// </returns>
68     [MethodImpl(MethodImplOptions.AggressiveInlining)]
69     protected override ref TLink GetRightReference(TLink node) => ref
        ↪ GetLinkIndexPartReference(node).RightAsSource;

70
71     /// <summary>
72     /// <para>
73     /// Gets the left using the specified node.
74     /// </para>
75     /// </summary>
76     /// <param name="node">
77     /// <para>The node.</para>
78     /// </para>
79     /// </param>
80     /// <returns>
81     /// <para>The link</para>
82     /// </returns>
83     [MethodImpl(MethodImplOptions.AggressiveInlining)]
84     protected override TLink GetLeft(TLink node) =>
        ↪ GetLinkIndexPartReference(node).LeftAsSource;

85
86     /// <summary>
87     /// <para>
88

```

```

94     /// Gets the right using the specified node.
95     /// </para>
96     /// <para></para>
97     /// </summary>
98     /// <param name="node">
99     /// <para>The node.</para>
100    /// <para></para>
101    /// </param>
102    /// <returns>
103    /// <para>The link</para>
104    /// <para></para>
105    /// </returns>
106    [MethodImpl(MethodImplOptions.AggressiveInlining)]
107    protected override TLink GetRight(TLink node) =>
108        ↪ GetLinkIndexPartReference(node).RightAsSource;
109
110    /// <summary>
111    /// <para>
112    /// Sets the left using the specified node.
113    /// </para>
114    /// <para></para>
115    /// </summary>
116    /// <param name="node">
117    /// <para>The node.</para>
118    /// <para></para>
119    /// </param>
120    /// <param name="left">
121    /// <para>The left.</para>
122    /// <para></para>
123    /// </param>
124    [MethodImpl(MethodImplOptions.AggressiveInlining)]
125    protected override void SetLeft(TLink node, TLink left) =>
126        ↪ GetLinkIndexPartReference(node).LeftAsSource = left;
127
128    /// <summary>
129    /// <para>
130    /// Sets the right using the specified node.
131    /// </para>
132    /// <para></para>
133    /// </summary>
134    /// <param name="node">
135    /// <para>The node.</para>
136    /// <para></para>
137    /// </param>
138    /// <param name="right">
139    /// <para>The right.</para>
140    /// <para></para>
141    /// </param>
142    [MethodImpl(MethodImplOptions.AggressiveInlining)]
143    protected override void SetRight(TLink node, TLink right) =>
144        ↪ GetLinkIndexPartReference(node).RightAsSource = right;
145
146    /// <summary>
147    /// <para>
148    /// Gets the size using the specified node.
149    /// </para>
150    /// <para></para>
151    /// </summary>
152    /// <param name="node">
153    /// <para>The node.</para>
154    /// <para></para>
155    /// </param>
156    /// <returns>
157    /// <para>The link</para>
158    /// <para></para>
159    /// </returns>
160    [MethodImpl(MethodImplOptions.AggressiveInlining)]
161    protected override TLink GetSize(TLink node) =>
162        ↪ GetLinkIndexPartReference(node).SizeAsSource;
163
164    /// <summary>
165    /// <para>
166    /// Sets the size using the specified node.
167    /// </para>
168    /// <para></para>
169    /// </summary>
170    /// <param name="node">
171    /// <para>The node.</para>

```

```

168     /// <para></para>
169     /// </param>
170     /// <param name="size">
171     /// <para>The size.</para>
172     /// <para></para>
173     /// </param>
174     [MethodImpl(MethodImplOptions.AggressiveInlining)]
175     protected override void SetSize(TLink node, TLink size) =>
176         ↪ GetLinkIndexPartReference(node).SizeAsSource = size;
177
178     /// <summary>
179     /// <para>
180     /// Gets the tree root.
181     /// </para>
182     /// <para></para>
183     /// </summary>
184     /// <returns>
185     /// <para>The link</para>
186     /// <para></para>
187     /// </returns>
188     [MethodImpl(MethodImplOptions.AggressiveInlining)]
189     protected override TLink GetTreeRoot() => GetHeaderReference().RootAsSource;
190
191     /// <summary>
192     /// <para>
193     /// Gets the base part value using the specified link.
194     /// </para>
195     /// <para></para>
196     /// </summary>
197     /// <param name="link">
198     /// <para>The link.</para>
199     /// <para></para>
200     /// </param>
201     /// <returns>
202     /// <para>The link</para>
203     /// <para></para>
204     /// </returns>
205     [MethodImpl(MethodImplOptions.AggressiveInlining)]
206     protected override TLink GetBasePartValue(TLink link) =>
207         ↪ GetLinkDataPartReference(link).Source;
208
209     /// <summary>
210     /// <para>
211     /// Determines whether this instance first is to the left of second.
212     /// </para>
213     /// <para></para>
214     /// </summary>
215     /// <param name="firstSource">
216     /// <para>The first source.</para>
217     /// <para></para>
218     /// </param>
219     /// <param name="firstTarget">
220     /// <para>The first target.</para>
221     /// <para></para>
222     /// </param>
223     /// <param name="secondSource">
224     /// <para>The second source.</para>
225     /// <para></para>
226     /// </param>
227     /// <param name="secondTarget">
228     /// <para>The second target.</para>
229     /// <para></para>
230     /// </param>
231     /// <returns>
232     /// <para>The bool</para>
233     /// <para></para>
234     /// </returns>
235     [MethodImpl(MethodImplOptions.AggressiveInlining)]
236     protected override bool FirstIsToLeftOfSecond(TLink firstSource, TLink firstTarget,
237         ↪ TLink secondSource, TLink secondTarget) => LessThan(firstSource, secondSource) ||
238         ↪ (AreEqual(firstSource, secondSource) && LessThan(firstTarget, secondTarget));
239
240     /// <summary>
241     /// <para>
242     /// Determines whether this instance first is to the right of second.
243     /// </para>
244     /// <para></para>
245     /// </summary>

```

```

242     /// <param name="firstSource">
243     /// <para>The first source.</para>
244     /// <para></para>
245     /// </param>
246     /// <param name="firstTarget">
247     /// <para>The first target.</para>
248     /// <para></para>
249     /// </param>
250     /// <param name="secondSource">
251     /// <para>The second source.</para>
252     /// <para></para>
253     /// </param>
254     /// <param name="secondTarget">
255     /// <para>The second target.</para>
256     /// <para></para>
257     /// </param>
258     /// <returns>
259     /// <para>The bool</para>
260     /// <para></para>
261     /// </returns>
262     [MethodImpl(MethodImplOptions.AggressiveInlining)]
263     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
        ↪ TLink secondSource, TLink secondTarget) => GreaterThan(firstSource, secondSource) ||
        ↪ (AreEqual(firstSource, secondSource) && GreaterThan(firstTarget, secondTarget));

264     /// <summary>
265     /// <para>
266     /// Clears the node using the specified node.
267     /// </para>
268     /// <para></para>
269     /// </summary>
270     /// <param name="node">
271     /// <para>The node.</para>
272     /// <para></para>
273     /// </param>
274     [MethodImpl(MethodImplOptions.AggressiveInlining)]
275     protected override void ClearNode(TLink node)
276     {
277         ref var link = ref GetLinkIndexPartReference(node);
278         link.LeftAsSource = Zero;
279         link.RightAsSource = Zero;
280         link.SizeAsSource = Zero;
281     }
282 }
283 }
284 }

```

### 1.32 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/ExternalLinksSourcesSizeBalancedTreeMethods.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.Data.Doublets.Memory.Split.Generic
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the external links sources size balanced tree methods.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="ExternalLinksSizeBalancedTreeMethodsBase{TLink}"/>
14     public unsafe class ExternalLinksSourcesSizeBalancedTreeMethods<TLink> :
        ↪ ExternalLinksSizeBalancedTreeMethodsBase<TLink>
15     {
16         /// <summary>
17         /// <para>
18         /// Initializes a new <see cref="ExternalLinksSourcesSizeBalancedTreeMethods"/> instance.
19         /// </para>
20         /// <para></para>
21         /// </summary>
22         /// <param name="constants">
23         /// <para>A constants.</para>
24         /// <para></para>
25         /// </param>
26         /// <param name="linksDataParts">
27         /// <para>A links data parts.</para>
28         /// <para></para>
29         /// </param>
30         /// <param name="linksIndexParts">

```

```

31    /// <para>A links index parts.</para>
32    /// <para></para>
33    /// </param>
34    /// <param name="header">
35    /// <para>A header.</para>
36    /// <para></para>
37    /// </param>
38    [MethodImpl(MethodImplOptions.AggressiveInlining)]
39    public ExternalLinksSourcesSizeBalancedTreeMethods(LinksConstants<TLink> constants,
    ↪ byte* linksDataParts, byte* linksIndexParts, byte* header) : base(constants,
    ↪ linksDataParts, linksIndexParts, header) { }

40
41    /// <summary>
42    /// <para>
43    /// Gets the left reference using the specified node.
44    /// </para>
45    /// <para></para>
46    /// </summary>
47    /// <param name="node">
48    /// <para>The node.</para>
49    /// <para></para>
50    /// </param>
51    /// <returns>
52    /// <para>The ref link</para>
53    /// <para></para>
54    /// </returns>
55    [MethodImpl(MethodImplOptions.AggressiveInlining)]
56    protected override ref TLink GetLeftReference(TLink node) => ref
    ↪ GetLinkIndexPartReference(node).LeftAsSource;

57
58    /// <summary>
59    /// <para>
60    /// Gets the right reference using the specified node.
61    /// </para>
62    /// <para></para>
63    /// </summary>
64    /// <param name="node">
65    /// <para>The node.</para>
66    /// <para></para>
67    /// </param>
68    /// <returns>
69    /// <para>The ref link</para>
70    /// <para></para>
71    /// </returns>
72    [MethodImpl(MethodImplOptions.AggressiveInlining)]
73    protected override ref TLink GetRightReference(TLink node) => ref
    ↪ GetLinkIndexPartReference(node).RightAsSource;

74
75    /// <summary>
76    /// <para>
77    /// Gets the left using the specified node.
78    /// </para>
79    /// <para></para>
80    /// </summary>
81    /// <param name="node">
82    /// <para>The node.</para>
83    /// <para></para>
84    /// </param>
85    /// <returns>
86    /// <para>The link</para>
87    /// <para></para>
88    /// </returns>
89    [MethodImpl(MethodImplOptions.AggressiveInlining)]
90    protected override TLink GetLeft(TLink node) =>
    ↪ GetLinkIndexPartReference(node).LeftAsSource;

91
92    /// <summary>
93    /// <para>
94    /// Gets the right using the specified node.
95    /// </para>
96    /// <para></para>
97    /// </summary>
98    /// <param name="node">
99    /// <para>The node.</para>
100    /// <para></para>
101    /// </param>
102    /// <returns>

```



```

103    /// <para>The link</para>
104    /// <para></para>
105    /// </returns>
106    [MethodImpl(MethodImplOptions.AggressiveInlining)]
107    protected override TLink GetRight(TLink node) =>
108        ↪ GetLinkIndexPartReference(node).RightAsSource;
109
110    /// <summary>
111    /// <para>
112    /// Sets the left using the specified node.
113    /// </para>
114    /// <para></para>
115    /// </summary>
116    /// <param name="node">
117    /// <para>The node.</para>
118    /// <para></para>
119    /// </param>
120    /// <param name="left">
121    /// <para>The left.</para>
122    /// <para></para>
123    /// </param>
124    [MethodImpl(MethodImplOptions.AggressiveInlining)]
125    protected override void SetLeft(TLink node, TLink left) =>
126        ↪ GetLinkIndexPartReference(node).LeftAsSource = left;
127
128    /// <summary>
129    /// <para>
130    /// Sets the right using the specified node.
131    /// </para>
132    /// <para></para>
133    /// </summary>
134    /// <param name="node">
135    /// <para>The node.</para>
136    /// <para></para>
137    /// </param>
138    /// <param name="right">
139    /// <para>The right.</para>
140    /// <para></para>
141    /// </param>
142    [MethodImpl(MethodImplOptions.AggressiveInlining)]
143    protected override void SetRight(TLink node, TLink right) =>
144        ↪ GetLinkIndexPartReference(node).RightAsSource = right;
145
146    /// <summary>
147    /// <para>
148    /// Gets the size using the specified node.
149    /// </para>
150    /// <para></para>
151    /// </summary>
152    /// <param name="node">
153    /// <para>The node.</para>
154    /// <para></para>
155    /// </param>
156    /// <returns>
157    /// <para>The link</para>
158    /// <para></para>
159    /// </returns>
160    [MethodImpl(MethodImplOptions.AggressiveInlining)]
161    protected override TLink GetSize(TLink node) =>
162        ↪ GetLinkIndexPartReference(node).SizeAsSource;
163
164    /// <summary>
165    /// <para>
166    /// Sets the size using the specified node.
167    /// </para>
168    /// <para></para>
169    /// </summary>
170    /// <param name="node">
171    /// <para>The node.</para>
172    /// <para></para>
173    /// </param>
174    /// <param name="size">
175    /// <para>The size.</para>
176    /// <para></para>
177    /// </param>
178    [MethodImpl(MethodImplOptions.AggressiveInlining)]
179    protected override void SetSize(TLink node, TLink size) =>
180        ↪ GetLinkIndexPartReference(node).SizeAsSource = size;

```

```

176
177     /// <summary>
178     /// <para>
179     /// Gets the tree root.
180     /// </para>
181     /// <para></para>
182     /// </summary>
183     /// <returns>
184     /// <para>The link</para>
185     /// <para></para>
186     /// </returns>
187     [MethodImpl(MethodImplOptions.AggressiveInlining)]
188     protected override TLink GetTreeRoot() => GetHeaderReference().RootAsSource;
189
190     /// <summary>
191     /// <para>
192     /// Gets the base part value using the specified link.
193     /// </para>
194     /// <para></para>
195     /// </summary>
196     /// <param name="link">
197     /// <para>The link.</para>
198     /// <para></para>
199     /// </param>
200     /// <returns>
201     /// <para>The link</para>
202     /// <para></para>
203     /// </returns>
204     [MethodImpl(MethodImplOptions.AggressiveInlining)]
205     protected override TLink GetBasePartValue(TLink link) =>
206         ↪ GetLinkDataPartReference(link).Source;
207
208     /// <summary>
209     /// <para>
210     /// Determines whether this instance first is to the left of second.
211     /// </para>
212     /// <para></para>
213     /// </summary>
214     /// <param name="firstSource">
215     /// <para>The first source.</para>
216     /// <para></para>
217     /// </param>
218     /// <param name="firstTarget">
219     /// <para>The first target.</para>
220     /// <para></para>
221     /// </param>
222     /// <param name="secondSource">
223     /// <para>The second source.</para>
224     /// <para></para>
225     /// </param>
226     /// <param name="secondTarget">
227     /// <para>The second target.</para>
228     /// <para></para>
229     /// </param>
230     /// <returns>
231     /// <para>The bool</para>
232     /// <para></para>
233     /// </returns>
234     [MethodImpl(MethodImplOptions.AggressiveInlining)]
235     protected override bool FirstIsToLeftOfSecond(TLink firstSource, TLink firstTarget,
236         ↪ TLink secondSource, TLink secondTarget) => LessThan(firstSource, secondSource) ||
237         ↪ (AreEqual(firstSource, secondSource) && LessThan(firstTarget, secondTarget));
238
239     /// <summary>
240     /// <para>
241     /// Determines whether this instance first is to the right of second.
242     /// </para>
243     /// <para></para>
244     /// </summary>
245     /// <param name="firstSource">
246     /// <para>The first source.</para>
247     /// <para></para>
248     /// </param>
249     /// <param name="firstTarget">
250     /// <para>The first target.</para>
251     /// <para></para>
252     /// </param>
253     /// <param name="secondSource">

```

```

251     /// <para>The second source.</para>
252     /// <para></para>
253     /// </param>
254     /// <param name="secondTarget">
255     /// <para>The second target.</para>
256     /// <para></para>
257     /// </param>
258     /// <returns>
259     /// <para>The bool</para>
260     /// <para></para>
261     /// </returns>
262     [MethodImpl(MethodImplOptions.AggressiveInlining)]
263     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
        ↪ TLink secondSource, TLink secondTarget) => GreaterThan(firstSource, secondSource) ||
        ↪ (AreEqual(firstSource, secondSource) && GreaterThan(firstTarget, secondTarget));
264
265     /// <summary>
266     /// <para>
267     /// Clears the node using the specified node.
268     /// </para>
269     /// <para></para>
270     /// </summary>
271     /// <param name="node">
272     /// <para>The node.</para>
273     /// <para></para>
274     /// </param>
275     [MethodImpl(MethodImplOptions.AggressiveInlining)]
276     protected override void ClearNode(TLink node)
277     {
278         ref var link = ref GetLinkIndexPartReference(node);
279         link.LeftAsSource = Zero;
280         link.RightAsSource = Zero;
281         link.SizeAsSource = Zero;
282     }
283 }
284 }

```

### 1.33 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/ExternalLinksTargetsRecursionlessSizeBalancedTree

```

1 using System.Runtime.CompilerServices;
2
3 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5 namespace Platform.Data.Doublets.Memory.Split.Generic
6 {
7     /// <summary>
8     /// <para>
9     /// Represents the external links targets recursionless size balanced tree methods.
10    /// </para>
11    /// <para></para>
12    /// </summary>
13    /// <seealso cref="ExternalLinksRecursionlessSizeBalancedTreeMethodsBase{TLink}"/>
14    public unsafe class ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods<TLink> :
        ↪ ExternalLinksRecursionlessSizeBalancedTreeMethodsBase<TLink>
15    {
16        /// <summary>
17        /// <para>
18        /// Initializes a new <see
19        ↪ cref="ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods"/> instance.
20        /// </para>
21        /// <para></para>
22        /// </summary>
23        /// <param name="constants">
24        /// <para>A constants.</para>
25        /// <para></para>
26        /// </param>
27        /// <param name="linksDataParts">
28        /// <para>A links data parts.</para>
29        /// <para></para>
30        /// </param>
31        /// <param name="linksIndexParts">
32        /// <para>A links index parts.</para>
33        /// <para></para>
34        /// </param>
35        /// <param name="header">
36        /// <para>A header.</para>
37        /// <para></para>
38        /// </param>
39        [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

39 public ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
    ↳ constants, byte* linksDataParts, byte* linksIndexParts, byte* header) :
    ↳ base(constants, linksDataParts, linksIndexParts, header) { }
40
41 /// <summary>
42 /// <para>
43 /// Gets the left reference using the specified node.
44 /// </para>
45 /// <para></para>
46 /// </summary>
47 /// <param name="node">
48 /// <para>The node.</para>
49 /// <para></para>
50 /// </param>
51 /// <returns>
52 /// <para>The ref link</para>
53 /// <para></para>
54 /// </returns>
55 [MethodImpl(MethodImplOptions.AggressiveInlining)]
56 protected override ref TLink GetLeftReference(TLink node) => ref
    ↳ GetLinkIndexPartReference(node).LeftAsTarget;
57
58 /// <summary>
59 /// <para>
60 /// Gets the right reference using the specified node.
61 /// </para>
62 /// <para></para>
63 /// </summary>
64 /// <param name="node">
65 /// <para>The node.</para>
66 /// <para></para>
67 /// </param>
68 /// <returns>
69 /// <para>The ref link</para>
70 /// <para></para>
71 /// </returns>
72 [MethodImpl(MethodImplOptions.AggressiveInlining)]
73 protected override ref TLink GetRightReference(TLink node) => ref
    ↳ GetLinkIndexPartReference(node).RightAsTarget;
74
75 /// <summary>
76 /// <para>
77 /// Gets the left using the specified node.
78 /// </para>
79 /// <para></para>
80 /// </summary>
81 /// <param name="node">
82 /// <para>The node.</para>
83 /// <para></para>
84 /// </param>
85 /// <returns>
86 /// <para>The link</para>
87 /// <para></para>
88 /// </returns>
89 [MethodImpl(MethodImplOptions.AggressiveInlining)]
90 protected override TLink GetLeft(TLink node) =>
    ↳ GetLinkIndexPartReference(node).LeftAsTarget;
91
92 /// <summary>
93 /// <para>
94 /// Gets the right using the specified node.
95 /// </para>
96 /// <para></para>
97 /// </summary>
98 /// <param name="node">
99 /// <para>The node.</para>
100 /// <para></para>
101 /// </param>
102 /// <returns>
103 /// <para>The link</para>
104 /// <para></para>
105 /// </returns>
106 [MethodImpl(MethodImplOptions.AggressiveInlining)]
107 protected override TLink GetRight(TLink node) =>
    ↳ GetLinkIndexPartReference(node).RightAsTarget;
108
109 /// <summary>

```

```

110    /// <para>
111    /// Sets the left using the specified node.
112    /// </para>
113    /// <para></para>
114    /// </summary>
115    /// <param name="node">
116    /// <para>The node.</para>
117    /// <para></para>
118    /// </param>
119    /// <param name="left">
120    /// <para>The left.</para>
121    /// <para></para>
122    /// </param>
123    [MethodImpl(MethodImplOptions.AggressiveInlining)]
124    protected override void SetLeft(TLink node, TLink left) =>
125        ↪ GetLinkIndexPartReference(node).LeftAsTarget = left;
126
127    /// <summary>
128    /// <para>
129    /// Sets the right using the specified node.
130    /// </para>
131    /// <para></para>
132    /// </summary>
133    /// <param name="node">
134    /// <para>The node.</para>
135    /// <para></para>
136    /// </param>
137    /// <param name="right">
138    /// <para>The right.</para>
139    /// <para></para>
140    /// </param>
141    [MethodImpl(MethodImplOptions.AggressiveInlining)]
142    protected override void SetRight(TLink node, TLink right) =>
143        ↪ GetLinkIndexPartReference(node).RightAsTarget = right;
144
145    /// <summary>
146    /// <para>
147    /// Gets the size using the specified node.
148    /// </para>
149    /// <para></para>
150    /// </summary>
151    /// <param name="node">
152    /// <para>The node.</para>
153    /// <para></para>
154    /// </param>
155    /// <returns>
156    /// <para>The link</para>
157    /// <para></para>
158    /// </returns>
159    [MethodImpl(MethodImplOptions.AggressiveInlining)]
160    protected override TLink GetSize(TLink node) =>
161        ↪ GetLinkIndexPartReference(node).SizeAsTarget;
162
163    /// <summary>
164    /// <para>
165    /// Sets the size using the specified node.
166    /// </para>
167    /// <para></para>
168    /// </summary>
169    /// <param name="node">
170    /// <para>The node.</para>
171    /// <para></para>
172    /// </param>
173    /// <param name="size">
174    /// <para>The size.</para>
175    /// <para></para>
176    /// </param>
177    [MethodImpl(MethodImplOptions.AggressiveInlining)]
178    protected override void SetSize(TLink node, TLink size) =>
179        ↪ GetLinkIndexPartReference(node).SizeAsTarget = size;
180
181    /// <summary>
182    /// <para>
183    /// Gets the tree root.
184    /// </para>
185    /// <para></para>
186    /// </summary>
187    /// <returns>

```

```

184    /// <para>The link</para>
185    /// <para></para>
186    /// </returns>
187    [MethodImpl(MethodImplOptions.AggressiveInlining)]
188    protected override TLink GetTreeRoot() => GetHeaderReference().RootAsTarget;
189
190    /// <summary>
191    /// <para>
192    /// Gets the base part value using the specified link.
193    /// </para>
194    /// <para></para>
195    /// </summary>
196    /// <param name="link">
197    /// <para>The link.</para>
198    /// <para></para>
199    /// </param>
200    /// <returns>
201    /// <para>The link</para>
202    /// <para></para>
203    /// </returns>
204    [MethodImpl(MethodImplOptions.AggressiveInlining)]
205    protected override TLink GetBasePartValue(TLink link) =>
206        ↪ GetLinkDataPartReference(link).Target;
207
208    /// <summary>
209    /// <para>
210    /// Determines whether this instance first is to the left of second.
211    /// </para>
212    /// <para></para>
213    /// </summary>
214    /// <param name="firstSource">
215    /// <para>The first source.</para>
216    /// <para></para>
217    /// </param>
218    /// <param name="firstTarget">
219    /// <para>The first target.</para>
220    /// <para></para>
221    /// </param>
222    /// <param name="secondSource">
223    /// <para>The second source.</para>
224    /// <para></para>
225    /// </param>
226    /// <param name="secondTarget">
227    /// <para>The second target.</para>
228    /// <para></para>
229    /// </param>
230    /// <returns>
231    /// <para>The bool</para>
232    /// <para></para>
233    /// </returns>
234    [MethodImpl(MethodImplOptions.AggressiveInlining)]
235    protected override bool FirstIsToLeftOfSecond(TLink firstSource, TLink firstTarget,
236        ↪ TLink secondSource, TLink secondTarget) => LessThan(firstTarget, secondTarget) ||
237        ↪ (AreEqual(firstTarget, secondTarget) && LessThan(firstSource, secondSource));
238
239    /// <summary>
240    /// <para>
241    /// Determines whether this instance first is to the right of second.
242    /// </para>
243    /// <para></para>
244    /// </summary>
245    /// <param name="firstSource">
246    /// <para>The first source.</para>
247    /// <para></para>
248    /// </param>
249    /// <param name="firstTarget">
250    /// <para>The first target.</para>
251    /// <para></para>
252    /// </param>
253    /// <param name="secondSource">
254    /// <para>The second source.</para>
255    /// <para></para>
256    /// </param>
257    /// <param name="secondTarget">
258    /// <para>The second target.</para>
259    /// <para></para>
260    /// </param>
261    /// <returns>

```

```

259     /// <para>The bool</para>
260     /// <para></para>
261     /// </returns>
262     [MethodImpl(MethodImplOptions.AggressiveInlining)]
263     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
        ↪ TLink secondSource, TLink secondTarget) => GreaterThan(firstTarget, secondTarget) ||
        ↪ (AreEqual(firstTarget, secondTarget) && GreaterThan(firstSource, secondSource));

264
265     /// <summary>
266     /// <para>
267     /// Clears the node using the specified node.
268     /// </para>
269     /// <para></para>
270     /// </summary>
271     /// <param name="node">
272     /// <para>The node.</para>
273     /// <para></para>
274     /// </param>
275     [MethodImpl(MethodImplOptions.AggressiveInlining)]
276     protected override void ClearNode(TLink node)
277     {
278         ref var link = ref GetLinkIndexPartReference(node);
279         link.LeftAsTarget = Zero;
280         link.RightAsTarget = Zero;
281         link.SizeAsTarget = Zero;
282     }
283 }
284 }

```

### 1.34 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/ExternalLinksTargetsSizeBalancedTreeMethods.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.Data.Doublets.Memory.Split.Generic
6 {
7     /// <summary>
8     /// <para>
9     /// Represents the external links targets size balanced tree methods.
10    /// </para>
11    /// <para></para>
12    /// </summary>
13    /// <seealso cref="ExternalLinksSizeBalancedTreeMethodsBase{TLink}"/>
14    public unsafe class ExternalLinksTargetsSizeBalancedTreeMethods<TLink> :
        ↪ ExternalLinksSizeBalancedTreeMethodsBase<TLink>
15    {
16        /// <summary>
17        /// <para>
18        /// Initializes a new <see cref="ExternalLinksTargetsSizeBalancedTreeMethods"/> instance.
19        /// </para>
20        /// <para></para>
21        /// </summary>
22        /// <param name="constants">
23        /// <para>A constants.</para>
24        /// <para></para>
25        /// </param>
26        /// <param name="linksDataParts">
27        /// <para>A links data parts.</para>
28        /// <para></para>
29        /// </param>
30        /// <param name="linksIndexParts">
31        /// <para>A links index parts.</para>
32        /// <para></para>
33        /// </param>
34        /// <param name="header">
35        /// <para>A header.</para>
36        /// <para></para>
37        /// </param>
38        [MethodImpl(MethodImplOptions.AggressiveInlining)]
39        public ExternalLinksTargetsSizeBalancedTreeMethods(LinksConstants<TLink> constants,
        ↪ byte* linksDataParts, byte* linksIndexParts, byte* header) : base(constants,
        ↪ linksDataParts, linksIndexParts, header) { }

40
41        /// <summary>
42        /// <para>
43        /// Gets the left reference using the specified node.
44        /// </para>
45        /// <para></para>

```

```

46     /// </summary>
47     /// <param name="node">
48     /// <para>The node.</para>
49     /// <para></para>
50     /// </param>
51     /// <returns>
52     /// <para>The ref link</para>
53     /// <para></para>
54     /// </returns>
55     [MethodImpl(MethodImplOptions.AggressiveInlining)]
56     protected override ref TLink GetLeftReference(TLink node) => ref
        ↪ GetLinkIndexPartReference(node).LeftAsTarget;
57
58     /// <summary>
59     /// <para>
60     /// Gets the right reference using the specified node.
61     /// </para>
62     /// <para></para>
63     /// </summary>
64     /// <param name="node">
65     /// <para>The node.</para>
66     /// <para></para>
67     /// </param>
68     /// <returns>
69     /// <para>The ref link</para>
70     /// <para></para>
71     /// </returns>
72     [MethodImpl(MethodImplOptions.AggressiveInlining)]
73     protected override ref TLink GetRightReference(TLink node) => ref
        ↪ GetLinkIndexPartReference(node).RightAsTarget;
74
75     /// <summary>
76     /// <para>
77     /// Gets the left using the specified node.
78     /// </para>
79     /// <para></para>
80     /// </summary>
81     /// <param name="node">
82     /// <para>The node.</para>
83     /// <para></para>
84     /// </param>
85     /// <returns>
86     /// <para>The link</para>
87     /// <para></para>
88     /// </returns>
89     [MethodImpl(MethodImplOptions.AggressiveInlining)]
90     protected override TLink GetLeft(TLink node) =>
        ↪ GetLinkIndexPartReference(node).LeftAsTarget;
91
92     /// <summary>
93     /// <para>
94     /// Gets the right using the specified node.
95     /// </para>
96     /// <para></para>
97     /// </summary>
98     /// <param name="node">
99     /// <para>The node.</para>
100    /// <para></para>
101    /// </param>
102    /// <returns>
103    /// <para>The link</para>
104    /// <para></para>
105    /// </returns>
106    [MethodImpl(MethodImplOptions.AggressiveInlining)]
107    protected override TLink GetRight(TLink node) =>
        ↪ GetLinkIndexPartReference(node).RightAsTarget;
108
109    /// <summary>
110    /// <para>
111    /// Sets the left using the specified node.
112    /// </para>
113    /// <para></para>
114    /// </summary>
115    /// <param name="node">
116    /// <para>The node.</para>
117    /// <para></para>
118    /// </param>
119    /// <param name="left">

```



```

120    /// <para>The left.</para>
121    /// <para></para>
122    /// </param>
123    [MethodImpl(MethodImplOptions.AggressiveInlining)]
124    protected override void SetLeft(TLink node, TLink left) =>
125        ↪ GetLinkIndexPartReference(node).LeftAsTarget = left;
126
127    /// <summary>
128    /// <para>
129    /// Sets the right using the specified node.
130    /// </para>
131    /// <para></para>
132    /// </summary>
133    /// <param name="node">
134    /// <para>The node.</para>
135    /// <para></para>
136    /// </param>
137    /// <param name="right">
138    /// <para>The right.</para>
139    /// <para></para>
140    /// </param>
141    [MethodImpl(MethodImplOptions.AggressiveInlining)]
142    protected override void SetRight(TLink node, TLink right) =>
143        ↪ GetLinkIndexPartReference(node).RightAsTarget = right;
144
145    /// <summary>
146    /// <para>
147    /// Gets the size using the specified node.
148    /// </para>
149    /// <para></para>
150    /// </summary>
151    /// <param name="node">
152    /// <para>The node.</para>
153    /// <para></para>
154    /// </param>
155    /// <returns>
156    /// <para>The link</para>
157    /// <para></para>
158    /// </returns>
159    [MethodImpl(MethodImplOptions.AggressiveInlining)]
160    protected override TLink GetSize(TLink node) =>
161        ↪ GetLinkIndexPartReference(node).SizeAsTarget;
162
163    /// <summary>
164    /// <para>
165    /// Sets the size using the specified node.
166    /// </para>
167    /// <para></para>
168    /// </summary>
169    /// <param name="node">
170    /// <para>The node.</para>
171    /// <para></para>
172    /// </param>
173    /// <param name="size">
174    /// <para>The size.</para>
175    /// <para></para>
176    /// </param>
177    [MethodImpl(MethodImplOptions.AggressiveInlining)]
178    protected override void SetSize(TLink node, TLink size) =>
179        ↪ GetLinkIndexPartReference(node).SizeAsTarget = size;
180
181    /// <summary>
182    /// <para>
183    /// Gets the tree root.
184    /// </para>
185    /// <para></para>
186    /// </summary>
187    /// <returns>
188    /// <para>The link</para>
189    /// <para></para>
190    /// </returns>
191    [MethodImpl(MethodImplOptions.AggressiveInlining)]
192    protected override TLink GetTreeRoot() => GetHeaderReference().RootAsTarget;
193
194    /// <summary>
195    /// <para>
196    /// Gets the base part value using the specified link.
197    /// </para>

```

```

194    /// <para></para>
195    /// </summary>
196    /// <param name="link">
197    /// <para>The link.</para>
198    /// <para></para>
199    /// </param>
200    /// <returns>
201    /// <para>The link</para>
202    /// <para></para>
203    /// </returns>
204    [MethodImpl(MethodImplOptions.AggressiveInlining)]
205    protected override TLink GetBasePartValue(TLink link) =>
206        ↪ GetLinkDataPartReference(link).Target;
207
208    /// <summary>
209    /// <para>
210    /// Determines whether this instance first is to the left of second.
211    /// </para>
212    /// <para></para>
213    /// </summary>
214    /// <param name="firstSource">
215    /// <para>The first source.</para>
216    /// <para></para>
217    /// </param>
218    /// <param name="firstTarget">
219    /// <para>The first target.</para>
220    /// <para></para>
221    /// </param>
222    /// <param name="secondSource">
223    /// <para>The second source.</para>
224    /// <para></para>
225    /// </param>
226    /// <param name="secondTarget">
227    /// <para>The second target.</para>
228    /// <para></para>
229    /// </param>
230    /// <returns>
231    /// <para>The bool</para>
232    /// <para></para>
233    /// </returns>
234    [MethodImpl(MethodImplOptions.AggressiveInlining)]
235    protected override bool FirstIsToTheLeftOfSecond(TLink firstSource, TLink firstTarget,
236        ↪ TLink secondSource, TLink secondTarget) => LessThan(firstTarget, secondTarget) ||
237        ↪ (AreEqual(firstTarget, secondTarget) && LessThan(firstSource, secondSource));
238
239    /// <summary>
240    /// <para>
241    /// Determines whether this instance first is to the right of second.
242    /// </para>
243    /// <para></para>
244    /// </summary>
245    /// <param name="firstSource">
246    /// <para>The first source.</para>
247    /// <para></para>
248    /// </param>
249    /// <param name="firstTarget">
250    /// <para>The first target.</para>
251    /// <para></para>
252    /// </param>
253    /// <param name="secondSource">
254    /// <para>The second source.</para>
255    /// <para></para>
256    /// </param>
257    /// <param name="secondTarget">
258    /// <para>The second target.</para>
259    /// <para></para>
260    /// </param>
261    /// <returns>
262    /// <para>The bool</para>
263    /// <para></para>
264    /// </returns>
265    [MethodImpl(MethodImplOptions.AggressiveInlining)]
266    protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
267        ↪ TLink secondSource, TLink secondTarget) => GreaterThan(firstTarget, secondTarget) ||
268        ↪ (AreEqual(firstTarget, secondTarget) && GreaterThan(firstSource, secondSource));
269
270    /// <summary>

```

```

266     /// <para>
267     /// Clears the node using the specified node.
268     /// </para>
269     /// <para></para>
270     /// </summary>
271     /// <param name="node">
272     /// <para>The node.</para>
273     /// <para></para>
274     /// </param>
275     [MethodImpl(MethodImplOptions.AggressiveInlining)]
276     protected override void ClearNode(TLink node)
277     {
278         ref var link = ref GetLinkIndexPartReference(node);
279         link.LeftAsTarget = Zero;
280         link.RightAsTarget = Zero;
281         link.SizeAsTarget = Zero;
282     }
283 }
284 }

```

### 1.35 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/InternalLinksRecursionlessSizeBalancedTreeMethod

```

1  using System;
2  using System.Text;
3  using System.Collections.Generic;
4  using System.Runtime.CompilerServices;
5  using Platform.Collections.Methods.Trees;
6  using Platform.Converters;
7  using static System.Runtime.CompilerServices.Unsafe;
8
9  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
10
11 namespace Platform.Data.Doublets.Memory.Split.Generic
12 {
13     /// <summary>
14     /// <para>
15     /// Represents the internal links recursionless size balanced tree methods base.
16     /// </para>
17     /// <para></para>
18     /// </summary>
19     /// <seealso cref="RecursionlessSizeBalancedTreeMethods{TLink}"/>
20     /// <seealso cref="ILinksTreeMethods{TLink}"/>
21     public unsafe abstract class InternalLinksRecursionlessSizeBalancedTreeMethodsBase<TLink> :
22     ↪ RecursionlessSizeBalancedTreeMethods<TLink>, ILinksTreeMethods<TLink>
23     {
24         /// <summary>
25         /// <para>
26         /// The default.
27         /// </para>
28         /// <para></para>
29         /// </summary>
30         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
31         ↪ UncheckedConverter<TLink, long>.Default;
32
33         /// <summary>
34         /// <para>
35         /// The break.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         protected readonly TLink Break;
40
41         /// <summary>
42         /// <para>
43         /// The continue.
44         /// </para>
45         /// <para></para>
46         /// </summary>
47         protected readonly TLink Continue;
48
49         /// <summary>
50         /// <para>
51         /// The links data parts.
52         /// </para>
53         /// <para></para>
54         /// </summary>
55         protected readonly byte* LinksDataParts;
56
57         /// <summary>
58         /// <para>
59         /// The links index parts.
60         /// </para>
61         /// <para></para>
62         /// </summary>

```

```

57     /// </summary>
58     protected readonly byte* LinksIndexParts;
59     /// <summary>
60     /// <para>
61     /// The header.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     protected readonly byte* Header;
66
67     /// <summary>
68     /// <para>
69     /// Initializes a new <see
70     ↪ cref="InternalLinksRecursionlessSizeBalancedTreeMethodsBase"/> instance.
71     /// </para>
72     /// <para></para>
73     /// </summary>
74     /// <param name="constants">
75     /// <para>A constants.</para>
76     /// <para></para>
77     /// </param>
78     /// <param name="linksDataParts">
79     /// <para>A links data parts.</para>
80     /// <para></para>
81     /// </param>
82     /// <param name="linksIndexParts">
83     /// <para>A links index parts.</para>
84     /// <para></para>
85     /// </param>
86     /// <param name="header">
87     /// <para>A header.</para>
88     /// <para></para>
89     /// </param>
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     protected InternalLinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<TLink>
92     ↪ constants, byte* linksDataParts, byte* linksIndexParts, byte* header)
93     {
94         LinksDataParts = linksDataParts;
95         LinksIndexParts = linksIndexParts;
96         Header = header;
97         Break = constants.Break;
98         Continue = constants.Continue;
99     }
100
101     /// <summary>
102     /// <para>
103     /// Gets the tree root using the specified link.
104     /// </para>
105     /// <para></para>
106     /// </summary>
107     /// <param name="link">
108     /// <para>The link.</para>
109     /// <para></para>
110     /// </param>
111     /// <returns>
112     /// <para>The link</para>
113     /// <para></para>
114     /// </returns>
115     [MethodImpl(MethodImplOptions.AggressiveInlining)]
116     protected abstract TLink GetTreeRoot(TLink link);
117
118     /// <summary>
119     /// <para>
120     /// Gets the base part value using the specified link.
121     /// </para>
122     /// <para></para>
123     /// </summary>
124     /// <param name="link">
125     /// <para>The link.</para>
126     /// <para></para>
127     /// </param>
128     /// <returns>
129     /// <para>The link</para>
130     /// <para></para>
131     /// </returns>
132     [MethodImpl(MethodImplOptions.AggressiveInlining)]
133     protected abstract TLink GetBasePartValue(TLink link);

```

```

133     /// <summary>
134     /// <para>
135     /// Gets the key part value using the specified link.
136     /// </para>
137     /// <para></para>
138     /// </summary>
139     /// <param name="link">
140     /// <para>The link.</para>
141     /// <para></para>
142     /// </param>
143     /// <returns>
144     /// <para>The link</para>
145     /// <para></para>
146     /// </returns>
147     [MethodImpl(MethodImplOptions.AggressiveInlining)]
148     protected abstract TLink GetKeyPartValue(TLink link);
149
150     /// <summary>
151     /// <para>
152     /// Gets the link data part reference using the specified link.
153     /// </para>
154     /// <para></para>
155     /// </summary>
156     /// <param name="link">
157     /// <para>The link.</para>
158     /// <para></para>
159     /// </param>
160     /// <returns>
161     /// <para>A ref raw link data part of t link</para>
162     /// <para></para>
163     /// </returns>
164     [MethodImpl(MethodImplOptions.AggressiveInlining)]
165     protected virtual ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) => ref
        ↪ AsRef<RawLinkDataPart<TLink>>(LinksDataParts + (RawLinkDataPart<TLink>.SizeInBytes *
        ↪ _addressToInt64Converter.Convert(link)));
166
167     /// <summary>
168     /// <para>
169     /// Gets the link index part reference using the specified link.
170     /// </para>
171     /// <para></para>
172     /// </summary>
173     /// <param name="link">
174     /// <para>The link.</para>
175     /// <para></para>
176     /// </param>
177     /// <returns>
178     /// <para>A ref raw link index part of t link</para>
179     /// <para></para>
180     /// </returns>
181     [MethodImpl(MethodImplOptions.AggressiveInlining)]
182     protected virtual ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
        ↪ ref AsRef<RawLinkIndexPart<TLink>>(LinksIndexParts +
        ↪ (RawLinkIndexPart<TLink>.SizeInBytes * _addressToInt64Converter.Convert(link)));
183
184     /// <summary>
185     /// <para>
186     /// Determines whether this instance first is to the left of second.
187     /// </para>
188     /// <para></para>
189     /// </summary>
190     /// <param name="first">
191     /// <para>The first.</para>
192     /// <para></para>
193     /// </param>
194     /// <param name="second">
195     /// <para>The second.</para>
196     /// <para></para>
197     /// </param>
198     /// <returns>
199     /// <para>The bool</para>
200     /// <para></para>
201     /// </returns>
202     [MethodImpl(MethodImplOptions.AggressiveInlining)]
203     protected override bool FirstIsToLeftOfSecond(TLink first, TLink second) =>
        ↪ LessThan(GetKeyPartValue(first), GetKeyPartValue(second));
204
205     /// <summary>

```

```

206    /// <para>
207    /// Determines whether this instance first is to the right of second.
208    /// </para>
209    /// <para></para>
210    /// </summary>
211    /// <param name="first">
212    /// <para>The first.</para>
213    /// <para></para>
214    /// </param>
215    /// <param name="second">
216    /// <para>The second.</para>
217    /// <para></para>
218    /// </param>
219    /// <returns>
220    /// <para>The bool</para>
221    /// <para></para>
222    /// </returns>
223    [MethodImpl(MethodImplOptions.AggressiveInlining)]
224    protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second) =>
225        ↪ GreaterThan(GetKeyPartValue(first), GetKeyPartValue(second));
226
227    /// <summary>
228    /// <para>
229    /// Gets the link values using the specified link index.
230    /// </para>
231    /// <para></para>
232    /// </summary>
233    /// <param name="linkIndex">
234    /// <para>The link index.</para>
235    /// <para></para>
236    /// </param>
237    /// <returns>
238    /// <para>A list of t link</para>
239    /// <para></para>
240    /// </returns>
241    [MethodImpl(MethodImplOptions.AggressiveInlining)]
242    protected virtual IList<TLink> GetLinkValues(TLink linkIndex)
243    {
244        ref var link = ref GetLinkDataPartReference(linkIndex);
245        return new Link<TLink>(linkIndex, link.Source, link.Target);
246    }
247
248    /// <summary>
249    /// <para>
250    /// The zero.
251    /// </para>
252    /// <para></para>
253    /// </summary>
254    public TLink this[TLink link, TLink index]
255    {
256        [MethodImpl(MethodImplOptions.AggressiveInlining)]
257        get
258        {
259            var root = GetTreeRoot(link);
260            if (GreaterOrEqualThan(index, GetSize(root)))
261            {
262                return Zero;
263            }
264            while (!EqualToZero(root))
265            {
266                var left = GetLeftOrDefault(root);
267                var leftSize = GetSizeOrZero(left);
268                if (LessThan(index, leftSize))
269                {
270                    root = left;
271                    continue;
272                }
273                if (AreEqual(index, leftSize))
274                {
275                    return root;
276                }
277                root = GetRightOrDefault(root);
278                index = Subtract(index, Increment(leftSize));
279            }
280            return Zero; // TODO: Impossible situation exception (only if tree structure
281            ↪ broken)

```

```

282
283 /// <summary>
284 /// Выполняет поиск и возвращает индекс связи с указанными Source (началом) и Target
    ↳ (концом).
285 /// </summary>
286 /// <param name="source">Индекс связи, которая является началом на искомой связи.</param>
287 /// <param name="target">Индекс связи, которая является концом на искомой связи.</param>
288 /// <returns>Индекс искомой связи.</returns>
289 [MethodImpl(MethodImplOptions.AggressiveInlining)]
290 public abstract TLink Search(TLink source, TLink target);
291
292 /// <summary>
293 /// <para>
294 /// Searches the core using the specified root.
295 /// </para>
296 /// <para></para>
297 /// </summary>
298 /// <param name="root">
299 /// <para>The root.</para>
300 /// <para></para>
301 /// </param>
302 /// <param name="key">
303 /// <para>The key.</para>
304 /// <para></para>
305 /// </param>
306 /// <returns>
307 /// <para>The zero.</para>
308 /// <para></para>
309 /// </returns>
310 [MethodImpl(MethodImplOptions.AggressiveInlining)]
311 protected TLink SearchCore(TLink root, TLink key)
312 {
313     while (!EqualToZero(root))
314     {
315         var rootKey = GetKeyPartValue(root);
316         if (LessThan(key, rootKey)) // node.Key < root.Key
317         {
318             root = GetLeftOrDefault(root);
319         }
320         else if (GreaterThan(key, rootKey)) // node.Key > root.Key
321         {
322             root = GetRightOrDefault(root);
323         }
324         else // node.Key == root.Key
325         {
326             return root;
327         }
328     }
329     return Zero;
330 }
331
332 // TODO: Return indices range instead of references count
333 /// <summary>
334 /// <para>
335 /// Counts the usages using the specified link.
336 /// </para>
337 /// <para></para>
338 /// </summary>
339 /// <param name="link">
340 /// <para>The link.</para>
341 /// <para></para>
342 /// </param>
343 /// <returns>
344 /// <para>The link</para>
345 /// <para></para>
346 /// </returns>
347 [MethodImpl(MethodImplOptions.AggressiveInlining)]
348 public TLink CountUsages(TLink link) => GetSizeOrZero(GetTreeRoot(link));
349
350 /// <summary>
351 /// <para>
352 /// Eaches the usage using the specified base.
353 /// </para>
354 /// <para></para>
355 /// </summary>
356 /// <param name="@base">
357 /// <para>The base.</para>
358 /// <para></para>

```

```

359     /// </param>
360     /// <param name="handler">
361     /// <para>The handler.</para>
362     /// <para></para>
363     /// </param>
364     /// <returns>
365     /// <para>The link</para>
366     /// <para></para>
367     /// </returns>
368     [MethodImpl(MethodImplOptions.AggressiveInlining)]
369     public TLink EachUsage(TLink @base, Func<IList<TLink>, TLink> handler) =>
370         ↳ EachUsageCore(@base, GetTreeRoot(@base), handler);
371
372     // TODO: 1. Move target, handler to separate object. 2. Use stack or walker 3. Use
373     ↳ low-level MSIL stack.
374     /// <summary>
375     /// <para>
376     /// Eaches the usage core using the specified base.
377     /// </para>
378     /// <para></para>
379     /// </summary>
380     /// <param name="@base">
381     /// <para>The base.</para>
382     /// <para></para>
383     /// </param>
384     /// <param name="link">
385     /// <para>The link.</para>
386     /// <para></para>
387     /// </param>
388     /// <param name="handler">
389     /// <para>The handler.</para>
390     /// <para></para>
391     /// </param>
392     /// <returns>
393     /// <para>The continue.</para>
394     /// <para></para>
395     /// </returns>
396     [MethodImpl(MethodImplOptions.AggressiveInlining)]
397     private TLink EachUsageCore(TLink @base, TLink link, Func<IList<TLink>, TLink> handler)
398     {
399         var @continue = Continue;
400         if (EqualToZero(link))
401         {
402             return @continue;
403         }
404         var @break = Break;
405         if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
406         {
407             return @break;
408         }
409         if (AreEqual(handler(GetLinkValues(link)), @break))
410         {
411             return @break;
412         }
413         if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
414         {
415             return @break;
416         }
417         return @continue;
418     }
419
420     /// <summary>
421     /// <para>
422     /// Prints the node value using the specified node.
423     /// </para>
424     /// <para></para>
425     /// </summary>
426     /// <param name="node">
427     /// <para>The node.</para>
428     /// <para></para>
429     /// </param>
430     /// <param name="sb">
431     /// <para>The sb.</para>
432     /// <para></para>
433     /// </param>
434     [MethodImpl(MethodImplOptions.AggressiveInlining)]
435     protected override void PrintNodeValue(TLink node, StringBuilder sb)
436     {

```



```

435         ref var link = ref GetLinkDataPartReference(node);
436         sb.Append(' ');
437         sb.Append(link.Source);
438         sb.Append('-');
439         sb.Append('>');
440         sb.Append(link.Target);
441     }
442 }
443 }

```

### 1.36 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/InternalLinksSizeBalancedTreeMethodsBase.cs

```

1  using System;
2  using System.Text;
3  using System.Collections.Generic;
4  using System.Runtime.CompilerServices;
5  using Platform.Collections.Methods.Trees;
6  using Platform.Converters;
7  using static System.Runtime.CompilerServices.Unsafe;
8
9  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
10
11 namespace Platform.Data.Doublets.Memory.Split.Generic
12 {
13     /// <summary>
14     /// <para>
15     /// Represents the internal links size balanced tree methods base.
16     /// </para>
17     /// <para></para>
18     /// </summary>
19     /// <seealso cref="SizeBalancedTreeMethods{TLink}"/>
20     /// <seealso cref="ILinksTreeMethods{TLink}"/>
21     public unsafe abstract class InternalLinksSizeBalancedTreeMethodsBase<TLink> :
22     ↪ SizeBalancedTreeMethods<TLink>, ILinksTreeMethods<TLink>
23     {
24         /// <summary>
25         /// <para>
26         /// The default.
27         /// </para>
28         /// <para></para>
29         /// </summary>
30         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
31         ↪ UncheckedConverter<TLink, long>.Default;
32
33         /// <summary>
34         /// <para>
35         /// The break.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         protected readonly TLink Break;
40
41         /// <summary>
42         /// <para>
43         /// The continue.
44         /// </para>
45         /// <para></para>
46         /// </summary>
47         protected readonly TLink Continue;
48
49         /// <summary>
50         /// <para>
51         /// The links data parts.
52         /// </para>
53         /// <para></para>
54         /// </summary>
55         protected readonly byte* LinksDataParts;
56
57         /// <summary>
58         /// <para>
59         /// The links index parts.
60         /// </para>
61         /// <para></para>
62         /// </summary>
63         protected readonly byte* LinksIndexParts;
64
65         /// <summary>
66         /// <para>
67         /// The header.
68         /// </para>
69         /// <para></para>
70         /// </summary>
71         protected readonly byte* Header;
72     }
73 }

```

```

67     /// <summary>
68     /// <para>
69     /// Initializes a new <see cref="InternalLinksSizeBalancedTreeMethodsBase"/> instance.
70     /// </para>
71     /// <para></para>
72     /// </summary>
73     /// <param name="constants">
74     /// <para>A constants.</para>
75     /// <para></para>
76     /// </param>
77     /// <param name="linksDataParts">
78     /// <para>A links data parts.</para>
79     /// <para></para>
80     /// </param>
81     /// <param name="linksIndexParts">
82     /// <para>A links index parts.</para>
83     /// <para></para>
84     /// </param>
85     /// <param name="header">
86     /// <para>A header.</para>
87     /// <para></para>
88     /// </param>
89     [MethodImpl(MethodImplOptions.AggressiveInlining)]
90     protected InternalLinksSizeBalancedTreeMethodsBase(LinksConstants<TLink> constants,
91     ↪     byte* linksDataParts, byte* linksIndexParts, byte* header)
92     {
93         LinksDataParts = linksDataParts;
94         LinksIndexParts = linksIndexParts;
95         Header = header;
96         Break = constants.Break;
97         Continue = constants.Continue;
98     }
99     /// <summary>
100    /// <para>
101    /// Gets the tree root using the specified link.
102    /// </para>
103    /// <para></para>
104    /// </summary>
105    /// <param name="link">
106    /// <para>The link.</para>
107    /// <para></para>
108    /// </param>
109    /// <returns>
110    /// <para>The link</para>
111    /// <para></para>
112    /// </returns>
113    [MethodImpl(MethodImplOptions.AggressiveInlining)]
114    protected abstract TLink GetTreeRoot(TLink link);
115
116    /// <summary>
117    /// <para>
118    /// Gets the base part value using the specified link.
119    /// </para>
120    /// <para></para>
121    /// </summary>
122    /// <param name="link">
123    /// <para>The link.</para>
124    /// <para></para>
125    /// </param>
126    /// <returns>
127    /// <para>The link</para>
128    /// <para></para>
129    /// </returns>
130    [MethodImpl(MethodImplOptions.AggressiveInlining)]
131    protected abstract TLink GetBasePartValue(TLink link);
132
133    /// <summary>
134    /// <para>
135    /// Gets the key part value using the specified link.
136    /// </para>
137    /// <para></para>
138    /// </summary>
139    /// <param name="link">
140    /// <para>The link.</para>
141    /// <para></para>
142    /// </param>
143    /// <returns>

```

```

144 /// <para>The link</para>
145 /// <para></para>
146 /// </returns>
147 [MethodImpl(MethodImplOptions.AggressiveInlining)]
148 protected abstract TLink GetKeyPartValue(TLink link);
149
150 /// <summary>
151 /// <para>
152 /// Gets the link data part reference using the specified link.
153 /// </para>
154 /// <para></para>
155 /// </summary>
156 /// <param name="link">
157 /// <para>The link.</para>
158 /// <para></para>
159 /// </param>
160 /// <returns>
161 /// <para>A ref raw link data part of t link</para>
162 /// <para></para>
163 /// </returns>
164 [MethodImpl(MethodImplOptions.AggressiveInlining)]
165 protected virtual ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) => ref
    ↪ AsRef<RawLinkDataPart<TLink>>(LinksDataParts + (RawLinkDataPart<TLink>.SizeInBytes *
    ↪ _addressToInt64Converter.Convert(link)));
166
167 /// <summary>
168 /// <para>
169 /// Gets the link index part reference using the specified link.
170 /// </para>
171 /// <para></para>
172 /// </summary>
173 /// <param name="link">
174 /// <para>The link.</para>
175 /// <para></para>
176 /// </param>
177 /// <returns>
178 /// <para>A ref raw link index part of t link</para>
179 /// <para></para>
180 /// </returns>
181 [MethodImpl(MethodImplOptions.AggressiveInlining)]
182 protected virtual ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
    ↪ ref AsRef<RawLinkIndexPart<TLink>>(LinksIndexParts +
    ↪ (RawLinkIndexPart<TLink>.SizeInBytes * _addressToInt64Converter.Convert(link)));
183
184 /// <summary>
185 /// <para>
186 /// Determines whether this instance first is to the left of second.
187 /// </para>
188 /// <para></para>
189 /// </summary>
190 /// <param name="first">
191 /// <para>The first.</para>
192 /// <para></para>
193 /// </param>
194 /// <param name="second">
195 /// <para>The second.</para>
196 /// <para></para>
197 /// </param>
198 /// <returns>
199 /// <para>The bool</para>
200 /// <para></para>
201 /// </returns>
202 [MethodImpl(MethodImplOptions.AggressiveInlining)]
203 protected override bool FirstIsToLeftOfSecond(TLink first, TLink second) =>
    ↪ LessThan(GetKeyPartValue(first), GetKeyPartValue(second));
204
205 /// <summary>
206 /// <para>
207 /// Determines whether this instance first is to the right of second.
208 /// </para>
209 /// <para></para>
210 /// </summary>
211 /// <param name="first">
212 /// <para>The first.</para>
213 /// <para></para>
214 /// </param>
215 /// <param name="second">
216 /// <para>The second.</para>

```

```

217     /// <para></para>
218     /// </param>
219     /// <returns>
220     /// <para>The bool</para>
221     /// <para></para>
222     /// </returns>
223     [MethodImpl(MethodImplOptions.AggressiveInlining)]
224     protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second) =>
225         ↪ GreaterThan(GetKeyPartValue(first), GetKeyPartValue(second));
226
227     /// <summary>
228     /// <para>
229     /// Gets the link values using the specified link index.
230     /// </para>
231     /// </summary>
232     /// <param name="linkIndex">
233     /// <para>The link index.</para>
234     /// <para></para>
235     /// </param>
236     /// <returns>
237     /// <para>A list of t link</para>
238     /// <para></para>
239     /// </returns>
240     [MethodImpl(MethodImplOptions.AggressiveInlining)]
241     protected virtual IList<TLink> GetLinkValues(TLink linkIndex)
242     {
243         ref var link = ref GetLinkDataPartReference(linkIndex);
244         return new Link<TLink>(linkIndex, link.Source, link.Target);
245     }
246
247     /// <summary>
248     /// <para>
249     /// The zero.
250     /// </para>
251     /// <para></para>
252     /// </summary>
253     public TLink this[TLink link, TLink index]
254     {
255         [MethodImpl(MethodImplOptions.AggressiveInlining)]
256         get
257         {
258             var root = GetTreeRoot(link);
259             if (GreaterOrEqualThan(index, GetSize(root)))
260             {
261                 return Zero;
262             }
263             while (!EqualToZero(root))
264             {
265                 var left = GetLeftOrDefault(root);
266                 var leftSize = GetSizeOrZero(left);
267                 if (LessThan(index, leftSize))
268                 {
269                     root = left;
270                     continue;
271                 }
272                 if (AreEqual(index, leftSize))
273                 {
274                     return root;
275                 }
276                 root = GetRightOrDefault(root);
277                 index = Subtract(index, Increment(leftSize));
278             }
279             return Zero; // TODO: Impossible situation exception (only if tree structure
280                 ↪ broken)
281         }
282     }
283
284     /// <summary>
285     /// Выполняет поиск и возвращает индекс связи с указанными Source (началом) и Target
286     ↪ (концом).
287     /// </summary>
288     /// <param name="source">Индекс связи, которая является началом на искомой связи.</param>
289     /// <param name="target">Индекс связи, которая является концом на искомой связи.</param>
290     /// <returns>Индекс искомой связи.</returns>
291     [MethodImpl(MethodImplOptions.AggressiveInlining)]
292     public abstract TLink Search(TLink source, TLink target);

```

```

292    /// <summary>
293    /// <para>
294    /// Searches the core using the specified root.
295    /// </para>
296    /// <para></para>
297    /// </summary>
298    /// <param name="root">
299    /// <para>The root.</para>
300    /// <para></para>
301    /// </param>
302    /// <param name="key">
303    /// <para>The key.</para>
304    /// <para></para>
305    /// </param>
306    /// <returns>
307    /// <para>The zero.</para>
308    /// <para></para>
309    /// </returns>
310    [MethodImpl(MethodImplOptions.AggressiveInlining)]
311    protected TLink SearchCore(TLink root, TLink key)
312    {
313        while (!EqualToZero(root))
314        {
315            var rootKey = GetKeyPartValue(root);
316            if (LessThan(key, rootKey)) // node.Key < root.Key
317            {
318                root = GetLeftOrDefault(root);
319            }
320            else if (GreaterThan(key, rootKey)) // node.Key > root.Key
321            {
322                root = GetRightOrDefault(root);
323            }
324            else // node.Key == root.Key
325            {
326                return root;
327            }
328        }
329        return Zero;
330    }
331
332    // TODO: Return indices range instead of references count
333    /// <summary>
334    /// <para>
335    /// Counts the usages using the specified link.
336    /// </para>
337    /// <para></para>
338    /// </summary>
339    /// <param name="link">
340    /// <para>The link.</para>
341    /// <para></para>
342    /// </param>
343    /// <returns>
344    /// <para>The link</para>
345    /// <para></para>
346    /// </returns>
347    [MethodImpl(MethodImplOptions.AggressiveInlining)]
348    public TLink CountUsages(TLink link) => GetSizeOrZero(GetTreeRoot(link));
349
350    /// <summary>
351    /// <para>
352    /// Eaches the usage using the specified base.
353    /// </para>
354    /// <para></para>
355    /// </summary>
356    /// <param name="@base">
357    /// <para>The base.</para>
358    /// <para></para>
359    /// </param>
360    /// <param name="handler">
361    /// <para>The handler.</para>
362    /// <para></para>
363    /// </param>
364    /// <returns>
365    /// <para>The link</para>
366    /// <para></para>
367    /// </returns>
368    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

369 public TLink EachUsage(TLink @base, Func<IList<TLink>, TLink> handler) =>
370     ↳ EachUsageCore(@base, GetTreeRoot(@base), handler);
371
372 // TODO: 1. Move target, handler to separate object. 2. Use stack or walker 3. Use
373 ↳ low-level MSIL stack.
374
375 /// <summary>
376 /// <para>
377 /// Eaches the usage core using the specified base.
378 /// </para>
379 /// <para></para>
380 /// </summary>
381 /// <param name="@base">
382 /// <para>The base.</para>
383 /// <para></para>
384 /// </param>
385 /// <param name="link">
386 /// <para>The link.</para>
387 /// <para></para>
388 /// </param>
389 /// <returns>
390 /// <para>The continue.</para>
391 /// <para></para>
392 /// </returns>
393 [MethodImpl(MethodImplOptions.AggressiveInlining)]
394 private TLink EachUsageCore(TLink @base, TLink link, Func<IList<TLink>, TLink> handler)
395 {
396     var @continue = Continue;
397     if (EqualToZero(link))
398     {
399         return @continue;
400     }
401     var @break = Break;
402     if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
403     {
404         return @break;
405     }
406     if (AreEqual(handler(GetLinkValues(link)), @break))
407     {
408         return @break;
409     }
410     if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
411     {
412         return @break;
413     }
414     return @continue;
415 }
416
417
418 /// <summary>
419 /// <para>
420 /// Prints the node value using the specified node.
421 /// </para>
422 /// <para></para>
423 /// </summary>
424 /// <param name="node">
425 /// <para>The node.</para>
426 /// <para></para>
427 /// </param>
428 /// <param name="sb">
429 /// <para>The sb.</para>
430 /// <para></para>
431 /// </param>
432 [MethodImpl(MethodImplOptions.AggressiveInlining)]
433 protected override void PrintNodeValue(TLink node, StringBuilder sb)
434 {
435     ref var link = ref GetLinkDataPartReference(node);
436     sb.Append(' ');
437     sb.Append(link.Source);
438     sb.Append('-');
439     sb.Append('>');
440     sb.Append(link.Target);
441 }
442 }
443 }

```

## 1.37 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/InternalLinksSourcesLinkedListMethods.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4  using Platform.Collections.Methods.Lists;
5  using Platform.Converters;
6  using static System.Runtime.CompilerServices.Unsafe;
7
8  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
9
10 namespace Platform.Data.Doublets.Memory.Split.Generic
11 {
12     /// <summary>
13     /// <para>
14     /// Represents the internal links sources linked list methods.
15     /// </para>
16     /// <para></para>
17     /// </summary>
18     /// <seealso cref="RelativeCircularDoublyLinkedListMethods{TLink}"/>
19     public unsafe class InternalLinksSourcesLinkedListMethods<TLink> :
20         ↳ RelativeCircularDoublyLinkedListMethods<TLink>
21     {
22         /// <summary>
23         /// <para>
24         /// The default.
25         /// </para>
26         /// <para></para>
27         /// </summary>
28         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
29             ↳ UncheckedConverter<TLink, long>.Default;
30         /// <summary>
31         /// <para>
32         /// The links data parts.
33         /// </para>
34         /// <para></para>
35         /// </summary>
36         private readonly byte* _linksDataParts;
37         /// <summary>
38         /// <para>
39         /// The links index parts.
40         /// </para>
41         /// <para></para>
42         /// </summary>
43         private readonly byte* _linksIndexParts;
44         /// <summary>
45         /// <para>
46         /// The break.
47         /// </para>
48         /// <para></para>
49         /// </summary>
50         protected readonly TLink Break;
51         /// <summary>
52         /// <para>
53         /// The continue.
54         /// </para>
55         /// <para></para>
56         /// </summary>
57         protected readonly TLink Continue;
58         /// <summary>
59         /// <para>
60         /// Initializes a new <see cref="InternalLinksSourcesLinkedListMethods"/> instance.
61         /// </para>
62         /// <para></para>
63         /// </summary>
64         /// <param name="constants">
65         /// <para>A constants.</para>
66         /// <para></para>
67         /// </param>
68         /// <param name="linksDataParts">
69         /// <para>A links data parts.</para>
70         /// <para></para>
71         /// </param>
72         /// <param name="linksIndexParts">
73         /// <para>A links index parts.</para>
74         /// <para></para>
75         /// </param>
76         [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

76 public InternalLinksSourcesLinkedListMethods(LinksConstants<TLink> constants, byte*
    ↳ linksDataParts, byte* linksIndexParts)
77 {
78     _linksDataParts = linksDataParts;
79     _linksIndexParts = linksIndexParts;
80     Break = constants.Break;
81     Continue = constants.Continue;
82 }
83
84 /// <summary>
85 /// <para>
86 /// Gets the link data part reference using the specified link.
87 /// </para>
88 /// <para></para>
89 /// </summary>
90 /// <param name="link">
91 /// <para>The link.</para>
92 /// <para></para>
93 /// </param>
94 /// <returns>
95 /// <para>A ref raw link data part of t link</para>
96 /// <para></para>
97 /// </returns>
98 [MethodImpl(MethodImplOptions.AggressiveInlining)]
99 protected virtual ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) => ref
    ↳ AsRef<RawLinkDataPart<TLink>>(_linksDataParts + (RawLinkDataPart<TLink>.SizeInBytes
    ↳ * _addressToInt64Converter.Convert(link)));
100
101 /// <summary>
102 /// <para>
103 /// Gets the link index part reference using the specified link.
104 /// </para>
105 /// <para></para>
106 /// </summary>
107 /// <param name="link">
108 /// <para>The link.</para>
109 /// <para></para>
110 /// </param>
111 /// <returns>
112 /// <para>A ref raw link index part of t link</para>
113 /// <para></para>
114 /// </returns>
115 [MethodImpl(MethodImplOptions.AggressiveInlining)]
116 protected virtual ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
    ↳ ref AsRef<RawLinkIndexPart<TLink>>(_linksIndexParts +
    ↳ (RawLinkIndexPart<TLink>.SizeInBytes * _addressToInt64Converter.Convert(link)));
117
118 /// <summary>
119 /// <para>
120 /// Gets the first using the specified head.
121 /// </para>
122 /// <para></para>
123 /// </summary>
124 /// <param name="head">
125 /// <para>The head.</para>
126 /// <para></para>
127 /// </param>
128 /// <returns>
129 /// <para>The link</para>
130 /// <para></para>
131 /// </returns>
132 [MethodImpl(MethodImplOptions.AggressiveInlining)]
133 protected override TLink GetFirst(TLink head) =>
    ↳ GetLinkIndexPartReference(head).RootAsSource;
134
135 /// <summary>
136 /// <para>
137 /// Gets the last using the specified head.
138 /// </para>
139 /// <para></para>
140 /// </summary>
141 /// <param name="head">
142 /// <para>The head.</para>
143 /// <para></para>
144 /// </param>
145 /// <returns>
146 /// <para>The link</para>
147 /// <para></para>

```



```

148 /// </returns>
149 [MethodImpl(MethodImplOptions.AggressiveInlining)]
150 protected override TLink GetLast(TLink head)
151 {
152     var first = GetLinkIndexPartReference(head).RootAsSource;
153     if (EqualToZero(first))
154     {
155         return first;
156     }
157     else
158     {
159         return GetPrevious(first);
160     }
161 }
162
163 /// <summary>
164 /// <para>
165 /// Gets the previous using the specified element.
166 /// </para>
167 /// <para></para>
168 /// </summary>
169 /// <param name="element">
170 /// <para>The element.</para>
171 /// <para></para>
172 /// </param>
173 /// <returns>
174 /// <para>The link</para>
175 /// <para></para>
176 /// </returns>
177 [MethodImpl(MethodImplOptions.AggressiveInlining)]
178 protected override TLink GetPrevious(TLink element) =>
179     ↪ GetLinkIndexPartReference(element).LeftAsSource;
180
181 /// <summary>
182 /// <para>
183 /// Gets the next using the specified element.
184 /// </para>
185 /// <para></para>
186 /// </summary>
187 /// <param name="element">
188 /// <para>The element.</para>
189 /// <para></para>
190 /// </param>
191 /// <returns>
192 /// <para>The link</para>
193 /// <para></para>
194 /// </returns>
195 [MethodImpl(MethodImplOptions.AggressiveInlining)]
196 protected override TLink GetNext(TLink element) =>
197     ↪ GetLinkIndexPartReference(element).RightAsSource;
198
199 /// <summary>
200 /// <para>
201 /// Gets the size using the specified head.
202 /// </para>
203 /// <para></para>
204 /// </summary>
205 /// <param name="head">
206 /// <para>The head.</para>
207 /// <para></para>
208 /// </param>
209 /// <returns>
210 /// <para>The link</para>
211 /// <para></para>
212 /// </returns>
213 [MethodImpl(MethodImplOptions.AggressiveInlining)]
214 protected override TLink GetSize(TLink head) =>
215     ↪ GetLinkIndexPartReference(head).SizeAsSource;
216
217 /// <summary>
218 /// <para>
219 /// Sets the first using the specified head.
220 /// </para>
221 /// <para></para>
222 /// </summary>
223 /// <param name="head">
224 /// <para>The head.</para>
225 /// <para></para>
226 /// </param>

```

```

223     /// </param>
224     /// <param name="element">
225     /// <para>The element.</para>
226     /// <para></para>
227     /// </param>
228     [MethodImpl(MethodImplOptions.AggressiveInlining)]
229     protected override void SetFirst(TLink head, TLink element) =>
230         ↪ GetLinkIndexPartReference(head).RootAsSource = element;
231
232     /// <summary>
233     /// <para>
234     /// Sets the last using the specified head.
235     /// </para>
236     /// <para></para>
237     /// </summary>
238     /// <param name="head">
239     /// <para>The head.</para>
240     /// <para></para>
241     /// </param>
242     /// <param name="element">
243     /// <para>The element.</para>
244     /// <para></para>
245     /// </param>
246     [MethodImpl(MethodImplOptions.AggressiveInlining)]
247     protected override void SetLast(TLink head, TLink element)
248     {
249         //var first = GetLinkIndexPartReference(head).RootAsSource;
250         //if (EqualToZero(first))
251         //{
252             // SetFirst(head, element);
253         //}
254         //else
255         //{
256             // SetPrevious(first, element);
257         //}
258     }
259
260     /// <summary>
261     /// <para>
262     /// Sets the previous using the specified element.
263     /// </para>
264     /// <para></para>
265     /// </summary>
266     /// <param name="element">
267     /// <para>The element.</para>
268     /// <para></para>
269     /// </param>
270     /// <param name="previous">
271     /// <para>The previous.</para>
272     /// <para></para>
273     /// </param>
274     [MethodImpl(MethodImplOptions.AggressiveInlining)]
275     protected override void SetPrevious(TLink element, TLink previous) =>
276         ↪ GetLinkIndexPartReference(element).LeftAsSource = previous;
277
278     /// <summary>
279     /// <para>
280     /// Sets the next using the specified element.
281     /// </para>
282     /// <para></para>
283     /// </summary>
284     /// <param name="element">
285     /// <para>The element.</para>
286     /// <para></para>
287     /// </param>
288     /// <param name="next">
289     /// <para>The next.</para>
290     /// <para></para>
291     /// </param>
292     [MethodImpl(MethodImplOptions.AggressiveInlining)]
293     protected override void SetNext(TLink element, TLink next) =>
294         ↪ GetLinkIndexPartReference(element).RightAsSource = next;
295
296     /// <summary>
297     /// <para>
298     /// Sets the size using the specified head.
299     /// </para>
300     /// <para></para>

```

```

298     /// </summary>
299     /// <param name="head">
300     /// <para>The head.</para>
301     /// <para></para>
302     /// </param>
303     /// <param name="size">
304     /// <para>The size.</para>
305     /// <para></para>
306     /// </param>
307     [MethodImpl(MethodImplOptions.AggressiveInlining)]
308     protected override void SetSize(TLink head, TLink size) =>
309         ↪ GetLinkIndexPartReference(head).SizeAsSource = size;
310
311     /// <summary>
312     /// <para>
313     /// Counts the usages using the specified head.
314     /// </para>
315     /// <para></para>
316     /// </summary>
317     /// <param name="head">
318     /// <para>The head.</para>
319     /// <para></para>
320     /// </param>
321     /// <returns>
322     /// <para>The link</para>
323     /// <para></para>
324     /// </returns>
325     [MethodImpl(MethodImplOptions.AggressiveInlining)]
326     public TLink CountUsages(TLink head) => GetSize(head);
327
328     /// <summary>
329     /// <para>
330     /// Gets the link values using the specified link index.
331     /// </para>
332     /// <para></para>
333     /// </summary>
334     /// <param name="linkIndex">
335     /// <para>The link index.</para>
336     /// <para></para>
337     /// </param>
338     /// <returns>
339     /// <para>A list of t link</para>
340     /// <para></para>
341     /// </returns>
342     [MethodImpl(MethodImplOptions.AggressiveInlining)]
343     protected virtual IList<TLink> GetLinkValues(TLink linkIndex)
344     {
345         ref var link = ref GetLinkDataPartReference(linkIndex);
346         return new Link<TLink>(linkIndex, link.Source, link.Target);
347     }
348
349     /// <summary>
350     /// <para>
351     /// Eaches the usage using the specified source.
352     /// </para>
353     /// <para></para>
354     /// </summary>
355     /// <param name="source">
356     /// <para>The source.</para>
357     /// <para></para>
358     /// </param>
359     /// <param name="handler">
360     /// <para>The handler.</para>
361     /// <para></para>
362     /// </param>
363     /// <returns>
364     /// <para>The continue.</para>
365     /// <para></para>
366     /// </returns>
367     [MethodImpl(MethodImplOptions.AggressiveInlining)]
368     public TLink EachUsage(TLink source, Func<IList<TLink>, TLink> handler)
369     {
370         var @continue = Continue;
371         var @break = Break;
372         var current = GetFirst(source);
373         var first = current;
374         while (!EqualToZero(current))
375         {

```

```

375         if (AreEqual(handler(GetLinkValues(current)), @break))
376         {
377             return @break;
378         }
379         current = GetNext(current);
380         if (AreEqual(current, first))
381         {
382             return @continue;
383         }
384     }
385     return @continue;
386 }
387 }
388 }

```

### 1.38 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/InternalLinksSourcesRecursionlessSizeBalancedTree

```

1  using System.Runtime.CompilerServices;
2
3  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5  namespace Platform.Data.Doublets.Memory.Split.Generic
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the internal links sources recursionless size balanced tree methods.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="InternalLinksRecursionlessSizeBalancedTreeMethodsBase{TLink}"/>
14     public unsafe class InternalLinksSourcesRecursionlessSizeBalancedTreeMethods<TLink> :
15         ↳ InternalLinksRecursionlessSizeBalancedTreeMethodsBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see
20         ↳ cref="InternalLinksSourcesRecursionlessSizeBalancedTreeMethods"/> instance.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         /// <param name="constants">
25         /// <para>A constants.</para>
26         /// <para></para>
27         /// </param>
28         /// <param name="linksDataParts">
29         /// <para>A links data parts.</para>
30         /// <para></para>
31         /// </param>
32         /// <param name="linksIndexParts">
33         /// <para>A links index parts.</para>
34         /// <para></para>
35         /// </param>
36         /// <param name="header">
37         /// <para>A header.</para>
38         /// <para></para>
39         /// </param>
40         [MethodImpl(MethodImplOptions.AggressiveInlining)]
41         public InternalLinksSourcesRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
42             ↳ constants, byte* linksDataParts, byte* linksIndexParts, byte* header) :
43             ↳ base(constants, linksDataParts, linksIndexParts, header) { }
44
45         /// <summary>
46         /// <para>
47         /// Gets the left reference using the specified node.
48         /// </para>
49         /// <para></para>
50         /// </summary>
51         /// <param name="node">
52         /// <para>The node.</para>
53         /// <para></para>
54         /// </param>
55         /// <returns>
56         /// <para>The ref link</para>
57         /// <para></para>
58         /// </returns>
59         [MethodImpl(MethodImplOptions.AggressiveInlining)]
60         protected override ref TLink GetLeftReference(TLink node) => ref
61             ↳ GetLinkIndexPartReference(node).LeftAsSource;
62     }
63 }

```

```

58     /// <summary>
59     /// <para>
60     /// Gets the right reference using the specified node.
61     /// </para>
62     /// <para></para>
63     /// </summary>
64     /// <param name="node">
65     /// <para>The node.</para>
66     /// <para></para>
67     /// </param>
68     /// <returns>
69     /// <para>The ref link</para>
70     /// <para></para>
71     /// </returns>
72     [MethodImpl(MethodImplOptions.AggressiveInlining)]
73     protected override ref TLink GetRightReference(TLink node) => ref
74     ↪ GetLinkIndexPartReference(node).RightAsSource;
75
76     /// <summary>
77     /// <para>
78     /// Gets the left using the specified node.
79     /// </para>
80     /// <para></para>
81     /// </summary>
82     /// <param name="node">
83     /// <para>The node.</para>
84     /// <para></para>
85     /// </param>
86     /// <returns>
87     /// <para>The link</para>
88     /// <para></para>
89     /// </returns>
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     protected override TLink GetLeft(TLink node) =>
92     ↪ GetLinkIndexPartReference(node).LeftAsSource;
93
94     /// <summary>
95     /// <para>
96     /// Gets the right using the specified node.
97     /// </para>
98     /// <para></para>
99     /// </summary>
100    /// <param name="node">
101    /// <para>The node.</para>
102    /// <para></para>
103    /// </param>
104    /// <returns>
105    /// <para>The link</para>
106    /// <para></para>
107    /// </returns>
108    [MethodImpl(MethodImplOptions.AggressiveInlining)]
109    protected override TLink GetRight(TLink node) =>
110    ↪ GetLinkIndexPartReference(node).RightAsSource;
111
112    /// <summary>
113    /// <para>
114    /// Sets the left using the specified node.
115    /// </para>
116    /// <para></para>
117    /// </summary>
118    /// <param name="node">
119    /// <para>The node.</para>
120    /// <para></para>
121    /// </param>
122    /// <param name="left">
123    /// <para>The left.</para>
124    /// <para></para>
125    /// </param>
126    [MethodImpl(MethodImplOptions.AggressiveInlining)]
127    protected override void SetLeft(TLink node, TLink left) =>
128    ↪ GetLinkIndexPartReference(node).LeftAsSource = left;
129
130    /// <summary>
131    /// <para>
132    /// Sets the right using the specified node.
133    /// </para>
134    /// <para></para>
135    /// </summary>

```

```

132    /// <param name="node">
133    /// <para>The node.</para>
134    /// <para></para>
135    /// </param>
136    /// <param name="right">
137    /// <para>The right.</para>
138    /// <para></para>
139    /// </param>
140    [MethodImpl(MethodImplOptions.AggressiveInlining)]
141    protected override void SetRight(TLink node, TLink right) =>
142        ↪ GetLinkIndexPartReference(node).RightAsSource = right;
143
144    /// <summary>
145    /// <para>
146    /// Gets the size using the specified node.
147    /// </para>
148    /// <para></para>
149    /// </summary>
150    /// <param name="node">
151    /// <para>The node.</para>
152    /// <para></para>
153    /// </param>
154    /// <returns>
155    /// <para>The link</para>
156    /// <para></para>
157    /// </returns>
158    [MethodImpl(MethodImplOptions.AggressiveInlining)]
159    protected override TLink GetSize(TLink node) =>
160        ↪ GetLinkIndexPartReference(node).SizeAsSource;
161
162    /// <summary>
163    /// <para>
164    /// Sets the size using the specified node.
165    /// </para>
166    /// <para></para>
167    /// </summary>
168    /// <param name="node">
169    /// <para>The node.</para>
170    /// <para></para>
171    /// </param>
172    /// <param name="size">
173    /// <para>The size.</para>
174    /// <para></para>
175    /// </param>
176    [MethodImpl(MethodImplOptions.AggressiveInlining)]
177    protected override void SetSize(TLink node, TLink size) =>
178        ↪ GetLinkIndexPartReference(node).SizeAsSource = size;
179
180    /// <summary>
181    /// <para>
182    /// Gets the tree root using the specified link.
183    /// </para>
184    /// <para></para>
185    /// </summary>
186    /// <param name="link">
187    /// <para>The link.</para>
188    /// <para></para>
189    /// </param>
190    /// <returns>
191    /// <para>The link</para>
192    /// <para></para>
193    /// </returns>
194    [MethodImpl(MethodImplOptions.AggressiveInlining)]
195    protected override TLink GetTreeRoot(TLink link) =>
196        ↪ GetLinkIndexPartReference(link).RootAsSource;
197
198    /// <summary>
199    /// <para>
200    /// Gets the base part value using the specified link.
201    /// </para>
202    /// <para></para>
203    /// </summary>
204    /// <param name="link">
205    /// <para>The link.</para>
206    /// <para></para>
207    /// </param>
208    /// <returns>
209    /// <para>The link</para>
210    /// <para></para>
211    /// </returns>

```

```

206     /// <para></para>
207     /// </returns>
208     [MethodImpl(MethodImplOptions.AggressiveInlining)]
209     protected override TLink GetBasePartValue(TLink link) =>
210         ↪ GetLinkDataPartReference(link).Source;
211
212     /// <summary>
213     /// <para>
214     /// Gets the key part value using the specified link.
215     /// </para>
216     /// <para></para>
217     /// </summary>
218     /// <param name="link">
219     /// <para>The link.</para>
220     /// </param>
221     /// <returns>
222     /// <para>The link</para>
223     /// <para></para>
224     /// </returns>
225     [MethodImpl(MethodImplOptions.AggressiveInlining)]
226     protected override TLink GetKeyPartValue(TLink link) =>
227         ↪ GetLinkDataPartReference(link).Target;
228
229     /// <summary>
230     /// <para>
231     /// Clears the node using the specified node.
232     /// </para>
233     /// <para></para>
234     /// </summary>
235     /// <param name="node">
236     /// <para>The node.</para>
237     /// </param>
238     [MethodImpl(MethodImplOptions.AggressiveInlining)]
239     protected override void ClearNode(TLink node)
240     {
241         ref var link = ref GetLinkIndexPartReference(node);
242         link.LeftAsSource = Zero;
243         link.RightAsSource = Zero;
244         link.SizeAsSource = Zero;
245     }
246
247     /// <summary>
248     /// <para>
249     /// Searches the source.
250     /// </para>
251     /// <para></para>
252     /// </summary>
253     /// <param name="source">
254     /// <para>The source.</para>
255     /// </param>
256     /// <param name="target">
257     /// <para>The target.</para>
258     /// </param>
259     /// <returns>
260     /// <para>The link</para>
261     /// <para></para>
262     /// </returns>
263     public override TLink Search(TLink source, TLink target) =>
264         ↪ SearchCore(GetTreeRoot(source), target);
265
266     }
267 }

```

### 1.39 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/InternalLinksSourcesSizeBalancedTreeMethods.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.Data.Doublets.Memory.Split.Generic
6 {
7     /// <summary>
8     /// <para>
9     /// Represents the internal links sources size balanced tree methods.
10    /// </para>
11    /// <para></para>

```

```

12  /// </summary>
13  /// <seealso cref="InternalLinksSizeBalancedTreeMethodsBase{TLink}"/>
14  public unsafe class InternalLinksSourcesSizeBalancedTreeMethods<TLink> :
    ↳ InternalLinksSizeBalancedTreeMethodsBase<TLink>
15  {
16      /// <summary>
17      /// <para>
18      /// Initializes a new <see cref="InternalLinksSourcesSizeBalancedTreeMethods"/> instance.
19      /// </para>
20      /// <para></para>
21      /// </summary>
22      /// <param name="constants">
23      /// <para>A constants.</para>
24      /// <para></para>
25      /// </param>
26      /// <param name="linksDataParts">
27      /// <para>A links data parts.</para>
28      /// <para></para>
29      /// </param>
30      /// <param name="linksIndexParts">
31      /// <para>A links index parts.</para>
32      /// <para></para>
33      /// </param>
34      /// <param name="header">
35      /// <para>A header.</para>
36      /// <para></para>
37      /// </param>
38      [MethodImpl(MethodImplOptions.AggressiveInlining)]
39      public InternalLinksSourcesSizeBalancedTreeMethods(LinksConstants<TLink> constants,
    ↳ byte* linksDataParts, byte* linksIndexParts, byte* header) : base(constants,
    ↳ linksDataParts, linksIndexParts, header) { }
40
41      /// <summary>
42      /// <para>
43      /// Gets the left reference using the specified node.
44      /// </para>
45      /// <para></para>
46      /// </summary>
47      /// <param name="node">
48      /// <para>The node.</para>
49      /// <para></para>
50      /// </param>
51      /// <returns>
52      /// <para>The ref link</para>
53      /// <para></para>
54      /// </returns>
55      [MethodImpl(MethodImplOptions.AggressiveInlining)]
56      protected override ref TLink GetLeftReference(TLink node) => ref
    ↳ GetLinkIndexPartReference(node).LeftAsSource;
57
58      /// <summary>
59      /// <para>
60      /// Gets the right reference using the specified node.
61      /// </para>
62      /// <para></para>
63      /// </summary>
64      /// <param name="node">
65      /// <para>The node.</para>
66      /// <para></para>
67      /// </param>
68      /// <returns>
69      /// <para>The ref link</para>
70      /// <para></para>
71      /// </returns>
72      [MethodImpl(MethodImplOptions.AggressiveInlining)]
73      protected override ref TLink GetRightReference(TLink node) => ref
    ↳ GetLinkIndexPartReference(node).RightAsSource;
74
75      /// <summary>
76      /// <para>
77      /// Gets the left using the specified node.
78      /// </para>
79      /// <para></para>
80      /// </summary>
81      /// <param name="node">
82      /// <para>The node.</para>
83      /// <para></para>
84      /// </param>

```



```

85     /// <returns>
86     /// <para>The link</para>
87     /// <para></para>
88     /// </returns>
89     [MethodImpl(MethodImplOptions.AggressiveInlining)]
90     protected override TLink GetLeft(TLink node) =>
91         ↪ GetLinkIndexPartReference(node).LeftAsSource;
92
93     /// <summary>
94     /// <para>
95     /// Gets the right using the specified node.
96     /// </para>
97     /// <para></para>
98     /// </summary>
99     /// <param name="node">
100    /// <para>The node.</para>
101    /// <para></para>
102    /// </param>
103    /// <returns>
104    /// <para>The link</para>
105    /// <para></para>
106    /// </returns>
107    [MethodImpl(MethodImplOptions.AggressiveInlining)]
108    protected override TLink GetRight(TLink node) =>
109        ↪ GetLinkIndexPartReference(node).RightAsSource;
110
111    /// <summary>
112    /// <para>
113    /// Sets the left using the specified node.
114    /// </para>
115    /// <para></para>
116    /// </summary>
117    /// <param name="node">
118    /// <para>The node.</para>
119    /// <para></para>
120    /// </param>
121    /// <param name="left">
122    /// <para>The left.</para>
123    /// <para></para>
124    /// </param>
125    [MethodImpl(MethodImplOptions.AggressiveInlining)]
126    protected override void SetLeft(TLink node, TLink left) =>
127        ↪ GetLinkIndexPartReference(node).LeftAsSource = left;
128
129    /// <summary>
130    /// <para>
131    /// Sets the right using the specified node.
132    /// </para>
133    /// <para></para>
134    /// </summary>
135    /// <param name="node">
136    /// <para>The node.</para>
137    /// <para></para>
138    /// </param>
139    /// <param name="right">
140    /// <para>The right.</para>
141    /// <para></para>
142    /// </param>
143    [MethodImpl(MethodImplOptions.AggressiveInlining)]
144    protected override void SetRight(TLink node, TLink right) =>
145        ↪ GetLinkIndexPartReference(node).RightAsSource = right;
146
147    /// <summary>
148    /// <para>
149    /// Gets the size using the specified node.
150    /// </para>
151    /// <para></para>
152    /// </summary>
153    /// <param name="node">
154    /// <para>The node.</para>
155    /// <para></para>
156    /// </param>
157    /// <returns>
158    /// <para>The link</para>
159    /// <para></para>
160    /// </returns>
161    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

158     protected override TLink GetSize(TLink node) =>
159         ↪ GetLinkIndexPartReference(node).SizeAsSource;
160
161     /// <summary>
162     /// <para>
163     /// Sets the size using the specified node.
164     /// </para>
165     /// </summary>
166     /// <param name="node">
167     /// <para>The node.</para>
168     /// </param>
169     /// <param name="size">
170     /// <para>The size.</para>
171     /// </param>
172     [MethodImpl(MethodImplOptions.AggressiveInlining)]
173     protected override void SetSize(TLink node, TLink size) =>
174         ↪ GetLinkIndexPartReference(node).SizeAsSource = size;
175
176     /// <summary>
177     /// <para>
178     /// Gets the tree root using the specified link.
179     /// </para>
180     /// </summary>
181     /// <param name="link">
182     /// <para>The link.</para>
183     /// </param>
184     /// <returns>
185     /// <para>The link</para>
186     /// </returns>
187     [MethodImpl(MethodImplOptions.AggressiveInlining)]
188     protected override TLink GetTreeRoot(TLink link) =>
189         ↪ GetLinkIndexPartReference(link).RootAsSource;
190
191     /// <summary>
192     /// <para>
193     /// Gets the base part value using the specified link.
194     /// </para>
195     /// </summary>
196     /// <param name="link">
197     /// <para>The link.</para>
198     /// </param>
199     /// <returns>
200     /// <para>The link</para>
201     /// </returns>
202     [MethodImpl(MethodImplOptions.AggressiveInlining)]
203     protected override TLink GetBasePartValue(TLink link) =>
204         ↪ GetLinkDataPartReference(link).Source;
205
206     /// <summary>
207     /// <para>
208     /// Gets the key part value using the specified link.
209     /// </para>
210     /// </summary>
211     /// <param name="link">
212     /// <para>The link.</para>
213     /// </param>
214     /// <returns>
215     /// <para>The link</para>
216     /// </returns>
217     [MethodImpl(MethodImplOptions.AggressiveInlining)]
218     protected override TLink GetKeyPartValue(TLink link) =>
219         ↪ GetLinkDataPartReference(link).Target;
220
221     /// <summary>
222     /// <para>

```

```

230     /// Clears the node using the specified node.
231     /// </para>
232     /// <para></para>
233     /// </summary>
234     /// <param name="node">
235     /// <para>The node.</para>
236     /// <para></para>
237     /// </param>
238     [MethodImpl(MethodImplOptions.AggressiveInlining)]
239     protected override void ClearNode(TLink node)
240     {
241         ref var link = ref GetLinkIndexPartReference(node);
242         link.LeftAsSource = Zero;
243         link.RightAsSource = Zero;
244         link.SizeAsSource = Zero;
245     }
246
247     /// <summary>
248     /// <para>
249     /// Searches the source.
250     /// </para>
251     /// <para></para>
252     /// </summary>
253     /// <param name="source">
254     /// <para>The source.</para>
255     /// <para></para>
256     /// </param>
257     /// <param name="target">
258     /// <para>The target.</para>
259     /// <para></para>
260     /// </param>
261     /// <returns>
262     /// <para>The link</para>
263     /// <para></para>
264     /// </returns>
265     public override TLink Search(TLink source, TLink target) =>
266         ↪ SearchCore(GetTreeRoot(source), target);
267 }

```

#### 1.40 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/InternalLinksTargetsRecursionlessSizeBalancedTree

```

1  using System.Runtime.CompilerServices;
2
3  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5  namespace Platform.Data.Doublets.Memory.Split.Generic
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the internal links targets recursionless size balanced tree methods.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="InternalLinksRecursionlessSizeBalancedTreeMethodsBase{TLink}"/>
14     public unsafe class InternalLinksTargetsRecursionlessSizeBalancedTreeMethods<TLink> :
15         ↪ InternalLinksRecursionlessSizeBalancedTreeMethodsBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see
20         ↪ cref="InternalLinksTargetsRecursionlessSizeBalancedTreeMethods"/> instance.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         /// <param name="constants">
25         /// <para>A constants.</para>
26         /// <para></para>
27         /// </param>
28         /// <param name="linksDataParts">
29         /// <para>A links data parts.</para>
30         /// <para></para>
31         /// </param>
32         /// <param name="linksIndexParts">
33         /// <para>A links index parts.</para>
34         /// <para></para>
35         /// </param>
36         /// <param name="header">
37         /// <para>A header.</para>

```

```

36    /// <para></para>
37    /// </param>
38    [MethodImpl(MethodImplOptions.AggressiveInlining)]
39    public InternalLinksTargetsRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
    ↪ constants, byte* linksDataParts, byte* linksIndexParts, byte* header) :
    ↪ base(constants, linksDataParts, linksIndexParts, header) { }

40
41    /// <summary>
42    /// <para>
43    /// Gets the left reference using the specified node.
44    /// </para>
45    /// <para></para>
46    /// </summary>
47    /// <param name="node">
48    /// <para>The node.</para>
49    /// <para></para>
50    /// </param>
51    /// <returns>
52    /// <para>The ref link</para>
53    /// <para></para>
54    /// </returns>
55    [MethodImpl(MethodImplOptions.AggressiveInlining)]
56    protected override ref TLink GetLeftReference(TLink node) => ref
    ↪ GetLinkIndexPartReference(node).LeftAsTarget;

57
58    /// <summary>
59    /// <para>
60    /// Gets the right reference using the specified node.
61    /// </para>
62    /// <para></para>
63    /// </summary>
64    /// <param name="node">
65    /// <para>The node.</para>
66    /// <para></para>
67    /// </param>
68    /// <returns>
69    /// <para>The ref link</para>
70    /// <para></para>
71    /// </returns>
72    [MethodImpl(MethodImplOptions.AggressiveInlining)]
73    protected override ref TLink GetRightReference(TLink node) => ref
    ↪ GetLinkIndexPartReference(node).RightAsTarget;

74
75    /// <summary>
76    /// <para>
77    /// Gets the left using the specified node.
78    /// </para>
79    /// <para></para>
80    /// </summary>
81    /// <param name="node">
82    /// <para>The node.</para>
83    /// <para></para>
84    /// </param>
85    /// <returns>
86    /// <para>The link</para>
87    /// <para></para>
88    /// </returns>
89    [MethodImpl(MethodImplOptions.AggressiveInlining)]
90    protected override TLink GetLeft(TLink node) =>
    ↪ GetLinkIndexPartReference(node).LeftAsTarget;

91
92    /// <summary>
93    /// <para>
94    /// Gets the right using the specified node.
95    /// </para>
96    /// <para></para>
97    /// </summary>
98    /// <param name="node">
99    /// <para>The node.</para>
100    /// <para></para>
101    /// </param>
102    /// <returns>
103    /// <para>The link</para>
104    /// <para></para>
105    /// </returns>
106    [MethodImpl(MethodImplOptions.AggressiveInlining)]
107    protected override TLink GetRight(TLink node) =>
    ↪ GetLinkIndexPartReference(node).RightAsTarget;

```

```

108     /// <summary>
109     /// <para>
110     /// Sets the left using the specified node.
111     /// </para>
112     /// <para></para>
113     /// </summary>
114     /// <param name="node">
115     /// <para>The node.</para>
116     /// <para></para>
117     /// </param>
118     /// <param name="left">
119     /// <para>The left.</para>
120     /// <para></para>
121     /// </param>
122     [MethodImpl(MethodImplOptions.AggressiveInlining)]
123     protected override void SetLeft(TLink node, TLink left) =>
124     ↪ GetLinkIndexPartReference(node).LeftAsTarget = left;
125
126     /// <summary>
127     /// <para>
128     /// Sets the right using the specified node.
129     /// </para>
130     /// <para></para>
131     /// </summary>
132     /// <param name="node">
133     /// <para>The node.</para>
134     /// <para></para>
135     /// </param>
136     /// <param name="right">
137     /// <para>The right.</para>
138     /// <para></para>
139     /// </param>
140     [MethodImpl(MethodImplOptions.AggressiveInlining)]
141     protected override void SetRight(TLink node, TLink right) =>
142     ↪ GetLinkIndexPartReference(node).RightAsTarget = right;
143
144     /// <summary>
145     /// <para>
146     /// Gets the size using the specified node.
147     /// </para>
148     /// <para></para>
149     /// </summary>
150     /// <param name="node">
151     /// <para>The node.</para>
152     /// <para></para>
153     /// </param>
154     /// <returns>
155     /// <para>The link</para>
156     /// <para></para>
157     /// </returns>
158     [MethodImpl(MethodImplOptions.AggressiveInlining)]
159     protected override TLink GetSize(TLink node) =>
160     ↪ GetLinkIndexPartReference(node).SizeAsTarget;
161
162     /// <summary>
163     /// <para>
164     /// Sets the size using the specified node.
165     /// </para>
166     /// <para></para>
167     /// </summary>
168     /// <param name="node">
169     /// <para>The node.</para>
170     /// <para></para>
171     /// </param>
172     /// <param name="size">
173     /// <para>The size.</para>
174     /// <para></para>
175     /// </param>
176     [MethodImpl(MethodImplOptions.AggressiveInlining)]
177     protected override void SetSize(TLink node, TLink size) =>
178     ↪ GetLinkIndexPartReference(node).SizeAsTarget = size;
179
180     /// <summary>
181     /// <para>
182     /// Gets the tree root using the specified link.
183     /// </para>
184     /// <para></para>

```

```

182     /// </summary>
183     /// <param name="link">
184     /// <para>The link.</para>
185     /// <para></para>
186     /// </param>
187     /// <returns>
188     /// <para>The link</para>
189     /// <para></para>
190     /// </returns>
191     [MethodImpl(MethodImplOptions.AggressiveInlining)]
192     protected override TLink GetTreeRoot(TLink link) =>
193         ↪ GetLinkIndexPartReference(link).RootAsTarget;
194
195     /// <summary>
196     /// <para>
197     /// Gets the base part value using the specified link.
198     /// </para>
199     /// <para></para>
200     /// </summary>
201     /// <param name="link">
202     /// <para>The link.</para>
203     /// <para></para>
204     /// </param>
205     /// <returns>
206     /// <para>The link</para>
207     /// <para></para>
208     /// </returns>
209     [MethodImpl(MethodImplOptions.AggressiveInlining)]
210     protected override TLink GetBasePartValue(TLink link) =>
211         ↪ GetLinkDataPartReference(link).Target;
212
213     /// <summary>
214     /// <para>
215     /// Gets the key part value using the specified link.
216     /// </para>
217     /// <para></para>
218     /// </summary>
219     /// <param name="link">
220     /// <para>The link.</para>
221     /// <para></para>
222     /// </param>
223     /// <returns>
224     /// <para>The link</para>
225     /// <para></para>
226     /// </returns>
227     [MethodImpl(MethodImplOptions.AggressiveInlining)]
228     protected override TLink GetKeyPartValue(TLink link) =>
229         ↪ GetLinkDataPartReference(link).Source;
230
231     /// <summary>
232     /// <para>
233     /// Clears the node using the specified node.
234     /// </para>
235     /// <para></para>
236     /// </summary>
237     /// <param name="node">
238     /// <para>The node.</para>
239     /// <para></para>
240     /// </param>
241     [MethodImpl(MethodImplOptions.AggressiveInlining)]
242     protected override void ClearNode(TLink node)
243     {
244         ref var link = ref GetLinkIndexPartReference(node);
245         link.LeftAsTarget = Zero;
246         link.RightAsTarget = Zero;
247         link.SizeAsTarget = Zero;
248     }
249
250     /// <summary>
251     /// <para>
252     /// Searches the source.
253     /// </para>
254     /// <para></para>
255     /// </summary>
256     /// <param name="source">
257     /// <para>The source.</para>
258     /// <para></para>
259     /// </param>

```

```

257     /// <param name="target">
258     /// <para>The target.</para>
259     /// <para></para>
260     /// </param>
261     /// <returns>
262     /// <para>The link</para>
263     /// <para></para>
264     /// </returns>
265     public override TLink Search(TLink source, TLink target) =>
        ↪ SearchCore(GetTreeRoot(target), source);
266 }
267 }

```

#### 1.41 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/InternalLinksTargetsSizeBalancedTreeMethods.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.Data.Doublets.Memory.Split.Generic
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the internal links targets size balanced tree methods.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="InternalLinksSizeBalancedTreeMethodsBase{TLink}"/>
14     public unsafe class InternalLinksTargetsSizeBalancedTreeMethods<TLink> :
        ↪ InternalLinksSizeBalancedTreeMethodsBase<TLink>
15     {
16         /// <summary>
17         /// <para>
18         /// Initializes a new <see cref="InternalLinksTargetsSizeBalancedTreeMethods"/> instance.
19         /// </para>
20         /// <para></para>
21         /// </summary>
22         /// <param name="constants">
23         /// <para>A constants.</para>
24         /// <para></para>
25         /// </param>
26         /// <param name="linksDataParts">
27         /// <para>A links data parts.</para>
28         /// <para></para>
29         /// </param>
30         /// <param name="linksIndexParts">
31         /// <para>A links index parts.</para>
32         /// <para></para>
33         /// </param>
34         /// <param name="header">
35         /// <para>A header.</para>
36         /// <para></para>
37         /// </param>
38         [MethodImpl(MethodImplOptions.AggressiveInlining)]
39         public InternalLinksTargetsSizeBalancedTreeMethods(LinksConstants<TLink> constants,
            ↪ byte* linksDataParts, byte* linksIndexParts, byte* header) : base(constants,
            ↪ linksDataParts, linksIndexParts, header) { }
40
41         /// <summary>
42         /// <para>
43         /// Gets the left reference using the specified node.
44         /// </para>
45         /// <para></para>
46         /// </summary>
47         /// <param name="node">
48         /// <para>The node.</para>
49         /// <para></para>
50         /// </param>
51         /// <returns>
52         /// <para>The ref link</para>
53         /// <para></para>
54         /// </returns>
55         [MethodImpl(MethodImplOptions.AggressiveInlining)]
56         protected override ref TLink GetLeftReference(TLink node) => ref
            ↪ GetLinkIndexPartReference(node).LeftAsTarget;
57
58         /// <summary>
59         /// <para>
60         /// Gets the right reference using the specified node.

```

```

61     /// </para>
62     /// <para></para>
63     /// </summary>
64     /// <param name="node">
65     /// <para>The node.</para>
66     /// <para></para>
67     /// </param>
68     /// <returns>
69     /// <para>The ref link</para>
70     /// <para></para>
71     /// </returns>
72     [MethodImpl(MethodImplOptions.AggressiveInlining)]
73     protected override ref TLink GetRightReference(TLink node) => ref
74     ↪ GetLinkIndexPartReference(node).RightAsTarget;
75
76     /// <summary>
77     /// <para>
78     /// Gets the left using the specified node.
79     /// </para>
80     /// <para></para>
81     /// </summary>
82     /// <param name="node">
83     /// <para>The node.</para>
84     /// <para></para>
85     /// </param>
86     /// <returns>
87     /// <para>The link</para>
88     /// <para></para>
89     /// </returns>
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     protected override TLink GetLeft(TLink node) =>
92     ↪ GetLinkIndexPartReference(node).LeftAsTarget;
93
94     /// <summary>
95     /// <para>
96     /// Gets the right using the specified node.
97     /// </para>
98     /// <para></para>
99     /// </summary>
100    /// <param name="node">
101    /// <para>The node.</para>
102    /// <para></para>
103    /// </param>
104    /// <returns>
105    /// <para>The link</para>
106    /// <para></para>
107    /// </returns>
108    [MethodImpl(MethodImplOptions.AggressiveInlining)]
109    protected override TLink GetRight(TLink node) =>
110    ↪ GetLinkIndexPartReference(node).RightAsTarget;
111
112    /// <summary>
113    /// <para>
114    /// Sets the left using the specified node.
115    /// </para>
116    /// <para></para>
117    /// </summary>
118    /// <param name="node">
119    /// <para>The node.</para>
120    /// <para></para>
121    /// </param>
122    /// <param name="left">
123    /// <para>The left.</para>
124    /// <para></para>
125    /// </param>
126    [MethodImpl(MethodImplOptions.AggressiveInlining)]
127    protected override void SetLeft(TLink node, TLink left) =>
128    ↪ GetLinkIndexPartReference(node).LeftAsTarget = left;
129
130    /// <summary>
131    /// <para>
132    /// Sets the right using the specified node.
133    /// </para>
134    /// <para></para>
135    /// </summary>
136    /// <param name="node">
137    /// <para>The node.</para>
138    /// <para></para>
139    /// </param>

```



```

135     /// </param>
136     /// <param name="right">
137     /// <para>The right.</para>
138     /// <para></para>
139     /// </param>
140     [MethodImpl(MethodImplOptions.AggressiveInlining)]
141     protected override void SetRight(TLink node, TLink right) =>
142     ↪ GetLinkIndexPartReference(node).RightAsTarget = right;
143
144     /// <summary>
145     /// <para>
146     /// Gets the size using the specified node.
147     /// </para>
148     /// <para></para>
149     /// </summary>
150     /// <param name="node">
151     /// <para>The node.</para>
152     /// <para></para>
153     /// </param>
154     /// <returns>
155     /// <para>The link</para>
156     /// <para></para>
157     /// </returns>
158     [MethodImpl(MethodImplOptions.AggressiveInlining)]
159     protected override TLink GetSize(TLink node) =>
160     ↪ GetLinkIndexPartReference(node).SizeAsTarget;
161
162     /// <summary>
163     /// <para>
164     /// Sets the size using the specified node.
165     /// </para>
166     /// <para></para>
167     /// </summary>
168     /// <param name="node">
169     /// <para>The node.</para>
170     /// <para></para>
171     /// </param>
172     /// <param name="size">
173     /// <para>The size.</para>
174     /// <para></para>
175     /// </param>
176     [MethodImpl(MethodImplOptions.AggressiveInlining)]
177     protected override void SetSize(TLink node, TLink size) =>
178     ↪ GetLinkIndexPartReference(node).SizeAsTarget = size;
179
180     /// <summary>
181     /// <para>
182     /// Gets the tree root using the specified link.
183     /// </para>
184     /// <para></para>
185     /// </summary>
186     /// <param name="link">
187     /// <para>The link.</para>
188     /// <para></para>
189     /// </param>
190     /// <returns>
191     /// <para>The link</para>
192     /// <para></para>
193     /// </returns>
194     [MethodImpl(MethodImplOptions.AggressiveInlining)]
195     protected override TLink GetTreeRoot(TLink link) =>
196     ↪ GetLinkIndexPartReference(link).RootAsTarget;
197
198     /// <summary>
199     /// <para>
200     /// Gets the base part value using the specified link.
201     /// </para>
202     /// <para></para>
203     /// </summary>
204     /// <param name="link">
205     /// <para>The link.</para>
206     /// <para></para>
207     /// </param>
208     /// <returns>
209     /// <para>The link</para>
210     /// <para></para>
211     /// </returns>
212     [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

209     protected override TLink GetBasePartValue(TLink link) =>
210         ↪ GetLinkDataPartReference(link).Target;
211
212     /// <summary>
213     /// <para>
214     /// Gets the key part value using the specified link.
215     /// </para>
216     /// <para></para>
217     /// </summary>
218     /// <param name="link">
219     /// <para>The link.</para>
220     /// <para></para>
221     /// </param>
222     /// <returns>
223     /// <para>The link</para>
224     /// <para></para>
225     /// </returns>
226     [MethodImpl(MethodImplOptions.AggressiveInlining)]
227     protected override TLink GetKeyPartValue(TLink link) =>
228         ↪ GetLinkDataPartReference(link).Source;
229
230     /// <summary>
231     /// <para>
232     /// Clears the node using the specified node.
233     /// </para>
234     /// <para></para>
235     /// </summary>
236     /// <param name="node">
237     /// <para>The node.</para>
238     /// <para></para>
239     /// </param>
240     [MethodImpl(MethodImplOptions.AggressiveInlining)]
241     protected override void ClearNode(TLink node)
242     {
243         ref var link = ref GetLinkIndexPartReference(node);
244         link.LeftAsTarget = Zero;
245         link.RightAsTarget = Zero;
246         link.SizeAsTarget = Zero;
247     }
248
249     /// <summary>
250     /// <para>
251     /// Searches the source.
252     /// </para>
253     /// <para></para>
254     /// </summary>
255     /// <param name="source">
256     /// <para>The source.</para>
257     /// <para></para>
258     /// </param>
259     /// <param name="target">
260     /// <para>The target.</para>
261     /// <para></para>
262     /// </param>
263     /// <returns>
264     /// <para>The link</para>
265     /// <para></para>
266     /// </returns>
267     public override TLink Search(TLink source, TLink target) =>
268         ↪ SearchCore(GetTreeRoot(target), source);
269 }

```

#### 1.42 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/SplitMemoryLinks.cs

```

1  using System;
2  using System.Runtime.CompilerServices;
3  using Platform.Singletons;
4  using Platform.Memory;
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.Data.Doublets.Memory.Split.Generic
10 {
11     /// <summary>
12     /// <para>
13     /// Represents the split memory links.
14     /// </para>
15     /// <para></para>

```

```

16  /// </summary>
17  /// <seealso cref="SplitMemoryLinksBase{TLink}"/>
18  public unsafe class SplitMemoryLinks<TLink> : SplitMemoryLinksBase<TLink>
19  {
20      /// <summary>
21      /// <para>
22      /// The create internal source tree methods.
23      /// </para>
24      /// <para></para>
25      /// </summary>
26      private readonly Func<ILinksTreeMethods<TLink>> _createInternalSourceTreeMethods;
27      /// <summary>
28      /// <para>
29      /// The create external source tree methods.
30      /// </para>
31      /// <para></para>
32      /// </summary>
33      private readonly Func<ILinksTreeMethods<TLink>> _createExternalSourceTreeMethods;
34      /// <summary>
35      /// <para>
36      /// The create internal target tree methods.
37      /// </para>
38      /// <para></para>
39      /// </summary>
40      private readonly Func<ILinksTreeMethods<TLink>> _createInternalTargetTreeMethods;
41      /// <summary>
42      /// <para>
43      /// The create external target tree methods.
44      /// </para>
45      /// <para></para>
46      /// </summary>
47      private readonly Func<ILinksTreeMethods<TLink>> _createExternalTargetTreeMethods;
48      /// <summary>
49      /// <para>
50      /// The header.
51      /// </para>
52      /// <para></para>
53      /// </summary>
54      private byte* _header;
55      /// <summary>
56      /// <para>
57      /// The links data parts.
58      /// </para>
59      /// <para></para>
60      /// </summary>
61      private byte* _linksDataParts;
62      /// <summary>
63      /// <para>
64      /// The links index parts.
65      /// </para>
66      /// <para></para>
67      /// </summary>
68      private byte* _linksIndexParts;
69
70      /// <summary>
71      /// <para>
72      /// Initializes a new <see cref="SplitMemoryLinks"/> instance.
73      /// </para>
74      /// <para></para>
75      /// </summary>
76      /// <param name="dataMemory">
77      /// <para>A data memory.</para>
78      /// <para></para>
79      /// </param>
80      /// <param name="indexMemory">
81      /// <para>A index memory.</para>
82      /// <para></para>
83      /// </param>
84      [MethodImpl(MethodImplOptions.AggressiveInlining)]
85      public SplitMemoryLinks(string dataMemory, string indexMemory) : this(new
86      ↪ FileMappedResizableDirectMemory(dataMemory), new
87      ↪ FileMappedResizableDirectMemory(indexMemory)) { }
88
89      /// <summary>
90      /// <para>
91      /// Initializes a new <see cref="SplitMemoryLinks"/> instance.
92      /// </para>
93      /// <para></para>
94      /// </summary>

```

```

92     /// </summary>
93     /// <param name="dataMemory">
94     /// <para>A data memory.</para>
95     /// <para></para>
96     /// </param>
97     /// <param name="indexMemory">
98     /// <para>A index memory.</para>
99     /// <para></para>
100    /// </param>
101    [MethodImpl(MethodImplOptions.AggressiveInlining)]
102    public SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
        ↪ indexMemory) : this(dataMemory, indexMemory, DefaultLinksSizeStep) { }
103
104    /// <summary>
105    /// <para>
106    /// Initializes a new <see cref="SplitMemoryLinks"/> instance.
107    /// </para>
108    /// <para></para>
109    /// </summary>
110    /// <param name="dataMemory">
111    /// <para>A data memory.</para>
112    /// <para></para>
113    /// </param>
114    /// <param name="indexMemory">
115    /// <para>A index memory.</para>
116    /// <para></para>
117    /// </param>
118    /// <param name="memoryReservationStep">
119    /// <para>A memory reservation step.</para>
120    /// <para></para>
121    /// </param>
122    [MethodImpl(MethodImplOptions.AggressiveInlining)]
123    public SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
        ↪ indexMemory, long memoryReservationStep) : this(dataMemory, indexMemory,
        ↪ memoryReservationStep, Default<LinksConstants<TLink>>.Instance,
        ↪ IndexTreeType.Default, useLinkedList: true) { }
124
125    /// <summary>
126    /// <para>
127    /// Initializes a new <see cref="SplitMemoryLinks"/> instance.
128    /// </para>
129    /// <para></para>
130    /// </summary>
131    /// <param name="dataMemory">
132    /// <para>A data memory.</para>
133    /// <para></para>
134    /// </param>
135    /// <param name="indexMemory">
136    /// <para>A index memory.</para>
137    /// <para></para>
138    /// </param>
139    /// <param name="memoryReservationStep">
140    /// <para>A memory reservation step.</para>
141    /// <para></para>
142    /// </param>
143    /// <param name="constants">
144    /// <para>A constants.</para>
145    /// <para></para>
146    /// </param>
147    [MethodImpl(MethodImplOptions.AggressiveInlining)]
148    public SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
        ↪ indexMemory, long memoryReservationStep, LinksConstants<TLink> constants) :
        ↪ this(dataMemory, indexMemory, memoryReservationStep, constants,
        ↪ IndexTreeType.Default, useLinkedList: true) { }
149
150    /// <summary>
151    /// <para>
152    /// Initializes a new <see cref="SplitMemoryLinks"/> instance.
153    /// </para>
154    /// <para></para>
155    /// </summary>
156    /// <param name="dataMemory">
157    /// <para>A data memory.</para>
158    /// <para></para>
159    /// </param>
160    /// <param name="indexMemory">
161    /// <para>A index memory.</para>

```

```

162     /// <para></para>
163     /// </param>
164     /// <param name="memoryReservationStep">
165     /// <para>A memory reservation step.</para>
166     /// <para></para>
167     /// </param>
168     /// <param name="constants">
169     /// <para>A constants.</para>
170     /// <para></para>
171     /// </param>
172     /// <param name="indexTreeType">
173     /// <para>A index tree type.</para>
174     /// <para></para>
175     /// </param>
176     /// <param name="useLinkedList">
177     /// <para>A use linked list.</para>
178     /// <para></para>
179     /// </param>
180     [MethodImpl(MethodImplOptions.AggressiveInlining)]
181     public SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
        ↪ indexMemory, long memoryReservationStep, LinksConstants<TLink> constants,
        ↪ IndexTreeType indexTreeType, bool useLinkedList) : base(dataMemory, indexMemory,
        ↪ memoryReservationStep, constants, useLinkedList)
182     {
183         if (indexTreeType == IndexTreeType.SizeBalancedTree)
184         {
185             _createInternalSourceTreeMethods = () => new
        ↪ InternalLinksSourcesSizeBalancedTreeMethods<TLink>(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
186             _createExternalSourceTreeMethods = () => new
        ↪ ExternalLinksSourcesSizeBalancedTreeMethods<TLink>(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
187             _createInternalTargetTreeMethods = () => new
        ↪ InternalLinksTargetsSizeBalancedTreeMethods<TLink>(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
188             _createExternalTargetTreeMethods = () => new
        ↪ ExternalLinksTargetsSizeBalancedTreeMethods<TLink>(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
189         }
190         else
191         {
192             _createInternalSourceTreeMethods = () => new
        ↪ InternalLinksSourcesRecursionlessSizeBalancedTreeMethods<TLink>(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
193             _createExternalSourceTreeMethods = () => new
        ↪ ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods<TLink>(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
194             _createInternalTargetTreeMethods = () => new
        ↪ InternalLinksTargetsRecursionlessSizeBalancedTreeMethods<TLink>(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
195             _createExternalTargetTreeMethods = () => new
        ↪ ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods<TLink>(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
196         }
197         Init(dataMemory, indexMemory);
198     }
199
200     /// <summary>
201     /// <para>
202     /// Sets the pointers using the specified data memory.
203     /// </para>
204     /// <para></para>
205     /// </summary>
206     /// <param name="dataMemory">
207     /// <para>The data memory.</para>
208     /// <para></para>
209     /// </param>
210     /// <param name="indexMemory">
211     /// <para>The index memory.</para>
212     /// <para></para>
213     /// </param>
214     [MethodImpl(MethodImplOptions.AggressiveInlining)]
215     protected override void SetPointers(IResizableDirectMemory dataMemory,
        ↪ IResizableDirectMemory indexMemory)
216     {
217         _linksDataParts = (byte*)dataMemory.Pointer;
218         _linksIndexParts = (byte*)indexMemory.Pointer;

```

```

219     _header = _linksIndexParts;
220     if (_useLinkedList)
221     {
222         InternalSourcesListMethods = new
            ↳ InternalLinksSourcesLinkedListMethods<TLink>(Constants, _linksDataParts,
            ↳ _linksIndexParts);
223     }
224     else
225     {
226         InternalSourcesTreeMethods = _createInternalSourceTreeMethods();
227     }
228     ExternalSourcesTreeMethods = _createExternalSourceTreeMethods();
229     InternalTargetsTreeMethods = _createInternalTargetTreeMethods();
230     ExternalTargetsTreeMethods = _createExternalTargetTreeMethods();
231     UnusedLinksListMethods = new UnusedLinksListMethods<TLink>(_linksDataParts, _header);
232 }
233
234 /// <summary>
235 /// <para>
236 /// Resets the pointers.
237 /// </para>
238 /// <para></para>
239 /// </summary>
240 [MethodImpl(MethodImplOptions.AggressiveInlining)]
241 protected override void ResetPointers()
242 {
243     base.ResetPointers();
244     _linksDataParts = null;
245     _linksIndexParts = null;
246     _header = null;
247 }
248
249 /// <summary>
250 /// <para>
251 /// Gets the header reference.
252 /// </para>
253 /// <para></para>
254 /// </summary>
255 /// <returns>
256 /// <para>A ref links header of t link</para>
257 /// <para></para>
258 /// </returns>
259 [MethodImpl(MethodImplOptions.AggressiveInlining)]
260 protected override ref LinksHeader<TLink> GetHeaderReference() => ref
    ↳ AsRef<LinksHeader<TLink>>(_header);
261
262 /// <summary>
263 /// <para>
264 /// Gets the link data part reference using the specified link index.
265 /// </para>
266 /// <para></para>
267 /// </summary>
268 /// <param name="linkIndex">
269 /// <para>The link index.</para>
270 /// <para></para>
271 /// </param>
272 /// <returns>
273 /// <para>A ref raw link data part of t link</para>
274 /// <para></para>
275 /// </returns>
276 [MethodImpl(MethodImplOptions.AggressiveInlining)]
277 protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink linkIndex)
    ↳ => ref AsRef<RawLinkDataPart<TLink>>(_linksDataParts + (LinkDataPartSizeInBytes *
    ↳ ConvertToInt64(linkIndex)));
278
279 /// <summary>
280 /// <para>
281 /// Gets the link index part reference using the specified link index.
282 /// </para>
283 /// <para></para>
284 /// </summary>
285 /// <param name="linkIndex">
286 /// <para>The link index.</para>
287 /// <para></para>
288 /// </param>
289 /// <returns>
290 /// <para>A ref raw link index part of t link</para>
291 /// <para></para>

```

```

292     /// </returns>
293     [MethodImpl(MethodImplOptions.AggressiveInlining)]
294     protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink
        ↪ linkIndex) => ref AsRef<RawLinkIndexPart<TLink>>(_linksIndexParts +
        ↪ (LinkIndexPartSizeInBytes * ConvertToInt64(linkIndex)));
295 }
296 }

```

#### 1.43 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/SplitMemoryLinksBase.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4  using Platform.Disposables;
5  using Platform.Singletons;
6  using Platform.Converters;
7  using Platform.Numbers;
8  using Platform.Memory;
9  using Platform.Data.Exceptions;
10
11 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
12
13 namespace Platform.Data.Doublets.Memory.Split.Generic
14 {
15     /// <summary>
16     /// <para>
17     /// Represents the split memory links base.
18     /// </para>
19     /// <para></para>
20     /// </summary>
21     /// <seealso cref="DisposableBase"/>
22     /// <seealso cref="ILinks{TLink}"/>
23     public abstract class SplitMemoryLinksBase<TLink> : DisposableBase, ILinks<TLink>
24     {
25         /// <summary>
26         /// <para>
27         /// The default.
28         /// </para>
29         /// <para></para>
30         /// </summary>
31         private static readonly EqualityComparer<TLink> _equalityComparer =
            ↪ EqualityComparer<TLink>.Default;
32         /// <summary>
33         /// <para>
34         /// The default.
35         /// </para>
36         /// <para></para>
37         /// </summary>
38         private static readonly Comparer<TLink> _comparer = Comparer<TLink>.Default;
39         /// <summary>
40         /// <para>
41         /// The default.
42         /// </para>
43         /// <para></para>
44         /// </summary>
45         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
            ↪ UncheckedConverter<TLink, long>.Default;
46         /// <summary>
47         /// <para>
48         /// The default.
49         /// </para>
50         /// <para></para>
51         /// </summary>
52         private static readonly UncheckedConverter<long, TLink> _int64ToAddressConverter =
            ↪ UncheckedConverter<long, TLink>.Default;
53
54         /// <summary>
55         /// <para>
56         /// The zero.
57         /// </para>
58         /// <para></para>
59         /// </summary>
60         private static readonly TLink _zero = default;
61         /// <summary>
62         /// <para>
63         /// The zero.
64         /// </para>
65         /// <para></para>
66         /// </summary>
67         private static readonly TLink _one = Arithmetic.Increment(_zero);

```

```

68     /// <summary>Возвращает размер одной связи в байтах.</summary>
69     /// <remarks>
70     /// Используется только во вне класса, не рекомендуется использовать внутри.
71     /// Так как во вне не обязательно будет доступен unsafe C#.
72     /// </remarks>
73     public static readonly long LinkDataPartSizeInBytes = RawLinkDataPart<TLink>.SizeInBytes;
74
75     /// <summary>
76     /// <para>
77     /// The size in bytes.
78     /// </para>
79     /// <para></para>
80     /// </summary>
81     public static readonly long LinkIndexPartSizeInBytes =
82     ↪ RawLinkIndexPart<TLink>.SizeInBytes;
83
84     /// <summary>
85     /// <para>
86     /// The size in bytes.
87     /// </para>
88     /// <para></para>
89     /// </summary>
90     public static readonly long LinkHeaderSizeInBytes = LinksHeader<TLink>.SizeInBytes;
91
92     /// <summary>
93     /// <para>
94     /// The default links size step.
95     /// </para>
96     /// <para></para>
97     /// </summary>
98     public static readonly long DefaultLinksSizeStep = 1 * 1024 * 1024;
99
100    /// <summary>
101    /// <para>
102    /// The data memory.
103    /// </para>
104    /// <para></para>
105    /// </summary>
106    protected readonly IResizableDirectMemory _dataMemory;
107    /// <summary>
108    /// <para>
109    /// The index memory.
110    /// </para>
111    /// <para></para>
112    /// </summary>
113    protected readonly IResizableDirectMemory _indexMemory;
114    /// <summary>
115    /// <para>
116    /// The use linked list.
117    /// </para>
118    /// <para></para>
119    /// </summary>
120    protected readonly bool _useLinkedList;
121    /// <summary>
122    /// <para>
123    /// The data memory reservation step in bytes.
124    /// </para>
125    /// <para></para>
126    /// </summary>
127    protected readonly long _dataMemoryReservationStepInBytes;
128    /// <summary>
129    /// <para>
130    /// The index memory reservation step in bytes.
131    /// </para>
132    /// <para></para>
133    /// </summary>
134    protected readonly long _indexMemoryReservationStepInBytes;
135
136    /// <summary>
137    /// <para>
138    /// The internal sources list methods.
139    /// </para>
140    /// <para></para>
141    /// </summary>
142    protected InternalLinksSourcesLinkedListMethods<TLink> InternalSourcesListMethods;
143    /// <summary>
144    /// <para>
145    /// The internal sources tree methods.

```



```

146     /// </para>
147     /// <para></para>
148     /// </summary>
149     protected ILinksTreeMethods<TLink> InternalSourcesTreeMethods;
150     /// <summary>
151     /// <para>
152     /// The external sources tree methods.
153     /// </para>
154     /// <para></para>
155     /// </summary>
156     protected ILinksTreeMethods<TLink> ExternalSourcesTreeMethods;
157     /// <summary>
158     /// <para>
159     /// The internal targets tree methods.
160     /// </para>
161     /// <para></para>
162     /// </summary>
163     protected ILinksTreeMethods<TLink> InternalTargetsTreeMethods;
164     /// <summary>
165     /// <para>
166     /// The external targets tree methods.
167     /// </para>
168     /// <para></para>
169     /// </summary>
170     protected ILinksTreeMethods<TLink> ExternalTargetsTreeMethods;
171     // TODO: Возможно чтобы гарантированно проверять на то, является ли связь удалённой,
172     // ↳ нужно использовать не список а дерево, так как так можно быстрее проверить на
173     // ↳ наличие связи внутри
174     /// <summary>
175     /// <para>
176     /// The unused links list methods.
177     /// </para>
178     /// <para></para>
179     /// </summary>
180     protected ILinksListMethods<TLink> UnusedLinksListMethods;
181     /// <summary>
182     /// Возвращает общее число связей находящихся в хранилище.
183     /// </summary>
184     protected virtual TLink Total
185     {
186         [MethodImpl(MethodImplOptions.AggressiveInlining)]
187         get
188         {
189             ref var header = ref GetHeaderReference();
190             return Subtract(header.AllocatedLinks, header.FreeLinks);
191         }
192     }
193     /// <summary>
194     /// <para>
195     /// Gets the constants value.
196     /// </para>
197     /// <para></para>
198     /// </summary>
199     public virtual LinksConstants<TLink> Constants
200     {
201         [MethodImpl(MethodImplOptions.AggressiveInlining)]
202         get;
203     }
204
205     /// <summary>
206     /// <para>
207     /// Initializes a new <see cref="SplitMemoryLinksBase"/> instance.
208     /// </para>
209     /// <para></para>
210     /// </summary>
211     /// <param name="dataMemory">
212     /// <para>A data memory.</para>
213     /// <para></para>
214     /// </param>
215     /// <param name="indexMemory">
216     /// <para>A index memory.</para>
217     /// <para></para>
218     /// </param>
219     /// <param name="memoryReservationStep">
220     /// <para>A memory reservation step.</para>
221     /// <para></para>
222     /// </param>

```

```

223 /// <param name="constants">
224 /// <para>A constants.</para>
225 /// <para></para>
226 /// </param>
227 /// <param name="useLinkedList">
228 /// <para>A use linked list.</para>
229 /// <para></para>
230 /// </param>
231 [MethodImpl(MethodImplOptions.AggressiveInlining)]
232 protected SplitMemoryLinksBase(IResizableDirectMemory dataMemory, IResizableDirectMemory
    ↪ indexMemory, long memoryReservationStep, LinksConstants<TLink> constants, bool
    ↪ useLinkedList)
233 {
234     _dataMemory = dataMemory;
235     _indexMemory = indexMemory;
236     _dataMemoryReservationStepInBytes = memoryReservationStep * LinkDataPartSizeInBytes;
237     _indexMemoryReservationStepInBytes = memoryReservationStep *
    ↪ LinkIndexPartSizeInBytes;
238     _useLinkedList = useLinkedList;
239     Constants = constants;
240 }
241
242 /// <summary>
243 /// <para>
244 /// Initializes a new <see cref="SplitMemoryLinksBase"/> instance.
245 /// </para>
246 /// <para></para>
247 /// </summary>
248 /// <param name="dataMemory">
249 /// <para>A data memory.</para>
250 /// <para></para>
251 /// </param>
252 /// <param name="indexMemory">
253 /// <para>A index memory.</para>
254 /// <para></para>
255 /// </param>
256 /// <param name="memoryReservationStep">
257 /// <para>A memory reservation step.</para>
258 /// <para></para>
259 /// </param>
260 [MethodImpl(MethodImplOptions.AggressiveInlining)]
261 protected SplitMemoryLinksBase(IResizableDirectMemory dataMemory, IResizableDirectMemory
    ↪ indexMemory, long memoryReservationStep) : this(dataMemory, indexMemory,
    ↪ memoryReservationStep, Default<LinksConstants<TLink>>.Instance, useLinkedList: true)
    ↪ { }
262
263 /// <summary>
264 /// <para>
265 /// Inits the data memory.
266 /// </para>
267 /// <para></para>
268 /// </summary>
269 /// <param name="dataMemory">
270 /// <para>The data memory.</para>
271 /// <para></para>
272 /// </param>
273 /// <param name="indexMemory">
274 /// <para>The index memory.</para>
275 /// <para></para>
276 /// </param>
277 [MethodImpl(MethodImplOptions.AggressiveInlining)]
278 protected virtual void Init(IResizableDirectMemory dataMemory, IResizableDirectMemory
    ↪ indexMemory)
279 {
280     // Read allocated links from header
281     if (indexMemory.ReservedCapacity < LinkHeaderSizeInBytes)
282     {
283         indexMemory.ReservedCapacity = LinkHeaderSizeInBytes;
284     }
285     SetPointers(dataMemory, indexMemory);
286     ref var header = ref GetHeaderReference();
287     var allocatedLinks = ConvertToInt64(header.AllocatedLinks);
288     // Adjust reserved capacity
289     var minimumDataReservedCapacity = allocatedLinks * LinkDataPartSizeInBytes;
290     if (minimumDataReservedCapacity < dataMemory.UsedCapacity)
291     {
292         minimumDataReservedCapacity = dataMemory.UsedCapacity;
293     }

```

```

294     if (minimumDataReservedCapacity < _dataMemoryReservationStepInBytes)
295     {
296         minimumDataReservedCapacity = _dataMemoryReservationStepInBytes;
297     }
298     var minimumIndexReservedCapacity = allocatedLinks * LinkDataPartSizeInBytes;
299     if (minimumIndexReservedCapacity < indexMemory.UsedCapacity)
300     {
301         minimumIndexReservedCapacity = indexMemory.UsedCapacity;
302     }
303     if (minimumIndexReservedCapacity < _indexMemoryReservationStepInBytes)
304     {
305         minimumIndexReservedCapacity = _indexMemoryReservationStepInBytes;
306     }
307     // Check for alignment
308     if (minimumDataReservedCapacity % _dataMemoryReservationStepInBytes > 0)
309     {
310         minimumDataReservedCapacity = ((minimumDataReservedCapacity /
311             ↪ _dataMemoryReservationStepInBytes) * _dataMemoryReservationStepInBytes) +
312             ↪ _dataMemoryReservationStepInBytes;
313     }
314     if (minimumIndexReservedCapacity % _indexMemoryReservationStepInBytes > 0)
315     {
316         minimumIndexReservedCapacity = ((minimumIndexReservedCapacity /
317             ↪ _indexMemoryReservationStepInBytes) * _indexMemoryReservationStepInBytes) +
318             ↪ _indexMemoryReservationStepInBytes;
319     }
320     if (dataMemory.ReservedCapacity != minimumDataReservedCapacity)
321     {
322         dataMemory.ReservedCapacity = minimumDataReservedCapacity;
323     }
324     if (indexMemory.ReservedCapacity != minimumIndexReservedCapacity)
325     {
326         indexMemory.ReservedCapacity = minimumIndexReservedCapacity;
327     }
328     SetPointers(dataMemory, indexMemory);
329     header = ref GetHeaderReference();
330     // Ensure correctness _memory.UsedCapacity over _header->AllocatedLinks
331     // Гарантия корректности _memory.UsedCapacity относительно _header->AllocatedLinks
332     dataMemory.UsedCapacity = (ConvertToInt64(header.AllocatedLinks) *
333         ↪ LinkDataPartSizeInBytes) + LinkDataPartSizeInBytes; // First link is read only
334     ↪ zero link.
335     indexMemory.UsedCapacity = (ConvertToInt64(header.AllocatedLinks) *
336         ↪ LinkIndexPartSizeInBytes) + LinkHeaderSizeInBytes;
337     // Ensure correctness _memory.ReservedLinks over _header->ReservedCapacity
338     // Гарантия корректности _header->ReservedLinks относительно _memory.ReservedCapacity
339     header.ReservedLinks = ConvertToAddress((dataMemory.ReservedCapacity -
340         ↪ LinkDataPartSizeInBytes) / LinkDataPartSizeInBytes);
341 }
342
343 /// <summary>
344 /// <para>
345 /// Counts the restrictions.
346 /// </para>
347 /// <para></para>
348 /// </summary>
349 /// <param name="restrictions">
350 /// <para>The restrictions.</para>
351 /// <para></para>
352 /// </param>
353 /// <exception cref="NotSupportedException">
354 /// <para>Другие размеры и способы ограничений не поддерживаются.</para>
355 /// <para></para>
356 /// </exception>
357 /// <returns>
358 /// <para>The link</para>
359 /// <para></para>
360 /// </returns>
361 [MethodImpl(MethodImplOptions.AggressiveInlining)]
362 public virtual TLink Count(IList<TLink> restrictions)
363 {
364     // Если нет ограничений, тогда возвращаем общее число связей находящихся в хранилище.
365     if (restrictions.Count == 0)
366     {
367         return Total;
368     }
369     var constants = Constants;
370     var any = constants.Any;
371     var index = restrictions[constants.IndexPart];

```

```

364 if (restrictions.Count == 1)
365 {
366     if (AreEqual(index, any))
367     {
368         return Total;
369     }
370     return Exists(index) ? GetOne() : GetZero();
371 }
372 if (restrictions.Count == 2)
373 {
374     var value = restrictions[1];
375     if (AreEqual(index, any))
376     {
377         if (AreEqual(value, any))
378         {
379             return Total; // Any - как отсутствие ограничения
380         }
381         var externalReferencesRange = constants.ExternalReferencesRange;
382         if (externalReferencesRange.HasValue &&
383             ⇨ externalReferencesRange.Value.Contains(value))
384         {
385             return Add(ExternalSourcesTreeMethods.CountUsages(value),
386                 ⇨ ExternalTargetsTreeMethods.CountUsages(value));
387         }
388         else
389         {
390             if (_useLinkedList)
391             {
392                 return Add(InternalSourcesListMethods.CountUsages(value),
393                     ⇨ InternalTargetsTreeMethods.CountUsages(value));
394             }
395             else
396             {
397                 return Add(InternalSourcesTreeMethods.CountUsages(value),
398                     ⇨ InternalTargetsTreeMethods.CountUsages(value));
399             }
400         }
401     }
402     else
403     {
404         if (!Exists(index))
405         {
406             return GetZero();
407         }
408         if (AreEqual(value, any))
409         {
410             return GetOne();
411         }
412         ref var storedLinkValue = ref GetLinkDataPartReference(index);
413         if (AreEqual(storedLinkValue.Source, value) ||
414             ⇨ AreEqual(storedLinkValue.Target, value))
415         {
416             return GetOne();
417         }
418         return GetZero();
419     }
420 }
421 if (restrictions.Count == 3)
422 {
423     var externalReferencesRange = constants.ExternalReferencesRange;
424     var source = restrictions[constants.SourcePart];
425     var target = restrictions[constants.TargetPart];
426     if (AreEqual(index, any))
427     {
428         if (AreEqual(source, any) && AreEqual(target, any))
429         {
430             return Total;
431         }
432         else if (AreEqual(source, any))
433         {
434             if (externalReferencesRange.HasValue &&
435                 ⇨ externalReferencesRange.Value.Contains(target))
436             {
437                 return ExternalTargetsTreeMethods.CountUsages(target);
438             }
439             else
440             {
441                 return InternalTargetsTreeMethods.CountUsages(target);
442             }
443         }
444         else if (AreEqual(target, any))
445         {
446             if (externalReferencesRange.HasValue &&
447                 ⇨ externalReferencesRange.Value.Contains(source))
448             {
449                 return ExternalTargetsTreeMethods.CountUsages(target);
450             }
451             else
452             {
453                 return InternalTargetsTreeMethods.CountUsages(target);
454             }
455         }
456         else
457         {
458             return InternalTargetsTreeMethods.CountUsages(target);
459         }
460     }
461     else
462     {
463         if (AreEqual(source, any) && AreEqual(target, any))
464         {
465             return Total;
466         }
467         else if (AreEqual(source, any))
468         {
469             if (externalReferencesRange.HasValue &&
470                 ⇨ externalReferencesRange.Value.Contains(target))
471             {
472                 return ExternalTargetsTreeMethods.CountUsages(target);
473             }
474             else
475             {
476                 return InternalTargetsTreeMethods.CountUsages(target);
477             }
478         }
479         else if (AreEqual(target, any))
480         {
481             if (externalReferencesRange.HasValue &&
482                 ⇨ externalReferencesRange.Value.Contains(source))
483             {
484                 return ExternalTargetsTreeMethods.CountUsages(target);
485             }
486             else
487             {
488                 return InternalTargetsTreeMethods.CountUsages(target);
489             }
490         }
491         else
492         {
493             return InternalTargetsTreeMethods.CountUsages(target);
494         }
495     }
496 }

```

```

436     }
437 }
438 else if (AreEqual(target, any))
439 {
440     if (externalReferencesRange.HasValue &&
441         ⇨ externalReferencesRange.Value.Contains(source))
442     {
443         return ExternalSourcesTreeMethods.CountUsages(source);
444     }
445     else
446     {
447         if (_useLinkedList)
448         {
449             return InternalSourcesListMethods.CountUsages(source);
450         }
451         else
452         {
453             return InternalSourcesTreeMethods.CountUsages(source);
454         }
455     }
456 }
457 else //if(source != Any && target != Any)
458 {
459     // Эквивалент Exists(source, target) => Count(Any, source, target) > 0
460     TLink link;
461     if (externalReferencesRange.HasValue)
462     {
463         if (externalReferencesRange.Value.Contains(source) &&
464             ⇨ externalReferencesRange.Value.Contains(target))
465         {
466             link = ExternalSourcesTreeMethods.Search(source, target);
467         }
468         else if (externalReferencesRange.Value.Contains(source))
469         {
470             link = InternalTargetsTreeMethods.Search(source, target);
471         }
472         else if (externalReferencesRange.Value.Contains(target))
473         {
474             if (_useLinkedList)
475             {
476                 link = ExternalSourcesTreeMethods.Search(source, target);
477             }
478             else
479             {
480                 link = InternalSourcesTreeMethods.Search(source, target);
481             }
482         }
483         else
484         {
485             if (_useLinkedList ||
486                 ⇨ GreaterThan(InternalSourcesTreeMethods.CountUsages(source),
487                 ⇨ InternalTargetsTreeMethods.CountUsages(target)))
488             {
489                 link = InternalTargetsTreeMethods.Search(source, target);
490             }
491             else
492             {
493                 link = InternalSourcesTreeMethods.Search(source, target);
494             }
495         }
496     }
497     else
498     {
499         if (_useLinkedList ||
500             ⇨ GreaterThan(InternalSourcesTreeMethods.CountUsages(source),
501             ⇨ InternalTargetsTreeMethods.CountUsages(target)))
502         {
503             link = InternalTargetsTreeMethods.Search(source, target);
504         }
505         else
506         {
507             link = InternalSourcesTreeMethods.Search(source, target);
508         }
509     }
510     return AreEqual(link, constants.Null) ? GetZero() : GetOne();
511 }
512 }
513 else

```

```

508     {
509         if (!Exists(index))
510         {
511             return GetZero();
512         }
513         if (AreEqual(source, any) && AreEqual(target, any))
514         {
515             return GetOne();
516         }
517         ref var storedLinkValue = ref GetLinkDataPartReference(index);
518         if (!AreEqual(source, any) && !AreEqual(target, any))
519         {
520             if (AreEqual(storedLinkValue.Source, source) &&
521                 ↪ AreEqual(storedLinkValue.Target, target))
522             {
523                 return GetOne();
524             }
525             return GetZero();
526         }
527         var value = default(TLink);
528         if (AreEqual(source, any))
529         {
530             value = target;
531         }
532         if (AreEqual(target, any))
533         {
534             value = source;
535         }
536         if (AreEqual(storedLinkValue.Source, value) ||
537             ↪ AreEqual(storedLinkValue.Target, value))
538         {
539             return GetOne();
540         }
541         return GetZero();
542     }
543 }
544
545 /// <summary>
546 /// <para>
547 /// Eaches the handler.
548 /// </para>
549 /// <para></para>
550 /// </summary>
551 /// <param name="handler">
552 /// <para>The handler.</para>
553 /// <para></para>
554 /// </param>
555 /// <param name="restrictions">
556 /// <para>The restrictions.</para>
557 /// <para></para>
558 /// </param>
559 /// <exception cref="NotSupportedException">
560 /// <para>Другие размеры и способы ограничений не поддерживаются.</para>
561 /// <para></para>
562 /// </exception>
563 /// <returns>
564 /// <para>The link</para>
565 /// <para></para>
566 /// </returns>
567 [MethodImpl(MethodImplOptions.AggressiveInlining)]
568 public virtual TLink Each(Func<IList<TLink>, TLink> handler, IList<TLink> restrictions)
569 {
570     var constants = Constants;
571     var @break = constants.Break;
572     if (restrictions.Count == 0)
573     {
574         for (var link = GetOne(); LessOrEqualThan(link,
575             ↪ GetHeaderReference().AllocatedLinks); link = Increment(link))
576         {
577             if (Exists(link) && AreEqual(handler(GetLinkStruct(link)), @break))
578             {
579                 return @break;
580             }
581         }
582     }
583     return @break;

```

```

582 }
583 var @continue = constants.Continue;
584 var any = constants.Any;
585 var index = restrictions[constants.IndexPart];
586 if (restrictions.Count == 1)
587 {
588     if (AreEqual(index, any))
589     {
590         return Each(handler, Array.Empty<TLink>());
591     }
592     if (!Exists(index))
593     {
594         return @continue;
595     }
596     return handler(GetLinkStruct(index));
597 }
598 if (restrictions.Count == 2)
599 {
600     var value = restrictions[1];
601     if (AreEqual(index, any))
602     {
603         if (AreEqual(value, any))
604         {
605             return Each(handler, Array.Empty<TLink>());
606         }
607         if (AreEqual(Each(handler, new Link<TLink>(index, value, any)), @break))
608         {
609             return @break;
610         }
611         return Each(handler, new Link<TLink>(index, any, value));
612     }
613     else
614     {
615         if (!Exists(index))
616         {
617             return @continue;
618         }
619         if (AreEqual(value, any))
620         {
621             return handler(GetLinkStruct(index));
622         }
623         ref var storedLinkValue = ref GetLinkDataPartReference(index);
624         if (AreEqual(storedLinkValue.Source, value) ||
625             AreEqual(storedLinkValue.Target, value))
626         {
627             return handler(GetLinkStruct(index));
628         }
629         return @continue;
630     }
631 }
632 if (restrictions.Count == 3)
633 {
634     var externalReferencesRange = constants.ExternalReferencesRange;
635     var source = restrictions[constants.SourcePart];
636     var target = restrictions[constants.TargetPart];
637     if (AreEqual(index, any))
638     {
639         if (AreEqual(source, any) && AreEqual(target, any))
640         {
641             return Each(handler, Array.Empty<TLink>());
642         }
643         else if (AreEqual(source, any))
644         {
645             if (externalReferencesRange.HasValue &&
646                 ⇨ externalReferencesRange.Value.Contains(target))
647             {
648                 return ExternalTargetsTreeMethods.EachUsage(target, handler);
649             }
650             else
651             {
652                 return InternalTargetsTreeMethods.EachUsage(target, handler);
653             }
654         }
655         else if (AreEqual(target, any))
656         {
657             if (externalReferencesRange.HasValue &&
658                 ⇨ externalReferencesRange.Value.Contains(source))
659             {

```

```

658         return ExternalSourcesTreeMethods.EachUsage(source, handler);
659     }
660     else
661     {
662         if (_useLinkedList)
663         {
664             return InternalSourcesListMethods.EachUsage(source, handler);
665         }
666         else
667         {
668             return InternalSourcesTreeMethods.EachUsage(source, handler);
669         }
670     }
671 }
672 else //if(source != Any && target != Any)
673 {
674     TLink link;
675     if (externalReferencesRange.HasValue)
676     {
677         if (externalReferencesRange.Value.Contains(source) &&
678             ↪ externalReferencesRange.Value.Contains(target))
679         {
680             link = ExternalSourcesTreeMethods.Search(source, target);
681         }
682         else if (externalReferencesRange.Value.Contains(source))
683         {
684             link = InternalTargetsTreeMethods.Search(source, target);
685         }
686         else if (externalReferencesRange.Value.Contains(target))
687         {
688             if (_useLinkedList)
689             {
690                 link = ExternalSourcesTreeMethods.Search(source, target);
691             }
692             else
693             {
694                 link = InternalSourcesTreeMethods.Search(source, target);
695             }
696         }
697         else
698         {
699             if (_useLinkedList ||
700                 ↪ GreaterThan(InternalSourcesTreeMethods.CountUsages(source),
701                 ↪ InternalTargetsTreeMethods.CountUsages(target)))
702             {
703                 link = InternalTargetsTreeMethods.Search(source, target);
704             }
705             else
706             {
707                 link = InternalSourcesTreeMethods.Search(source, target);
708             }
709         }
710     }
711     else
712     {
713         if (_useLinkedList ||
714             ↪ GreaterThan(InternalSourcesTreeMethods.CountUsages(source),
715             ↪ InternalTargetsTreeMethods.CountUsages(target)))
716         {
717             link = InternalTargetsTreeMethods.Search(source, target);
718         }
719         else
720         {
721             link = InternalSourcesTreeMethods.Search(source, target);
722         }
723     }
724     return AreEqual(link, constants.Null) ? @continue :
725         ↪ handler(GetLinkStruct(link));
726 }
727 else
728 {
729     if (!Exists(index))
730     {
731         return @continue;
732     }
733     if (AreEqual(source, any) && AreEqual(target, any))
734     {

```



```

730         return handler(GetLinkStruct(index));
731     }
732     ref var storedLinkValue = ref GetLinkDataPartReference(index);
733     if (!AreEqual(source, any) && !AreEqual(target, any))
734     {
735         if (AreEqual(storedLinkValue.Source, source) &&
736             AreEqual(storedLinkValue.Target, target))
737         {
738             return handler(GetLinkStruct(index));
739         }
740         return @continue;
741     }
742     var value = default(TLink);
743     if (AreEqual(source, any))
744     {
745         value = target;
746     }
747     if (AreEqual(target, any))
748     {
749         value = source;
750     }
751     if (AreEqual(storedLinkValue.Source, value) ||
752         AreEqual(storedLinkValue.Target, value))
753     {
754         return handler(GetLinkStruct(index));
755     }
756     return @continue;
757 }
758 throw new NotSupportedException("Другие размеры и способы ограничений не
759     ↳ поддерживаются.");
760 }
761
762 /// <remarks>
763 /// TODO: Возможно можно перемещать значения, если указан индекс, но значение существует
764     ↳ в другом месте (но не в менеджере памяти, а в логике Links)
765 /// </remarks>
766 [MethodImpl(MethodImplOptions.AggressiveInlining)]
767 public virtual TLink Update(IList<TLink> restrictions, IList<TLink> substitution)
768 {
769     var constants = Constants;
770     var @null = constants.Null;
771     var externalReferencesRange = constants.ExternalReferencesRange;
772     var linkIndex = restrictions[constants.IndexPart];
773     ref var link = ref GetLinkDataPartReference(linkIndex);
774     var source = link.Source;
775     var target = link.Target;
776     ref var header = ref GetHeaderReference();
777     ref var rootAsSource = ref header.RootAsSource;
778     ref var rootAsTarget = ref header.RootAsTarget;
779     // Будет корректно работать только в том случае, если пространство выделенной связи
780     ↳ предварительно заполнено нулями
781     if (!AreEqual(source, @null))
782     {
783         if (externalReferencesRange.HasValue &&
784             ↳ externalReferencesRange.Value.Contains(source))
785         {
786             ExternalSourcesTreeMethods.Detach(ref rootAsSource, linkIndex);
787         }
788         else
789         {
790             if (_useLinkedList)
791             {
792                 InternalSourcesListMethods.Detach(source, linkIndex);
793             }
794             else
795             {
796                 InternalSourcesTreeMethods.Detach(ref
797                     ↳ GetLinkIndexPartReference(source).RootAsSource, linkIndex);
798             }
799         }
800     }
801     if (!AreEqual(target, @null))
802     {
803         if (externalReferencesRange.HasValue &&
804             ↳ externalReferencesRange.Value.Contains(target))
805         {
806             ExternalTargetsTreeMethods.Detach(ref rootAsTarget, linkIndex);

```

```

802     }
803     else
804     {
805         InternalTargetsTreeMethods.Detach(ref
            ↪ GetLinkIndexPartReference(target).RootAsTarget, linkIndex);
806     }
807 }
808 source = link.Source = substitution[constants.SourcePart];
809 target = link.Target = substitution[constants.TargetPart];
810 if (!AreEqual(source, @null))
811 {
812     if (externalReferencesRange.HasValue &&
            ↪ externalReferencesRange.Value.Contains(source))
813     {
814         ExternalSourcesTreeMethods.Attach(ref rootAsSource, linkIndex);
815     }
816     else
817     {
818         if (_useLinkedList)
819         {
820             InternalSourcesListMethods.AttachAsLast(source, linkIndex);
821         }
822         else
823         {
824             InternalSourcesTreeMethods.Attach(ref
                ↪ GetLinkIndexPartReference(source).RootAsSource, linkIndex);
825         }
826     }
827 }
828 if (!AreEqual(target, @null))
829 {
830     if (externalReferencesRange.HasValue &&
            ↪ externalReferencesRange.Value.Contains(target))
831     {
832         ExternalTargetsTreeMethods.Attach(ref rootAsTarget, linkIndex);
833     }
834     else
835     {
836         InternalTargetsTreeMethods.Attach(ref
            ↪ GetLinkIndexPartReference(target).RootAsTarget, linkIndex);
837     }
838 }
839 return linkIndex;
840 }
841
842 /// <remarks>
843 /// TODO: Возможно нужно будет заполнение нулями, если внешнее API ими не заполняет
            ↪ пространство
844 /// </remarks>
845 [MethodImpl(MethodImplOptions.AggressiveInlining)]
846 public virtual TLink Create(ICollection<TLink> restrictions)
847 {
848     ref var header = ref GetHeaderReference();
849     var freeLink = header.FirstFreeLink;
850     if (!AreEqual(freeLink, Constants.Null))
851     {
852         UnusedLinksListMethods.Detach(freeLink);
853     }
854     else
855     {
856         var maximumPossibleInnerReference = Constants.InternalReferencesRange.Maximum;
857         if (GreaterThan(header.AllocatedLinks, maximumPossibleInnerReference))
858         {
859             throw new LinksLimitReachedException<TLink>(maximumPossibleInnerReference);
860         }
861         if (GreaterOrEqualThan(header.AllocatedLinks, Decrement(header.ReservedLinks)))
862         {
863             _dataMemory.ReservedCapacity += _dataMemory.ReservationStepInBytes;
864             _indexMemory.ReservedCapacity += _indexMemory.ReservationStepInBytes;
865             SetPointers(_dataMemory, _indexMemory);
866             header = ref GetHeaderReference();
867             header.ReservedLinks = ConvertToAddress(_dataMemory.ReservedCapacity /
                ↪ LinkDataPartSizeInBytes);
868         }
869         freeLink = header.AllocatedLinks = Increment(header.AllocatedLinks);
870         _dataMemory.UsedCapacity += LinkDataPartSizeInBytes;
871         _indexMemory.UsedCapacity += LinkIndexPartSizeInBytes;
872     }

```

```

873         return freeLink;
874     }
875
876     /// <summary>
877     /// <para>
878     /// Deletes the restrictions.
879     /// </para>
880     /// <para></para>
881     /// </summary>
882     /// <param name="restrictions">
883     /// <para>The restrictions.</para>
884     /// <para></para>
885     /// </param>
886     [MethodImpl(MethodImplOptions.AggressiveInlining)]
887     public virtual void Delete(ICollection<TLink> restrictions)
888     {
889         ref var header = ref GetHeaderReference();
890         var link = restrictions[Constants.IndexPart];
891         if (LessThan(link, header.AllocatedLinks))
892         {
893             UnusedLinksListMethods.AttachAsFirst(link);
894         }
895         else if (AreEqual(link, header.AllocatedLinks))
896         {
897             header.AllocatedLinks = Decrement(header.AllocatedLinks);
898             _dataMemory.UsedCapacity -= LinkDataPartSizeInBytes;
899             _indexMemory.UsedCapacity -= LinkIndexPartSizeInBytes;
900             // Убираем все связи, находящиеся в списке свободных в конце файла, до тех пор,
901             // пока не дойдём до первой существующей связи
902             // Позволяет оптимизировать количество выделенных связей (AllocatedLinks)
903             while (GreaterThan(header.AllocatedLinks, GetZero()) &&
904                 IsUnusedLink(header.AllocatedLinks))
905             {
906                 UnusedLinksListMethods.Detach(header.AllocatedLinks);
907                 header.AllocatedLinks = Decrement(header.AllocatedLinks);
908                 _dataMemory.UsedCapacity -= LinkDataPartSizeInBytes;
909                 _indexMemory.UsedCapacity -= LinkIndexPartSizeInBytes;
910             }
911         }
912     }
913
914     /// <summary>
915     /// <para>
916     /// Gets the link struct using the specified link index.
917     /// </para>
918     /// <para></para>
919     /// </summary>
920     /// <param name="linkIndex">
921     /// <para>The link index.</para>
922     /// <para></para>
923     /// </param>
924     /// <returns>
925     /// <para>A list of t link</para>
926     /// <para></para>
927     /// </returns>
928     [MethodImpl(MethodImplOptions.AggressiveInlining)]
929     public ICollection<TLink> GetLinkStruct(TLink linkIndex)
930     {
931         ref var link = ref GetLinkDataPartReference(linkIndex);
932         return new Link<TLink>(linkIndex, link.Source, link.Target);
933     }
934
935     /// <remarks>
936     /// TODO: Возможно это должно быть событием, вызываемым из IMemory, в том случае, если
937     // адрес реально поменялся
938     ///
939     /// Указатель this.links может быть в том же месте,
940     /// так как 0-я связь не используется и имеет такой же размер как Header,
941     /// поэтому header размещается в том же месте, что и 0-я связь
942     /// </remarks>
943     [MethodImpl(MethodImplOptions.AggressiveInlining)]
944     protected abstract void SetPointers(IResizableDirectMemory dataMemory,
945         IResizableDirectMemory indexMemory);
946
947     /// <summary>
948     /// <para>
949     /// Resets the pointers.
950     /// </para>

```

```

947     /// <para></para>
948     /// </summary>
949     [MethodImpl(MethodImplOptions.AggressiveInlining)]
950     protected virtual void ResetPointers()
951     {
952         InternalSourcesListMethods = null;
953         InternalSourcesTreeMethods = null;
954         ExternalSourcesTreeMethods = null;
955         InternalTargetsTreeMethods = null;
956         ExternalTargetsTreeMethods = null;
957         UnusedLinksListMethods = null;
958     }
959
960     /// <summary>
961     /// <para>
962     /// Gets the header reference.
963     /// </para>
964     /// <para></para>
965     /// </summary>
966     /// <returns>
967     /// <para>A ref links header of t link</para>
968     /// <para></para>
969     /// </returns>
970     [MethodImpl(MethodImplOptions.AggressiveInlining)]
971     protected abstract ref LinksHeader<TLink> GetHeaderReference();
972
973     /// <summary>
974     /// <para>
975     /// Gets the link data part reference using the specified link index.
976     /// </para>
977     /// <para></para>
978     /// </summary>
979     /// <param name="linkIndex">
980     /// <para>The link index.</para>
981     /// <para></para>
982     /// </param>
983     /// <returns>
984     /// <para>A ref raw link data part of t link</para>
985     /// <para></para>
986     /// </returns>
987     [MethodImpl(MethodImplOptions.AggressiveInlining)]
988     protected abstract ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink linkIndex);
989
990     /// <summary>
991     /// <para>
992     /// Gets the link index part reference using the specified link index.
993     /// </para>
994     /// <para></para>
995     /// </summary>
996     /// <param name="linkIndex">
997     /// <para>The link index.</para>
998     /// <para></para>
999     /// </param>
1000    /// <returns>
1001    /// <para>A ref raw link index part of t link</para>
1002    /// <para></para>
1003    /// </returns>
1004    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1005    protected abstract ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink
    ↪ linkIndex);
1006
1007    /// <summary>
1008    /// <para>
1009    /// Determines whether this instance exists.
1010    /// </para>
1011    /// <para></para>
1012    /// </summary>
1013    /// <param name="link">
1014    /// <para>The link.</para>
1015    /// <para></para>
1016    /// </param>
1017    /// <returns>
1018    /// <para>The bool</para>
1019    /// <para></para>
1020    /// </returns>
1021    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1022    protected virtual bool Exists(TLink link)
1023        => GreaterOrEqualThan(link, Constants.InternalReferencesRange.Minimum)

```

```

1024         && LessOrEqualThan(link, GetHeaderReference().AllocatedLinks)
1025         && !IsUnusedLink(link);
1026
1027     /// <summary>
1028     /// <para>
1029     /// Determines whether this instance is unused link.
1030     /// </para>
1031     /// <para></para>
1032     /// </summary>
1033     /// <param name="linkIndex">
1034     /// <para>The link index.</para>
1035     /// <para></para>
1036     /// </param>
1037     /// <returns>
1038     /// <para>The bool</para>
1039     /// <para></para>
1040     /// </returns>
1041     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1042     protected virtual bool IsUnusedLink(TLink linkIndex)
1043     {
1044         if (!AreEqual(GetHeaderReference().FirstFreeLink, linkIndex)) // May be this check
1045             ↪ is not needed
1046         {
1047             // TODO: Reduce access to memory in different location (should be enough to use
1048             ↪ just linkIndexPart)
1049             ref var linkDataPart = ref GetLinkDataPartReference(linkIndex);
1050             ref var linkIndexPart = ref GetLinkIndexPartReference(linkIndex);
1051             return AreEqual(linkIndexPart.SizeAsTarget, default) &&
1052                 ↪ !AreEqual(linkDataPart.Source, default);
1053         }
1054         else
1055         {
1056             return true;
1057         }
1058     }
1059
1060     /// <summary>
1061     /// <para>
1062     /// Gets the one.
1063     /// </para>
1064     /// <para></para>
1065     /// </summary>
1066     /// <returns>
1067     /// <para>The link</para>
1068     /// <para></para>
1069     /// </returns>
1070     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1071     protected virtual TLink GetOne() => _one;
1072
1073     /// <summary>
1074     /// <para>
1075     /// Gets the zero.
1076     /// </para>
1077     /// <para></para>
1078     /// </summary>
1079     /// <returns>
1080     /// <para>The link</para>
1081     /// <para></para>
1082     /// </returns>
1083     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1084     protected virtual TLink GetZero() => default;
1085
1086     /// <summary>
1087     /// <para>
1088     /// Determines whether this instance are equal.
1089     /// </para>
1090     /// <para></para>
1091     /// <param name="first">
1092     /// <para>The first.</para>
1093     /// <para></para>
1094     /// </param>
1095     /// <param name="second">
1096     /// <para>The second.</para>
1097     /// <para></para>
1098     /// </param>
1099     /// <returns>
1100     /// <para>The bool</para>

```

```

1099     /// <para></para>
1100     /// </returns>
1101     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1102     protected virtual bool AreEqual(TLink first, TLink second) =>
1103         ↪ _equalityComparer.Equals(first, second);
1104
1105     /// <summary>
1106     /// <para>
1107     /// Determines whether this instance less than.
1108     /// </para>
1109     /// </summary>
1110     /// <param name="first">
1111     /// <para>The first.</para>
1112     /// </param>
1113     /// </param>
1114     /// <param name="second">
1115     /// <para>The second.</para>
1116     /// </param>
1117     /// </param>
1118     /// <returns>
1119     /// <para>The bool</para>
1120     /// </returns>
1121     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1122     protected virtual bool LessThan(TLink first, TLink second) => _comparer.Compare(first,
1123         ↪ second) < 0;
1124
1125     /// <summary>
1126     /// <para>
1127     /// Determines whether this instance less or equal than.
1128     /// </para>
1129     /// </summary>
1130     /// <param name="first">
1131     /// <para>The first.</para>
1132     /// </param>
1133     /// </param>
1134     /// <param name="second">
1135     /// <para>The second.</para>
1136     /// </param>
1137     /// </param>
1138     /// <returns>
1139     /// <para>The bool</para>
1140     /// </returns>
1141     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1142     protected virtual bool LessOrEqualThan(TLink first, TLink second) =>
1143         ↪ _comparer.Compare(first, second) <= 0;
1144
1145     /// <summary>
1146     /// <para>
1147     /// Determines whether this instance greater than.
1148     /// </para>
1149     /// </summary>
1150     /// <param name="first">
1151     /// <para>The first.</para>
1152     /// </param>
1153     /// </param>
1154     /// <param name="second">
1155     /// <para>The second.</para>
1156     /// </param>
1157     /// </param>
1158     /// <returns>
1159     /// <para>The bool</para>
1160     /// </returns>
1161     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1162     protected virtual bool GreaterThan(TLink first, TLink second) =>
1163         ↪ _comparer.Compare(first, second) > 0;
1164
1165     /// <summary>
1166     /// <para>
1167     /// Determines whether this instance greater or equal than.
1168     /// </para>
1169     /// </summary>
1170     /// <param name="first">
1171     /// <para>The first.</para>
1172     /// </param>
1173     /// </param>
1174     /// <param name="second">
1175     /// <para>The second.</para>
1176     /// </param>
1177     /// </param>
1178     /// <returns>
1179     /// <para>The bool</para>
1180     /// </returns>
1181     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1182     protected virtual bool GreaterOrEqualThan(TLink first, TLink second) =>
1183         ↪ _comparer.Compare(first, second) >= 0;

```

```

1173     /// <param name="first">
1174     /// <para>The first.</para>
1175     /// <para></para>
1176     /// </param>
1177     /// <param name="second">
1178     /// <para>The second.</para>
1179     /// <para></para>
1180     /// </param>
1181     /// <returns>
1182     /// <para>The bool</para>
1183     /// <para></para>
1184     /// </returns>
1185     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1186     protected virtual bool GreaterOrEqualThan(TLink first, TLink second) =>
1187         ↪ _comparer.Compare(first, second) >= 0;
1188
1189     /// <summary>
1190     /// <para>
1191     /// Converts the to int 64 using the specified value.
1192     /// </para>
1193     /// <para></para>
1194     /// </summary>
1195     /// <param name="value">
1196     /// <para>The value.</para>
1197     /// <para></para>
1198     /// </param>
1199     /// <returns>
1200     /// <para>The long</para>
1201     /// <para></para>
1202     /// </returns>
1203     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1204     protected virtual long ConvertToInt64(TLink value) =>
1205         ↪ _addressToInt64Converter.Convert(value);
1206
1207     /// <summary>
1208     /// <para>
1209     /// Converts the to address using the specified value.
1210     /// </para>
1211     /// <para></para>
1212     /// </summary>
1213     /// <param name="value">
1214     /// <para>The value.</para>
1215     /// <para></para>
1216     /// </param>
1217     /// <returns>
1218     /// <para>The link</para>
1219     /// <para></para>
1220     /// </returns>
1221     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1222     protected virtual TLink ConvertToAddress(long value) =>
1223         ↪ _int64ToAddressConverter.Convert(value);
1224
1225     /// <summary>
1226     /// <para>
1227     /// Adds the first.
1228     /// </para>
1229     /// <para></para>
1230     /// </summary>
1231     /// <param name="first">
1232     /// <para>The first.</para>
1233     /// <para></para>
1234     /// </param>
1235     /// <param name="second">
1236     /// <para>The second.</para>
1237     /// <para></para>
1238     /// </param>
1239     /// <returns>
1240     /// <para>The link</para>
1241     /// <para></para>
1242     /// </returns>
1243     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1244     protected virtual TLink Add(TLink first, TLink second) => Arithmetic<TLink>.Add(first,
1245         ↪ second);
1246
1247     /// <summary>
1248     /// <para>
1249     /// Subtracts the first.
1250     /// </para>

```

```

1247     /// <para></para>
1248     /// </summary>
1249     /// <param name="first">
1250     /// <para>The first.</para>
1251     /// <para></para>
1252     /// </param>
1253     /// <param name="second">
1254     /// <para>The second.</para>
1255     /// <para></para>
1256     /// </param>
1257     /// <returns>
1258     /// <para>The link</para>
1259     /// <para></para>
1260     /// </returns>
1261     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1262     protected virtual TLink Subtract(TLink first, TLink second) =>
1263         ↪ Arithmetic<TLink>.Subtract(first, second);
1264
1265     /// <summary>
1266     /// <para>
1267     /// Increments the link.
1268     /// </para>
1269     /// <para></para>
1270     /// </summary>
1271     /// <param name="link">
1272     /// <para>The link.</para>
1273     /// <para></para>
1274     /// </param>
1275     /// <returns>
1276     /// <para>The link</para>
1277     /// <para></para>
1278     /// </returns>
1279     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1280     protected virtual TLink Increment(TLink link) => Arithmetic<TLink>.Increment(link);
1281
1282     /// <summary>
1283     /// <para>
1284     /// Decrements the link.
1285     /// </para>
1286     /// <para></para>
1287     /// </summary>
1288     /// <param name="link">
1289     /// <para>The link.</para>
1290     /// <para></para>
1291     /// </param>
1292     /// <returns>
1293     /// <para>The link</para>
1294     /// <para></para>
1295     /// </returns>
1296     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1297     protected virtual TLink Decrement(TLink link) => Arithmetic<TLink>.Decrement(link);
1298
1299     #region Disposable
1300
1301     /// <summary>
1302     /// <para>
1303     /// Gets the allow multiple dispose calls value.
1304     /// </para>
1305     /// <para></para>
1306     /// </summary>
1307     protected override bool AllowMultipleDisposeCalls
1308     {
1309         [MethodImpl(MethodImplOptions.AggressiveInlining)]
1310         get => true;
1311     }
1312
1313     /// <summary>
1314     /// <para>
1315     /// Disposes the manual.
1316     /// </para>
1317     /// <para></para>
1318     /// </summary>
1319     /// <param name="manual">
1320     /// <para>The manual.</para>
1321     /// <para></para>
1322     /// </param>
1323     /// <param name="wasDisposed">
1324     /// <para>The was disposed.</para>

```



```

1324     /// <para></para>
1325     /// </param>
1326     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1327     protected override void Dispose(bool manual, bool wasDisposed)
1328     {
1329         if (!wasDisposed)
1330         {
1331             ResetPointers();
1332             _dataMemory.DisposeIfPossible();
1333             _indexMemory.DisposeIfPossible();
1334         }
1335     }
1336
1337     #endregion
1338 }
1339 }

```

#### 1.44 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/UnusedLinksListMethods.cs

```

1  using System.Runtime.CompilerServices;
2  using Platform.Collections.Methods.Lists;
3  using Platform.Converters;
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.Data.Doublets.Memory.Split.Generic
9  {
10     /// <summary>
11     /// <para>
12     /// Represents the unused links list methods.
13     /// </para>
14     /// <para></para>
15     /// </summary>
16     /// <seealso cref="AbsoluteCircularDoublyLinkedListMethods{TLink}"/>
17     /// <seealso cref="ILinksListMethods{TLink}"/>
18     public unsafe class UnusedLinksListMethods<TLink> :
19         ↳ AbsoluteCircularDoublyLinkedListMethods<TLink>, ILinksListMethods<TLink>
20     {
21         /// <summary>
22         /// <para>
23         /// The default.
24         /// </para>
25         /// <para></para>
26         /// </summary>
27         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
28             ↳ UncheckedConverter<TLink, long>.Default;
29
30         /// <summary>
31         /// <para>
32         /// The links.
33         /// </para>
34         /// <para></para>
35         /// </summary>
36         private readonly byte* _links;
37
38         /// <summary>
39         /// <para>
40         /// The header.
41         /// </para>
42         /// <para></para>
43         /// </summary>
44         private readonly byte* _header;
45
46         /// <summary>
47         /// <para>
48         /// Initializes a new <see cref="UnusedLinksListMethods"/> instance.
49         /// </para>
50         /// <para></para>
51         /// </summary>
52         /// <param name="links">
53         /// <para>A links.</para>
54         /// <para></para>
55         /// </param>
56         /// <param name="header">
57         /// <para>A header.</para>
58         /// <para></para>
59         /// </param>
60         [MethodImpl(MethodImplOptions.AggressiveInlining)]
61         public UnusedLinksListMethods(byte* links, byte* header)
62         {

```

```

60     _links = links;
61     _header = header;
62 }
63
64 /// <summary>
65 /// <para>
66 /// Gets the header reference.
67 /// </para>
68 /// <para></para>
69 /// </summary>
70 /// <returns>
71 /// <para>A ref links header of t link</para>
72 /// <para></para>
73 /// </returns>
74 [MethodImpl(MethodImplOptions.AggressiveInlining)]
75 protected virtual ref LinksHeader<TLink> GetHeaderReference() => ref
    ↳ AsRef<LinksHeader<TLink>>(_header);
76
77 /// <summary>
78 /// <para>
79 /// Gets the link data part reference using the specified link.
80 /// </para>
81 /// <para></para>
82 /// </summary>
83 /// <param name="link">
84 /// <para>The link.</para>
85 /// <para></para>
86 /// </param>
87 /// <returns>
88 /// <para>A ref raw link data part of t link</para>
89 /// <para></para>
90 /// </returns>
91 [MethodImpl(MethodImplOptions.AggressiveInlining)]
92 protected virtual ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) => ref
    ↳ AsRef<RawLinkDataPart<TLink>>(_links + (RawLinkDataPart<TLink>.SizeInBytes *
    ↳ _addressToInt64Converter.Convert(link)));
93
94 /// <summary>
95 /// <para>
96 /// Gets the first.
97 /// </para>
98 /// <para></para>
99 /// </summary>
100 /// <returns>
101 /// <para>The link</para>
102 /// <para></para>
103 /// </returns>
104 [MethodImpl(MethodImplOptions.AggressiveInlining)]
105 protected override TLink GetFirst() => GetHeaderReference().FirstFreeLink;
106
107 /// <summary>
108 /// <para>
109 /// Gets the last.
110 /// </para>
111 /// <para></para>
112 /// </summary>
113 /// <returns>
114 /// <para>The link</para>
115 /// <para></para>
116 /// </returns>
117 [MethodImpl(MethodImplOptions.AggressiveInlining)]
118 protected override TLink GetLast() => GetHeaderReference().LastFreeLink;
119
120 /// <summary>
121 /// <para>
122 /// Gets the previous using the specified element.
123 /// </para>
124 /// <para></para>
125 /// </summary>
126 /// <param name="element">
127 /// <para>The element.</para>
128 /// <para></para>
129 /// </param>
130 /// <returns>
131 /// <para>The link</para>
132 /// <para></para>
133 /// </returns>
134 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

135     protected override TLink GetPrevious(TLink element) =>
136         ↪ GetLinkDataPartReference(element).Source;
137
138     /// <summary>
139     /// <para>
140     /// Gets the next using the specified element.
141     /// </para>
142     /// <para></para>
143     /// </summary>
144     /// <param name="element">
145     /// <para>The element.</para>
146     /// <para></para>
147     /// </param>
148     /// <returns>
149     /// <para>The link</para>
150     /// <para></para>
151     /// </returns>
152     [MethodImpl(MethodImplOptions.AggressiveInlining)]
153     protected override TLink GetNext(TLink element) =>
154         ↪ GetLinkDataPartReference(element).Target;
155
156     /// <summary>
157     /// <para>
158     /// Gets the size.
159     /// </para>
160     /// <para></para>
161     /// </summary>
162     /// <returns>
163     /// <para>The link</para>
164     /// <para></para>
165     /// </returns>
166     [MethodImpl(MethodImplOptions.AggressiveInlining)]
167     protected override TLink GetSize() => GetHeaderReference().FreeLinks;
168
169     /// <summary>
170     /// <para>
171     /// Sets the first using the specified element.
172     /// </para>
173     /// <para></para>
174     /// </summary>
175     /// <param name="element">
176     /// <para>The element.</para>
177     /// <para></para>
178     /// </param>
179     [MethodImpl(MethodImplOptions.AggressiveInlining)]
180     protected override void SetFirst(TLink element) => GetHeaderReference().FirstFreeLink =
181         ↪ element;
182
183     /// <summary>
184     /// <para>
185     /// Sets the last using the specified element.
186     /// </para>
187     /// <para></para>
188     /// </summary>
189     /// <param name="element">
190     /// <para>The element.</para>
191     /// <para></para>
192     /// </param>
193     [MethodImpl(MethodImplOptions.AggressiveInlining)]
194     protected override void SetLast(TLink element) => GetHeaderReference().LastFreeLink =
195         ↪ element;
196
197     /// <summary>
198     /// <para>
199     /// Sets the previous using the specified element.
200     /// </para>
201     /// <para></para>
202     /// </summary>
203     /// <param name="element">
204     /// <para>The element.</para>
205     /// <para></para>
206     /// </param>
207     [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

208     protected override void SetPrevious(TLink element, TLink previous) =>
209         ↪ GetLinkDataPartReference(element).Source = previous;
210
211     /// <summary>
212     /// <para>
213     /// Sets the next using the specified element.
214     /// </para>
215     /// </summary>
216     /// <param name="element">
217     /// <para>The element.</para>
218     /// </param>
219     /// <param name="next">
220     /// <para>The next.</para>
221     /// </param>
222     [MethodImpl(MethodImplOptions.AggressiveInlining)]
223     protected override void SetNext(TLink element, TLink next) =>
224         ↪ GetLinkDataPartReference(element).Target = next;
225
226     /// <summary>
227     /// <para>
228     /// Sets the size using the specified size.
229     /// </para>
230     /// </summary>
231     /// <param name="size">
232     /// <para>The size.</para>
233     /// </param>
234     [MethodImpl(MethodImplOptions.AggressiveInlining)]
235     protected override void SetSize(TLink size) => GetHeaderReference().FreeLinks = size;
236
237 }
238
239 }
240 }

```

#### 1.45 ./csharp/Platform.Data.Doublets/Memory/Split/RawLinkDataPart.cs

```

1  using Platform.Unsafe;
2  using System;
3  using System.Collections.Generic;
4  using System.Runtime.CompilerServices;
5
6  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
7
8  namespace Platform.Data.Doublets.Memory.Split
9  {
10     /// <summary>
11     /// <para>
12     /// The raw link data part.
13     /// </para>
14     /// </summary>
15     public struct RawLinkDataPart<TLink> : IEquatable<RawLinkDataPart<TLink>>
16     {
17         /// <summary>
18         /// <para>
19         /// The default.
20         /// </para>
21         /// </summary>
22         private static readonly EqualityComparer<TLink> _equalityComparer =
23             ↪ EqualityComparer<TLink>.Default;
24
25         /// <summary>
26         /// <para>
27         /// The size.
28         /// </para>
29         /// </summary>
30         public static readonly long SizeInBytes = Structure<RawLinkDataPart<TLink>>.Size;
31
32         /// <summary>
33         /// <para>
34         /// The source.
35         /// </para>
36         /// </summary>
37         public TLink Source;
38     }
39 }
40
41

```

```

42     /// <para>
43     /// The target.
44     /// </para>
45     /// <para></para>
46     /// </summary>
47     public TLink Target;
48
49     /// <summary>
50     /// <para>
51     /// Determines whether this instance equals.
52     /// </para>
53     /// <para></para>
54     /// </summary>
55     /// <param name="obj">
56     /// <para>The obj.</para>
57     /// <para></para>
58     /// </param>
59     /// <returns>
60     /// <para>The bool</para>
61     /// <para></para>
62     /// </returns>
63     [MethodImpl(MethodImplOptions.AggressiveInlining)]
64     public override bool Equals(object obj) => obj is RawLinkDataPart<TLink> link ?
        ↳ Equals(link) : false;
65
66     /// <summary>
67     /// <para>
68     /// Determines whether this instance equals.
69     /// </para>
70     /// <para></para>
71     /// </summary>
72     /// <param name="other">
73     /// <para>The other.</para>
74     /// <para></para>
75     /// </param>
76     /// <returns>
77     /// <para>The bool</para>
78     /// <para></para>
79     /// </returns>
80     [MethodImpl(MethodImplOptions.AggressiveInlining)]
81     public bool Equals(RawLinkDataPart<TLink> other)
82         => _equalityComparer.Equals(Source, other.Source)
83         && _equalityComparer.Equals(Target, other.Target);
84
85     /// <summary>
86     /// <para>
87     /// Gets the hash code.
88     /// </para>
89     /// <para></para>
90     /// </summary>
91     /// <returns>
92     /// <para>The int</para>
93     /// <para></para>
94     /// </returns>
95     [MethodImpl(MethodImplOptions.AggressiveInlining)]
96     public override int GetHashCode() => (Source, Target).GetHashCode();
97
98     [MethodImpl(MethodImplOptions.AggressiveInlining)]
99     public static bool operator ==(RawLinkDataPart<TLink> left, RawLinkDataPart<TLink>
        ↳ right) => left.Equals(right);
100
101     [MethodImpl(MethodImplOptions.AggressiveInlining)]
102     public static bool operator !=(RawLinkDataPart<TLink> left, RawLinkDataPart<TLink>
        ↳ right) => !(left == right);
103 }
104 }

```

#### 1.46 ./csharp/Platform.Data.Doublets/Memory/Split/RawLinkIndexPart.cs

```

1  using Platform.Unsafe;
2  using System;
3  using System.Collections.Generic;
4  using System.Runtime.CompilerServices;
5
6  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
7
8  namespace Platform.Data.Doublets.Memory.Split
9  {
10     /// <summary>

```

```

11  /// <para>
12  /// The raw link index part.
13  /// </para>
14  /// <para></para>
15  /// </summary>
16  public struct RawLinkIndexPart<TLink> : IEquatable<RawLinkIndexPart<TLink>>
17  {
18      /// <summary>
19      /// <para>
20      /// The default.
21      /// </para>
22      /// <para></para>
23      /// </summary>
24      private static readonly EqualityComparer<TLink> _equalityComparer =
25          ↪ EqualityComparer<TLink>.Default;
26
27      /// <summary>
28      /// <para>
29      /// The size.
30      /// </para>
31      /// <para></para>
32      /// </summary>
33      public static readonly long SizeInBytes = Structure<RawLinkIndexPart<TLink>>.Size;
34
35      /// <summary>
36      /// <para>
37      /// The root as source.
38      /// </para>
39      /// <para></para>
40      /// </summary>
41      public TLink RootAsSource;
42      /// <summary>
43      /// <para>
44      /// The left as source.
45      /// </para>
46      /// <para></para>
47      /// </summary>
48      public TLink LeftAsSource;
49      /// <summary>
50      /// <para>
51      /// The right as source.
52      /// </para>
53      /// <para></para>
54      /// </summary>
55      public TLink RightAsSource;
56      /// <summary>
57      /// <para>
58      /// The size as source.
59      /// </para>
60      /// <para></para>
61      /// </summary>
62      public TLink SizeAsSource;
63      /// <summary>
64      /// <para>
65      /// The root as target.
66      /// </para>
67      /// <para></para>
68      /// </summary>
69      public TLink RootAsTarget;
70      /// <summary>
71      /// <para>
72      /// The left as target.
73      /// </para>
74      /// <para></para>
75      /// </summary>
76      public TLink LeftAsTarget;
77      /// <summary>
78      /// <para>
79      /// The right as target.
80      /// </para>
81      /// <para></para>
82      /// </summary>
83      public TLink RightAsTarget;
84      /// <summary>
85      /// <para>
86      /// The size as target.
87      /// </para>
88      /// <para></para>
89      /// </summary>

```

```

89     public TLink SizeAsTarget;
90
91     /// <summary>
92     /// <para>
93     /// Determines whether this instance equals.
94     /// </para>
95     /// <para></para>
96     /// </summary>
97     /// <param name="obj">
98     /// <para>The obj.</para>
99     /// <para></para>
100    /// </param>
101    /// <returns>
102    /// <para>The bool</para>
103    /// <para></para>
104    /// </returns>
105    [MethodImpl(MethodImplOptions.AggressiveInlining)]
106    public override bool Equals(object obj) => obj is RawLinkIndexPart<TLink> link ?
    ↪ Equals(link) : false;
107
108    /// <summary>
109    /// <para>
110    /// Determines whether this instance equals.
111    /// </para>
112    /// <para></para>
113    /// </summary>
114    /// <param name="other">
115    /// <para>The other.</para>
116    /// <para></para>
117    /// </param>
118    /// <returns>
119    /// <para>The bool</para>
120    /// <para></para>
121    /// </returns>
122    [MethodImpl(MethodImplOptions.AggressiveInlining)]
123    public bool Equals(RawLinkIndexPart<TLink> other)
124        => _equalityComparer.Equals(RootAsSource, other.RootAsSource)
125        && _equalityComparer.Equals(LeftAsSource, other.LeftAsSource)
126        && _equalityComparer.Equals(RightAsSource, other.RightAsSource)
127        && _equalityComparer.Equals(SizeAsSource, other.SizeAsSource)
128        && _equalityComparer.Equals(RootAsTarget, other.RootAsTarget)
129        && _equalityComparer.Equals(LeftAsTarget, other.LeftAsTarget)
130        && _equalityComparer.Equals(RightAsTarget, other.RightAsTarget)
131        && _equalityComparer.Equals(SizeAsTarget, other.SizeAsTarget);
132
133    /// <summary>
134    /// <para>
135    /// Gets the hash code.
136    /// </para>
137    /// <para></para>
138    /// </summary>
139    /// <returns>
140    /// <para>The int</para>
141    /// <para></para>
142    /// </returns>
143    [MethodImpl(MethodImplOptions.AggressiveInlining)]
144    public override int GetHashCode() => (RootAsSource, LeftAsSource, RightAsSource,
    ↪ SizeAsSource, RootAsTarget, LeftAsTarget, RightAsTarget, SizeAsTarget).GetHashCode();
145
146    [MethodImpl(MethodImplOptions.AggressiveInlining)]
147    public static bool operator ==(RawLinkIndexPart<TLink> left, RawLinkIndexPart<TLink>
    ↪ right) => left.Equals(right);
148
149    [MethodImpl(MethodImplOptions.AggressiveInlining)]
150    public static bool operator !=(RawLinkIndexPart<TLink> left, RawLinkIndexPart<TLink>
    ↪ right) => !(left == right);
151 }
152 }

```

## 1.47 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32ExternalLinksRecursionlessSizeBalancedTree

```

1  using System.Runtime.CompilerServices;
2  using Platform.Data.Doublets.Memory.Split.Generic;
3  using TLink = System.UInt32;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Doublets.Memory.Split.Specific
8  {

```

```

9      /// <summary>
10     /// <para>
11     /// Represents the int 32 external links recursionless size balanced tree methods base.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     /// <seealso cref="ExternalLinksRecursionlessSizeBalancedTreeMethodsBase{TLink}"/>
16     /// <seealso cref="ILinksTreeMethods{TLink}"/>
17     public unsafe abstract class UInt32ExternalLinksRecursionlessSizeBalancedTreeMethodsBase :
18     ↪ ExternalLinksRecursionlessSizeBalancedTreeMethodsBase<TLink>, ILinksTreeMethods<TLink>
19     {
20         /// <summary>
21         /// <para>
22         /// The links data parts.
23         /// </para>
24         /// <para></para>
25         /// </summary>
26         protected new readonly RawLinkDataPart<TLink>* LinksDataParts;
27         /// <summary>
28         /// <para>
29         /// The links index parts.
30         /// </para>
31         /// <para></para>
32         /// </summary>
33         protected new readonly RawLinkIndexPart<TLink>* LinksIndexParts;
34         /// <summary>
35         /// <para>
36         /// The header.
37         /// </para>
38         /// <para></para>
39         /// </summary>
40         protected new readonly LinksHeader<TLink>* Header;
41
42         /// <summary>
43         /// <para>
44         /// Initializes a new <see
45         ↪ cref="UInt32ExternalLinksRecursionlessSizeBalancedTreeMethodsBase"/> instance.
46         /// </para>
47         /// <para></para>
48         /// </summary>
49         /// <param name="constants">
50         /// <para>A constants.</para>
51         /// <para></para>
52         /// </param>
53         /// <param name="linksDataParts">
54         /// <para>A links data parts.</para>
55         /// <para></para>
56         /// </param>
57         /// <param name="linksIndexParts">
58         /// <para>A links index parts.</para>
59         /// <para></para>
60         /// </param>
61         /// <param name="header">
62         /// <para>A header.</para>
63         /// <para></para>
64         /// </param>
65         [MethodImpl(MethodImplOptions.AggressiveInlining)]
66         protected
67         ↪ UInt32ExternalLinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<TLink>
68         ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
69         ↪ linksIndexParts, LinksHeader<TLink>* header)
70         : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
71         {
72             LinksDataParts = linksDataParts;
73             LinksIndexParts = linksIndexParts;
74             Header = header;
75         }
76
77         /// <summary>
78         /// <para>
79         /// Gets the zero.
80         /// </para>
81         /// <para></para>
82         /// </summary>
83         /// <returns>
84         /// <para>The link</para>
85         /// <para></para>
86         /// </returns>

```



```

82 [MethodImpl(MethodImplOptions.AggressiveInlining)]
83 protected override TLink GetZero() => 0U;
84
85 /// <summary>
86 /// <para>
87 /// Determines whether this instance equal to zero.
88 /// </para>
89 /// <para></para>
90 /// </summary>
91 /// <param name="value">
92 /// <para>The value.</para>
93 /// <para></para>
94 /// </param>
95 /// <returns>
96 /// <para>The bool</para>
97 /// <para></para>
98 /// </returns>
99 [MethodImpl(MethodImplOptions.AggressiveInlining)]
100 protected override bool EqualToZero(TLink value) => value == 0U;
101
102 /// <summary>
103 /// <para>
104 /// Determines whether this instance are equal.
105 /// </para>
106 /// <para></para>
107 /// </summary>
108 /// <param name="first">
109 /// <para>The first.</para>
110 /// <para></para>
111 /// </param>
112 /// <param name="second">
113 /// <para>The second.</para>
114 /// <para></para>
115 /// </param>
116 /// <returns>
117 /// <para>The bool</para>
118 /// <para></para>
119 /// </returns>
120 [MethodImpl(MethodImplOptions.AggressiveInlining)]
121 protected override bool AreEqual(TLink first, TLink second) => first == second;
122
123 /// <summary>
124 /// <para>
125 /// Determines whether this instance greater than zero.
126 /// </para>
127 /// <para></para>
128 /// </summary>
129 /// <param name="value">
130 /// <para>The value.</para>
131 /// <para></para>
132 /// </param>
133 /// <returns>
134 /// <para>The bool</para>
135 /// <para></para>
136 /// </returns>
137 [MethodImpl(MethodImplOptions.AggressiveInlining)]
138 protected override bool GreaterThanZero(TLink value) => value > 0U;
139
140 /// <summary>
141 /// <para>
142 /// Determines whether this instance greater than.
143 /// </para>
144 /// <para></para>
145 /// </summary>
146 /// <param name="first">
147 /// <para>The first.</para>
148 /// <para></para>
149 /// </param>
150 /// <param name="second">
151 /// <para>The second.</para>
152 /// <para></para>
153 /// </param>
154 /// <returns>
155 /// <para>The bool</para>
156 /// <para></para>
157 /// </returns>
158 [MethodImpl(MethodImplOptions.AggressiveInlining)]
159 protected override bool GreaterThan(TLink first, TLink second) => first > second;

```

```

160
161     /// <summary>
162     /// <para>
163     /// Determines whether this instance greater or equal than.
164     /// </para>
165     /// <para></para>
166     /// </summary>
167     /// <param name="first">
168     /// <para>The first.</para>
169     /// <para></para>
170     /// </param>
171     /// <param name="second">
172     /// <para>The second.</para>
173     /// <para></para>
174     /// </param>
175     /// <returns>
176     /// <para>The bool</para>
177     /// <para></para>
178     /// </returns>
179     [MethodImpl(MethodImplOptions.AggressiveInlining)]
180     protected override bool GreaterOrEqualThan(TLink first, TLink second) => first >= second;
181
182     /// <summary>
183     /// <para>
184     /// Determines whether this instance greater or equal than zero.
185     /// </para>
186     /// <para></para>
187     /// </summary>
188     /// <param name="value">
189     /// <para>The value.</para>
190     /// <para></para>
191     /// </param>
192     /// <returns>
193     /// <para>The bool</para>
194     /// <para></para>
195     /// </returns>
196     [MethodImpl(MethodImplOptions.AggressiveInlining)]
197     protected override bool GreaterOrEqualThanZero(TLink value) => true; // value >= 0 is
198     ↪ always true for ulong
199
200     /// <summary>
201     /// <para>
202     /// Determines whether this instance less or equal than zero.
203     /// </para>
204     /// <para></para>
205     /// </summary>
206     /// <param name="value">
207     /// <para>The value.</para>
208     /// <para></para>
209     /// </param>
210     /// <returns>
211     /// <para>The bool</para>
212     /// <para></para>
213     /// </returns>
214     [MethodImpl(MethodImplOptions.AggressiveInlining)]
215     protected override bool LessOrEqualThanZero(TLink value) => value == 0UL; // value is
216     ↪ always >= 0 for ulong
217
218     /// <summary>
219     /// <para>
220     /// Determines whether this instance less or equal than.
221     /// </para>
222     /// <para></para>
223     /// </summary>
224     /// <param name="first">
225     /// <para>The first.</para>
226     /// <para></para>
227     /// </param>
228     /// <param name="second">
229     /// <para>The second.</para>
230     /// <para></para>
231     /// </param>
232     /// <returns>
233     /// <para>The bool</para>
234     /// <para></para>
235     /// </returns>
236     [MethodImpl(MethodImplOptions.AggressiveInlining)]
237     protected override bool LessOrEqualThan(TLink first, TLink second) => first <= second;

```

```

236
237     /// <summary>
238     /// <para>
239     /// Determines whether this instance less than zero.
240     /// </para>
241     /// <para></para>
242     /// </summary>
243     /// <param name="value">
244     /// <para>The value.</para>
245     /// <para></para>
246     /// </param>
247     /// <returns>
248     /// <para>The bool</para>
249     /// <para></para>
250     /// </returns>
251     [MethodImpl(MethodImplOptions.AggressiveInlining)]
252     protected override bool LessThanZero(TLink value) => false; // value < 0 is always false
    ↪   for ulong
253
254     /// <summary>
255     /// <para>
256     /// Determines whether this instance less than.
257     /// </para>
258     /// <para></para>
259     /// </summary>
260     /// <param name="first">
261     /// <para>The first.</para>
262     /// <para></para>
263     /// </param>
264     /// <param name="second">
265     /// <para>The second.</para>
266     /// <para></para>
267     /// </param>
268     /// <returns>
269     /// <para>The bool</para>
270     /// <para></para>
271     /// </returns>
272     [MethodImpl(MethodImplOptions.AggressiveInlining)]
273     protected override bool LessThan(TLink first, TLink second) => first < second;
274
275     /// <summary>
276     /// <para>
277     /// Increments the value.
278     /// </para>
279     /// <para></para>
280     /// </summary>
281     /// <param name="value">
282     /// <para>The value.</para>
283     /// <para></para>
284     /// </param>
285     /// <returns>
286     /// <para>The link</para>
287     /// <para></para>
288     /// </returns>
289     [MethodImpl(MethodImplOptions.AggressiveInlining)]
290     protected override TLink Increment(TLink value) => ++value;
291
292     /// <summary>
293     /// <para>
294     /// Decrements the value.
295     /// </para>
296     /// <para></para>
297     /// </summary>
298     /// <param name="value">
299     /// <para>The value.</para>
300     /// <para></para>
301     /// </param>
302     /// <returns>
303     /// <para>The link</para>
304     /// <para></para>
305     /// </returns>
306     [MethodImpl(MethodImplOptions.AggressiveInlining)]
307     protected override TLink Decrement(TLink value) => --value;
308
309     /// <summary>
310     /// <para>
311     /// Adds the first.
312     /// </para>

```

```

313     /// <para></para>
314     /// </summary>
315     /// <param name="first">
316     /// <para>The first.</para>
317     /// <para></para>
318     /// </param>
319     /// <param name="second">
320     /// <para>The second.</para>
321     /// <para></para>
322     /// </param>
323     /// <returns>
324     /// <para>The link</para>
325     /// <para></para>
326     /// </returns>
327     [MethodImpl(MethodImplOptions.AggressiveInlining)]
328     protected override TLink Add(TLink first, TLink second) => first + second;
329
330     /// <summary>
331     /// <para>
332     /// Subtracts the first.
333     /// </para>
334     /// <para></para>
335     /// </summary>
336     /// <param name="first">
337     /// <para>The first.</para>
338     /// <para></para>
339     /// </param>
340     /// <param name="second">
341     /// <para>The second.</para>
342     /// <para></para>
343     /// </param>
344     /// <returns>
345     /// <para>The link</para>
346     /// <para></para>
347     /// </returns>
348     [MethodImpl(MethodImplOptions.AggressiveInlining)]
349     protected override TLink Subtract(TLink first, TLink second) => first - second;
350
351     /// <summary>
352     /// <para>
353     /// Gets the header reference.
354     /// </para>
355     /// <para></para>
356     /// </summary>
357     /// <returns>
358     /// <para>A ref links header of t link</para>
359     /// <para></para>
360     /// </returns>
361     [MethodImpl(MethodImplOptions.AggressiveInlining)]
362     protected override ref LinksHeader<TLink> GetHeaderReference() => ref *Header;
363
364     /// <summary>
365     /// <para>
366     /// Gets the link data part reference using the specified link.
367     /// </para>
368     /// <para></para>
369     /// </summary>
370     /// <param name="link">
371     /// <para>The link.</para>
372     /// <para></para>
373     /// </param>
374     /// <returns>
375     /// <para>A ref raw link data part of t link</para>
376     /// <para></para>
377     /// </returns>
378     [MethodImpl(MethodImplOptions.AggressiveInlining)]
379     protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
380         ↪ ref LinksDataParts[link];
381
382     /// <summary>
383     /// <para>
384     /// Gets the link index part reference using the specified link.
385     /// </para>
386     /// <para></para>
387     /// </summary>
388     /// <param name="link">
389     /// <para>The link.</para>
390     /// <para></para>

```

```

390     /// </param>
391     /// <returns>
392     /// <para>A ref raw link index part of t link</para>
393     /// <para></para>
394     /// </returns>
395     [MethodImpl(MethodImplOptions.AggressiveInlining)]
396     protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
        ↪ ref LinksIndexParts[link];
397
398     /// <summary>
399     /// <para>
400     /// Determines whether this instance first is to the left of second.
401     /// </para>
402     /// <para></para>
403     /// </summary>
404     /// <param name="first">
405     /// <para>The first.</para>
406     /// <para></para>
407     /// </param>
408     /// <param name="second">
409     /// <para>The second.</para>
410     /// <para></para>
411     /// </param>
412     /// <returns>
413     /// <para>The bool</para>
414     /// <para></para>
415     /// </returns>
416     [MethodImpl(MethodImplOptions.AggressiveInlining)]
417     protected override bool FirstIsToTheLeftOfSecond(TLink first, TLink second)
418     {
419         ref var firstLink = ref LinksDataParts[first];
420         ref var secondLink = ref LinksDataParts[second];
421         return FirstIsToTheLeftOfSecond(firstLink.Source, firstLink.Target,
            ↪ secondLink.Source, secondLink.Target);
422     }
423
424     /// <summary>
425     /// <para>
426     /// Determines whether this instance first is to the right of second.
427     /// </para>
428     /// <para></para>
429     /// </summary>
430     /// <param name="first">
431     /// <para>The first.</para>
432     /// <para></para>
433     /// </param>
434     /// <param name="second">
435     /// <para>The second.</para>
436     /// <para></para>
437     /// </param>
438     /// <returns>
439     /// <para>The bool</para>
440     /// <para></para>
441     /// </returns>
442     [MethodImpl(MethodImplOptions.AggressiveInlining)]
443     protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second)
444     {
445         ref var firstLink = ref LinksDataParts[first];
446         ref var secondLink = ref LinksDataParts[second];
447         return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
            ↪ secondLink.Source, secondLink.Target);
448     }
449 }
450 }

```

#### 1.48 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32ExternalLinksSizeBalancedTreeMethodsBase

```

1 using System.Runtime.CompilerServices;
2 using Platform.Data.Doublets.Memory.Split.Generic;
3 using TLink = System.UInt32;
4
5 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7 namespace Platform.Data.Doublets.Memory.Split.Specific
8 {
9     /// <summary>
10    /// <para>
11    /// Represents the int 32 external links size balanced tree methods base.
12    /// </para>

```

```

13  /// <para></para>
14  /// </summary>
15  /// <seealso cref="ExternalLinksSizeBalancedTreeMethodsBase{TLink}"/>
16  /// <seealso cref="ILinksTreeMethods{TLink}"/>
17  public unsafe abstract class UInt32ExternalLinksSizeBalancedTreeMethodsBase :
    ↳ ExternalLinksSizeBalancedTreeMethodsBase<TLink>, ILinksTreeMethods<TLink>
18  {
19      /// <summary>
20      /// <para>
21      /// The links data parts.
22      /// </para>
23      /// <para></para>
24      /// </summary>
25      protected new readonly RawLinkDataPart<TLink>* LinksDataParts;
26      /// <summary>
27      /// <para>
28      /// The links index parts.
29      /// </para>
30      /// <para></para>
31      /// </summary>
32      protected new readonly RawLinkIndexPart<TLink>* LinksIndexParts;
33      /// <summary>
34      /// <para>
35      /// The header.
36      /// </para>
37      /// <para></para>
38      /// </summary>
39      protected new readonly LinksHeader<TLink>* Header;
40
41      /// <summary>
42      /// <para>
43      /// Initializes a new <see cref="UInt32ExternalLinksSizeBalancedTreeMethodsBase"/>
44      ↳ instance.
45      /// </para>
46      /// <para></para>
47      /// </summary>
48      /// <param name="constants">
49      /// <para>A constants.</para>
50      /// <para></para>
51      /// </param>
52      /// <param name="linksDataParts">
53      /// <para>A links data parts.</para>
54      /// <para></para>
55      /// </param>
56      /// <param name="linksIndexParts">
57      /// <para>A links index parts.</para>
58      /// <para></para>
59      /// </param>
60      /// <param name="header">
61      /// <para>A header.</para>
62      /// <para></para>
63      /// </param>
64      [MethodImpl(MethodImplOptions.AggressiveInlining)]
65      protected UInt32ExternalLinksSizeBalancedTreeMethodsBase(LinksConstants<TLink>
66      ↳ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
67      ↳ linksIndexParts, LinksHeader<TLink>* header)
68      : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
69      {
70      LinksDataParts = linksDataParts;
71      LinksIndexParts = linksIndexParts;
72      Header = header;
73      }
74
75      /// <summary>
76      /// <para>
77      /// Gets the zero.
78      /// </para>
79      /// <para></para>
80      /// </summary>
81      /// <returns>
82      /// <para>The link</para>
83      /// <para></para>
84      /// </returns>
85      [MethodImpl(MethodImplOptions.AggressiveInlining)]
86      protected override TLink GetZero() => 0U;

```

```

87     /// Determines whether this instance equal to zero.
88     /// </para>
89     /// <para></para>
90     /// </summary>
91     /// <param name="value">
92     /// <para>The value.</para>
93     /// <para></para>
94     /// </param>
95     /// <returns>
96     /// <para>The bool</para>
97     /// <para></para>
98     /// </returns>
99     [MethodImpl(MethodImplOptions.AggressiveInlining)]
100    protected override bool EqualToZero(TLink value) => value == 0U;
101
102    /// <summary>
103    /// <para>
104    /// Determines whether this instance are equal.
105    /// </para>
106    /// <para></para>
107    /// </summary>
108    /// <param name="first">
109    /// <para>The first.</para>
110    /// <para></para>
111    /// </param>
112    /// <param name="second">
113    /// <para>The second.</para>
114    /// <para></para>
115    /// </param>
116    /// <returns>
117    /// <para>The bool</para>
118    /// <para></para>
119    /// </returns>
120    [MethodImpl(MethodImplOptions.AggressiveInlining)]
121    protected override bool AreEqual(TLink first, TLink second) => first == second;
122
123    /// <summary>
124    /// <para>
125    /// Determines whether this instance greater than zero.
126    /// </para>
127    /// <para></para>
128    /// </summary>
129    /// <param name="value">
130    /// <para>The value.</para>
131    /// <para></para>
132    /// </param>
133    /// <returns>
134    /// <para>The bool</para>
135    /// <para></para>
136    /// </returns>
137    [MethodImpl(MethodImplOptions.AggressiveInlining)]
138    protected override bool GreaterThanZero(TLink value) => value > 0U;
139
140    /// <summary>
141    /// <para>
142    /// Determines whether this instance greater than.
143    /// </para>
144    /// <para></para>
145    /// </summary>
146    /// <param name="first">
147    /// <para>The first.</para>
148    /// <para></para>
149    /// </param>
150    /// <param name="second">
151    /// <para>The second.</para>
152    /// <para></para>
153    /// </param>
154    /// <returns>
155    /// <para>The bool</para>
156    /// <para></para>
157    /// </returns>
158    [MethodImpl(MethodImplOptions.AggressiveInlining)]
159    protected override bool GreaterThan(TLink first, TLink second) => first > second;
160
161    /// <summary>
162    /// <para>
163    /// Determines whether this instance greater or equal than.
164    /// </para>

```

```

165     /// <para></para>
166     /// </summary>
167     /// <param name="first">
168     /// <para>The first.</para>
169     /// <para></para>
170     /// </param>
171     /// <param name="second">
172     /// <para>The second.</para>
173     /// <para></para>
174     /// </param>
175     /// <returns>
176     /// <para>The bool</para>
177     /// <para></para>
178     /// </returns>
179     [MethodImpl(MethodImplOptions.AggressiveInlining)]
180     protected override bool GreaterOrEqualThan(TLink first, TLink second) => first >= second;
181
182     /// <summary>
183     /// <para>
184     /// Determines whether this instance greater or equal than zero.
185     /// </para>
186     /// <para></para>
187     /// </summary>
188     /// <param name="value">
189     /// <para>The value.</para>
190     /// <para></para>
191     /// </param>
192     /// <returns>
193     /// <para>The bool</para>
194     /// <para></para>
195     /// </returns>
196     [MethodImpl(MethodImplOptions.AggressiveInlining)]
197     protected override bool GreaterOrEqualThanZero(TLink value) => true; // value >= 0 is
    ↪ always true for ulong
198
199     /// <summary>
200     /// <para>
201     /// Determines whether this instance less or equal than zero.
202     /// </para>
203     /// <para></para>
204     /// </summary>
205     /// <param name="value">
206     /// <para>The value.</para>
207     /// <para></para>
208     /// </param>
209     /// <returns>
210     /// <para>The bool</para>
211     /// <para></para>
212     /// </returns>
213     [MethodImpl(MethodImplOptions.AggressiveInlining)]
214     protected override bool LessOrEqualThanZero(TLink value) => value == OUL; // value is
    ↪ always >= 0 for ulong
215
216     /// <summary>
217     /// <para>
218     /// Determines whether this instance less or equal than.
219     /// </para>
220     /// <para></para>
221     /// </summary>
222     /// <param name="first">
223     /// <para>The first.</para>
224     /// <para></para>
225     /// </param>
226     /// <param name="second">
227     /// <para>The second.</para>
228     /// <para></para>
229     /// </param>
230     /// <returns>
231     /// <para>The bool</para>
232     /// <para></para>
233     /// </returns>
234     [MethodImpl(MethodImplOptions.AggressiveInlining)]
235     protected override bool LessOrEqualThan(TLink first, TLink second) => first <= second;
236
237     /// <summary>
238     /// <para>
239     /// Determines whether this instance less than zero.
240     /// </para>

```



```

241     /// <para></para>
242     /// </summary>
243     /// <param name="value">
244     /// <para>The value.</para>
245     /// <para></para>
246     /// </param>
247     /// <returns>
248     /// <para>The bool</para>
249     /// <para></para>
250     /// </returns>
251     [MethodImpl(MethodImplOptions.AggressiveInlining)]
252     protected override bool LessThanZero(TLink value) => false; // value < 0 is always false
    ↪    for ulong

253
254     /// <summary>
255     /// <para>
256     /// Determines whether this instance less than.
257     /// </para>
258     /// <para></para>
259     /// </summary>
260     /// <param name="first">
261     /// <para>The first.</para>
262     /// <para></para>
263     /// </param>
264     /// <param name="second">
265     /// <para>The second.</para>
266     /// <para></para>
267     /// </param>
268     /// <returns>
269     /// <para>The bool</para>
270     /// <para></para>
271     /// </returns>
272     [MethodImpl(MethodImplOptions.AggressiveInlining)]
273     protected override bool LessThan(TLink first, TLink second) => first < second;

274
275     /// <summary>
276     /// <para>
277     /// Increments the value.
278     /// </para>
279     /// <para></para>
280     /// </summary>
281     /// <param name="value">
282     /// <para>The value.</para>
283     /// <para></para>
284     /// </param>
285     /// <returns>
286     /// <para>The link</para>
287     /// <para></para>
288     /// </returns>
289     [MethodImpl(MethodImplOptions.AggressiveInlining)]
290     protected override TLink Increment(TLink value) => ++value;

291
292     /// <summary>
293     /// <para>
294     /// Decrements the value.
295     /// </para>
296     /// <para></para>
297     /// </summary>
298     /// <param name="value">
299     /// <para>The value.</para>
300     /// <para></para>
301     /// </param>
302     /// <returns>
303     /// <para>The link</para>
304     /// <para></para>
305     /// </returns>
306     [MethodImpl(MethodImplOptions.AggressiveInlining)]
307     protected override TLink Decrement(TLink value) => --value;

308
309     /// <summary>
310     /// <para>
311     /// Adds the first.
312     /// </para>
313     /// <para></para>
314     /// </summary>
315     /// <param name="first">
316     /// <para>The first.</para>
317     /// <para></para>

```

```

318     /// </param>
319     /// <param name="second">
320     /// <para>The second.</para>
321     /// <para></para>
322     /// </param>
323     /// <returns>
324     /// <para>The link</para>
325     /// <para></para>
326     /// </returns>
327     [MethodImpl(MethodImplOptions.AggressiveInlining)]
328     protected override TLink Add(TLink first, TLink second) => first + second;
329
330     /// <summary>
331     /// <para>
332     /// Subtracts the first.
333     /// </para>
334     /// <para></para>
335     /// </summary>
336     /// <param name="first">
337     /// <para>The first.</para>
338     /// <para></para>
339     /// </param>
340     /// <param name="second">
341     /// <para>The second.</para>
342     /// <para></para>
343     /// </param>
344     /// <returns>
345     /// <para>The link</para>
346     /// <para></para>
347     /// </returns>
348     [MethodImpl(MethodImplOptions.AggressiveInlining)]
349     protected override TLink Subtract(TLink first, TLink second) => first - second;
350
351     /// <summary>
352     /// <para>
353     /// Gets the header reference.
354     /// </para>
355     /// <para></para>
356     /// </summary>
357     /// <returns>
358     /// <para>A ref links header of t link</para>
359     /// <para></para>
360     /// </returns>
361     [MethodImpl(MethodImplOptions.AggressiveInlining)]
362     protected override ref LinksHeader<TLink> GetHeaderReference() => ref *Header;
363
364     /// <summary>
365     /// <para>
366     /// Gets the link data part reference using the specified link.
367     /// </para>
368     /// <para></para>
369     /// </summary>
370     /// <param name="link">
371     /// <para>The link.</para>
372     /// <para></para>
373     /// </param>
374     /// <returns>
375     /// <para>A ref raw link data part of t link</para>
376     /// <para></para>
377     /// </returns>
378     [MethodImpl(MethodImplOptions.AggressiveInlining)]
379     protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
380         ↪ ref LinksDataParts[link];
381
382     /// <summary>
383     /// <para>
384     /// Gets the link index part reference using the specified link.
385     /// </para>
386     /// <para></para>
387     /// </summary>
388     /// <param name="link">
389     /// <para>The link.</para>
390     /// <para></para>
391     /// </param>
392     /// <returns>
393     /// <para>A ref raw link index part of t link</para>
394     /// <para></para>
395     /// </returns>

```

```

395 [MethodImpl(MethodImplOptions.AggressiveInlining)]
396 protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
    ↪ ref LinksIndexParts[link];
397
398 /// <summary>
399 /// <para>
400 /// Determines whether this instance first is to the left of second.
401 /// </para>
402 /// <para></para>
403 /// </summary>
404 /// <param name="first">
405 /// <para>The first.</para>
406 /// <para></para>
407 /// </param>
408 /// <param name="second">
409 /// <para>The second.</para>
410 /// <para></para>
411 /// </param>
412 /// <returns>
413 /// <para>The bool</para>
414 /// <para></para>
415 /// </returns>
416 [MethodImpl(MethodImplOptions.AggressiveInlining)]
417 protected override bool FirstIsToLeftOfSecond(TLink first, TLink second)
418 {
419     ref var firstLink = ref LinksDataParts[first];
420     ref var secondLink = ref LinksDataParts[second];
421     return FirstIsToLeftOfSecond(firstLink.Source, firstLink.Target,
    ↪ secondLink.Source, secondLink.Target);
422 }
423
424 /// <summary>
425 /// <para>
426 /// Determines whether this instance first is to the right of second.
427 /// </para>
428 /// <para></para>
429 /// </summary>
430 /// <param name="first">
431 /// <para>The first.</para>
432 /// <para></para>
433 /// </param>
434 /// <param name="second">
435 /// <para>The second.</para>
436 /// <para></para>
437 /// </param>
438 /// <returns>
439 /// <para>The bool</para>
440 /// <para></para>
441 /// </returns>
442 [MethodImpl(MethodImplOptions.AggressiveInlining)]
443 protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second)
444 {
445     ref var firstLink = ref LinksDataParts[first];
446     ref var secondLink = ref LinksDataParts[second];
447     return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
    ↪ secondLink.Source, secondLink.Target);
448 }
449 }
450 }

```

#### 1.49 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32ExternalLinksSourcesRecursionlessSizeBalancedTreeMethodsBase

```

1 using System.Runtime.CompilerServices;
2 using TLink = System.UInt32;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6 namespace Platform.Data.Doublets.Memory.Split.Specific
7 {
8     /// <summary>
9     /// <para>
10    /// Represents the int 32 external links sources recursionless size balanced tree methods.
11    /// </para>
12    /// <para></para>
13    /// </summary>
14    /// <seealso cref="UInt32ExternalLinksRecursionlessSizeBalancedTreeMethodsBase"/>
15    public unsafe class UInt32ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods :
    ↪ UInt32ExternalLinksRecursionlessSizeBalancedTreeMethodsBase
16    {

```

```

17     /// <summary>
18     /// <para>
19     /// Initializes a new <see
    ↪ cref="UInt32ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods"/> instance.
20     /// </para>
21     /// <para></para>
22     /// </summary>
23     /// <param name="constants">
24     /// <para>A constants.</para>
25     /// <para></para>
26     /// </param>
27     /// <param name="linksDataParts">
28     /// <para>A links data parts.</para>
29     /// <para></para>
30     /// </param>
31     /// <param name="linksIndexParts">
32     /// <para>A links index parts.</para>
33     /// <para></para>
34     /// </param>
35     /// <param name="header">
36     /// <para>A header.</para>
37     /// <para></para>
38     /// </param>
39     [MethodImpl(MethodImplOptions.AggressiveInlining)]
40     public
    ↪ UInt32ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
    ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
    ↪ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
    ↪ linksIndexParts, header) { }

41
42     /// <summary>
43     /// <para>
44     /// Gets the left reference using the specified node.
45     /// </para>
46     /// <para></para>
47     /// </summary>
48     /// <param name="node">
49     /// <para>The node.</para>
50     /// <para></para>
51     /// </param>
52     /// <returns>
53     /// <para>The ref link</para>
54     /// <para></para>
55     /// </returns>
56     [MethodImpl(MethodImplOptions.AggressiveInlining)]
57     protected override ref TLink GetLeftReference(TLink node) => ref
    ↪ LinksIndexParts[node].LeftAsSource;

58
59     /// <summary>
60     /// <para>
61     /// Gets the right reference using the specified node.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     /// <param name="node">
66     /// <para>The node.</para>
67     /// <para></para>
68     /// </param>
69     /// <returns>
70     /// <para>The ref link</para>
71     /// <para></para>
72     /// </returns>
73     [MethodImpl(MethodImplOptions.AggressiveInlining)]
74     protected override ref TLink GetRightReference(TLink node) => ref
    ↪ LinksIndexParts[node].RightAsSource;

75
76     /// <summary>
77     /// <para>
78     /// Gets the left using the specified node.
79     /// </para>
80     /// <para></para>
81     /// </summary>
82     /// <param name="node">
83     /// <para>The node.</para>
84     /// <para></para>
85     /// </param>
86     /// <returns>
87     /// <para>The link</para>

```

```

88     /// <para></para>
89     /// </returns>
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsSource;
92
93     /// <summary>
94     /// <para>
95     /// Gets the right using the specified node.
96     /// </para>
97     /// <para></para>
98     /// </summary>
99     /// <param name="node">
100    /// <para>The node.</para>
101    /// <para></para>
102    /// </param>
103    /// <returns>
104    /// <para>The link</para>
105    /// <para></para>
106    /// </returns>
107    [MethodImpl(MethodImplOptions.AggressiveInlining)]
108    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsSource;
109
110    /// <summary>
111    /// <para>
112    /// Sets the left using the specified node.
113    /// </para>
114    /// <para></para>
115    /// </summary>
116    /// <param name="node">
117    /// <para>The node.</para>
118    /// <para></para>
119    /// </param>
120    /// <param name="left">
121    /// <para>The left.</para>
122    /// <para></para>
123    /// </param>
124    [MethodImpl(MethodImplOptions.AggressiveInlining)]
125    protected override void SetLeft(TLink node, TLink left) =>
126        ↪ LinksIndexParts[node].LeftAsSource = left;
127
128    /// <summary>
129    /// <para>
130    /// Sets the right using the specified node.
131    /// </para>
132    /// <para></para>
133    /// </summary>
134    /// <param name="node">
135    /// <para>The node.</para>
136    /// <para></para>
137    /// </param>
138    /// <param name="right">
139    /// <para>The right.</para>
140    /// <para></para>
141    /// </param>
142    [MethodImpl(MethodImplOptions.AggressiveInlining)]
143    protected override void SetRight(TLink node, TLink right) =>
144        ↪ LinksIndexParts[node].RightAsSource = right;
145
146    /// <summary>
147    /// <para>
148    /// Gets the size using the specified node.
149    /// </para>
150    /// <para></para>
151    /// </summary>
152    /// <param name="node">
153    /// <para>The node.</para>
154    /// <para></para>
155    /// </param>
156    /// <returns>
157    /// <para>The link</para>
158    /// <para></para>
159    /// </returns>
160    [MethodImpl(MethodImplOptions.AggressiveInlining)]
161    protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsSource;
162
163    /// <summary>
164    /// <para>
165    /// Sets the size using the specified node.

```

```

164    /// </para>
165    /// <para></para>
166    /// </summary>
167    /// <param name="node">
168    /// <para>The node.</para>
169    /// <para></para>
170    /// </param>
171    /// <param name="size">
172    /// <para>The size.</para>
173    /// <para></para>
174    /// </param>
175    [MethodImpl(MethodImplOptions.AggressiveInlining)]
176    protected override void SetSize(TLink node, TLink size) =>
177        ↳ LinksIndexParts[node].SizeAsSource = size;
178
179    /// <summary>
180    /// <para>
181    /// Gets the tree root.
182    /// </para>
183    /// <para></para>
184    /// </summary>
185    /// <returns>
186    /// <para>The link</para>
187    /// <para></para>
188    /// </returns>
189    [MethodImpl(MethodImplOptions.AggressiveInlining)]
190    protected override TLink GetTreeRoot() => Header->RootAsSource;
191
192    /// <summary>
193    /// <para>
194    /// Gets the base part value using the specified node.
195    /// </para>
196    /// <para></para>
197    /// </summary>
198    /// <param name="node">
199    /// <para>The node.</para>
200    /// <para></para>
201    /// </param>
202    /// <returns>
203    /// <para>The link</para>
204    /// <para></para>
205    /// </returns>
206    [MethodImpl(MethodImplOptions.AggressiveInlining)]
207    protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Source;
208
209    /// <summary>
210    /// <para>
211    /// Determines whether this instance first is to the left of second.
212    /// </para>
213    /// <para></para>
214    /// </summary>
215    /// <param name="firstSource">
216    /// <para>The first source.</para>
217    /// <para></para>
218    /// </param>
219    /// <param name="firstTarget">
220    /// <para>The first target.</para>
221    /// <para></para>
222    /// </param>
223    /// <param name="secondSource">
224    /// <para>The second source.</para>
225    /// <para></para>
226    /// </param>
227    /// <param name="secondTarget">
228    /// <para>The second target.</para>
229    /// <para></para>
230    /// </param>
231    /// <returns>
232    /// <para>The bool</para>
233    /// <para></para>
234    /// </returns>
235    [MethodImpl(MethodImplOptions.AggressiveInlining)]
236    protected override bool FirstIsToTheLeftOfSecond(TLink firstSource, TLink firstTarget,
237        ↳ TLink secondSource, TLink secondTarget)
238        ↳ => firstSource < secondSource || firstSource == secondSource && firstTarget <
239            ↳ secondTarget;
240
241    /// <summary>

```

```

239     /// <para>
240     /// Determines whether this instance first is to the right of second.
241     /// </para>
242     /// <para></para>
243     /// </summary>
244     /// <param name="firstSource">
245     /// <para>The first source.</para>
246     /// <para></para>
247     /// </param>
248     /// <param name="firstTarget">
249     /// <para>The first target.</para>
250     /// <para></para>
251     /// </param>
252     /// <param name="secondSource">
253     /// <para>The second source.</para>
254     /// <para></para>
255     /// </param>
256     /// <param name="secondTarget">
257     /// <para>The second target.</para>
258     /// <para></para>
259     /// </param>
260     /// <returns>
261     /// <para>The bool</para>
262     /// <para></para>
263     /// </returns>
264     [MethodImpl(MethodImplOptions.AggressiveInlining)]
265     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
266         ↪ TLink secondSource, TLink secondTarget)
267         => firstSource > secondSource || firstSource == secondSource && firstTarget >
268         ↪ secondTarget;
269
270     /// <summary>
271     /// <para>
272     /// Clears the node using the specified node.
273     /// </para>
274     /// <para></para>
275     /// </summary>
276     /// <param name="node">
277     /// <para>The node.</para>
278     /// <para></para>
279     /// </param>
280     [MethodImpl(MethodImplOptions.AggressiveInlining)]
281     protected override void ClearNode(TLink node)
282     {
283         ref var link = ref LinksIndexParts[node];
284         link.LeftAsSource = Zero;
285         link.RightAsSource = Zero;
286         link.SizeAsSource = Zero;
287     }
288 }

```

## 1.50 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32ExternalLinksSourcesSizeBalancedTreeMethods

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt32;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 32 external links sources size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt32ExternalLinksSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt32ExternalLinksSourcesSizeBalancedTreeMethods :
16         ↪ UInt32ExternalLinksSizeBalancedTreeMethodsBase
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see cref="UInt32ExternalLinksSourcesSizeBalancedTreeMethods"/>
21         ↪ instance.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         /// <param name="constants">

```

```

24    /// <para>A constants.</para>
25    /// <para></para>
26    /// </param>
27    /// <param name="linksDataParts">
28    /// <para>A links data parts.</para>
29    /// <para></para>
30    /// </param>
31    /// <param name="linksIndexParts">
32    /// <para>A links index parts.</para>
33    /// <para></para>
34    /// </param>
35    /// <param name="header">
36    /// <para>A header.</para>
37    /// <para></para>
38    /// </param>
39    [MethodImpl(MethodImplOptions.AggressiveInlining)]
40    public UInt32ExternalLinksSourcesSizeBalancedTreeMethods(LinksConstants<TLink>
    ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
    ↪ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
    ↪ linksIndexParts, header) { }

41
42    /// <summary>
43    /// <para>
44    /// Gets the left reference using the specified node.
45    /// </para>
46    /// <para></para>
47    /// </summary>
48    /// <param name="node">
49    /// <para>The node.</para>
50    /// <para></para>
51    /// </param>
52    /// <returns>
53    /// <para>The ref link</para>
54    /// <para></para>
55    /// </returns>
56    [MethodImpl(MethodImplOptions.AggressiveInlining)]
57    protected override ref TLink GetLeftReference(TLink node) => ref
    ↪ LinksIndexParts[node].LeftAsSource;

58
59    /// <summary>
60    /// <para>
61    /// Gets the right reference using the specified node.
62    /// </para>
63    /// <para></para>
64    /// </summary>
65    /// <param name="node">
66    /// <para>The node.</para>
67    /// <para></para>
68    /// </param>
69    /// <returns>
70    /// <para>The ref link</para>
71    /// <para></para>
72    /// </returns>
73    [MethodImpl(MethodImplOptions.AggressiveInlining)]
74    protected override ref TLink GetRightReference(TLink node) => ref
    ↪ LinksIndexParts[node].RightAsSource;

75
76    /// <summary>
77    /// <para>
78    /// Gets the left using the specified node.
79    /// </para>
80    /// <para></para>
81    /// </summary>
82    /// <param name="node">
83    /// <para>The node.</para>
84    /// <para></para>
85    /// </param>
86    /// <returns>
87    /// <para>The link</para>
88    /// <para></para>
89    /// </returns>
90    [MethodImpl(MethodImplOptions.AggressiveInlining)]
91    protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsSource;
92
93    /// <summary>
94    /// <para>
95    /// Gets the right using the specified node.
96    /// </para>

```



```

97     /// <para></para>
98     /// </summary>
99     /// <param name="node">
100    /// <para>The node.</para>
101    /// <para></para>
102    /// </param>
103    /// <returns>
104    /// <para>The link</para>
105    /// <para></para>
106    /// </returns>
107    [MethodImpl(MethodImplOptions.AggressiveInlining)]
108    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsSource;
109
110    /// <summary>
111    /// <para>
112    /// Sets the left using the specified node.
113    /// </para>
114    /// <para></para>
115    /// </summary>
116    /// <param name="node">
117    /// <para>The node.</para>
118    /// <para></para>
119    /// </param>
120    /// <param name="left">
121    /// <para>The left.</para>
122    /// <para></para>
123    /// </param>
124    [MethodImpl(MethodImplOptions.AggressiveInlining)]
125    protected override void SetLeft(TLink node, TLink left) =>
126        ↳ LinksIndexParts[node].LeftAsSource = left;
127
128    /// <summary>
129    /// <para>
130    /// Sets the right using the specified node.
131    /// </para>
132    /// <para></para>
133    /// </summary>
134    /// <param name="node">
135    /// <para>The node.</para>
136    /// <para></para>
137    /// </param>
138    /// <param name="right">
139    /// <para>The right.</para>
140    /// <para></para>
141    /// </param>
142    [MethodImpl(MethodImplOptions.AggressiveInlining)]
143    protected override void SetRight(TLink node, TLink right) =>
144        ↳ LinksIndexParts[node].RightAsSource = right;
145
146    /// <summary>
147    /// <para>
148    /// Gets the size using the specified node.
149    /// </para>
150    /// <para></para>
151    /// </summary>
152    /// <param name="node">
153    /// <para>The node.</para>
154    /// <para></para>
155    /// </param>
156    /// <returns>
157    /// <para>The link</para>
158    /// <para></para>
159    /// </returns>
160    [MethodImpl(MethodImplOptions.AggressiveInlining)]
161    protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsSource;
162
163    /// <summary>
164    /// <para>
165    /// Sets the size using the specified node.
166    /// </para>
167    /// <para></para>
168    /// </summary>
169    /// <param name="node">
170    /// <para>The node.</para>
171    /// <para></para>
172    /// </param>
173    /// <param name="size">
174    /// <para>The size.</para>

```

```

173     /// <para></para>
174     /// </param>
175     [MethodImpl(MethodImplOptions.AggressiveInlining)]
176     protected override void SetSize(TLink node, TLink size) =>
177         ↳ LinksIndexParts[node].SizeAsSource = size;
178
179     /// <summary>
180     /// <para>
181     /// Gets the tree root.
182     /// </para>
183     /// </summary>
184     /// <returns>
185     /// <para>The link</para>
186     /// </returns>
187     [MethodImpl(MethodImplOptions.AggressiveInlining)]
188     protected override TLink GetTreeRoot() => Header->RootAsSource;
189
190     /// <summary>
191     /// <para>
192     /// Gets the base part value using the specified node.
193     /// </para>
194     /// <para></para>
195     /// </summary>
196     /// <param name="node">
197     /// <para>The node.</para>
198     /// </param>
199     /// <returns>
200     /// <para>The link</para>
201     /// </returns>
202     [MethodImpl(MethodImplOptions.AggressiveInlining)]
203     protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Source;
204
205     /// <summary>
206     /// <para>
207     /// Determines whether this instance first is to the left of second.
208     /// </para>
209     /// <para></para>
210     /// </summary>
211     /// <param name="firstSource">
212     /// <para>The first source.</para>
213     /// </param>
214     /// <param name="firstTarget">
215     /// <para>The first target.</para>
216     /// </param>
217     /// <param name="secondSource">
218     /// <para>The second source.</para>
219     /// </param>
220     /// <param name="secondTarget">
221     /// <para>The second target.</para>
222     /// </param>
223     /// <returns>
224     /// <para>The bool</para>
225     /// </returns>
226     [MethodImpl(MethodImplOptions.AggressiveInlining)]
227     protected override bool FirstIsToTheLeftOfSecond(TLink firstSource, TLink firstTarget,
228         ↳ TLink secondSource, TLink secondTarget)
229         => firstSource < secondSource || firstSource == secondSource && firstTarget <
230             ↳ secondTarget;
231
232     /// <summary>
233     /// <para>
234     /// Determines whether this instance first is to the right of second.
235     /// </para>
236     /// <para></para>
237     /// </summary>
238     /// <param name="firstSource">
239     /// <para>The first source.</para>
240     /// </param>

```

```

248     /// <param name="firstTarget">
249     /// <para>The first target.</para>
250     /// <para></para>
251     /// </param>
252     /// <param name="secondSource">
253     /// <para>The second source.</para>
254     /// <para></para>
255     /// </param>
256     /// <param name="secondTarget">
257     /// <para>The second target.</para>
258     /// <para></para>
259     /// </param>
260     /// <returns>
261     /// <para>The bool</para>
262     /// <para></para>
263     /// </returns>
264     [MethodImpl(MethodImplOptions.AggressiveInlining)]
265     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
266         ↪ TLink secondSource, TLink secondTarget)
267         => firstSource > secondSource || firstSource == secondSource && firstTarget >
268         ↪ secondTarget;
269
270     /// <summary>
271     /// <para>
272     /// Clears the node using the specified node.
273     /// </para>
274     /// <para></para>
275     /// </summary>
276     /// <param name="node">
277     /// <para>The node.</para>
278     /// <para></para>
279     /// </param>
280     [MethodImpl(MethodImplOptions.AggressiveInlining)]
281     protected override void ClearNode(TLink node)
282     {
283         ref var link = ref LinksIndexParts[node];
284         link.LeftAsSource = Zero;
285         link.RightAsSource = Zero;
286         link.SizeAsSource = Zero;
287     }
288 }

```

## 1.51 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32ExternalLinksTargetsRecursionlessSizeBalancedTreeMethodsBase

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt32;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 32 external links targets recursionless size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt32ExternalLinksRecursionlessSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt32ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods :
16         ↪ UInt32ExternalLinksRecursionlessSizeBalancedTreeMethodsBase
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see
21         ↪ cref="UInt32ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods"/> instance.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         /// <param name="constants">
26         /// <para>A constants.</para>
27         /// <para></para>
28         /// </param>
29         /// <param name="linksDataParts">
30         /// <para>A links data parts.</para>
31         /// <para></para>
32         /// </param>
33         /// <param name="linksIndexParts">
34         /// <para>A links index parts.</para>

```

```

33    /// <para></para>
34    /// </param>
35    /// <param name="header">
36    /// <para>A header.</para>
37    /// <para></para>
38    /// </param>
39    [MethodImpl(MethodImplOptions.AggressiveInlining)]
40    public
41    ↪ UInt32ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
42    ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
43    ↪ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
44    ↪ linksIndexParts, header) { }
45
46    /// <summary>
47    /// <para>
48    /// Gets the left reference using the specified node.
49    /// </para>
50    /// <para></para>
51    /// </summary>
52    /// <param name="node">
53    /// <para>The node.</para>
54    /// <para></para>
55    /// </param>
56    /// <returns>
57    /// <para>The ref link</para>
58    /// <para></para>
59    /// </returns>
60    [MethodImpl(MethodImplOptions.AggressiveInlining)]
61    protected override ref TLink GetLeftReference(TLink node) => ref
62    ↪ LinksIndexParts[node].LeftAsTarget;
63
64    /// <summary>
65    /// <para>
66    /// Gets the right reference using the specified node.
67    /// </para>
68    /// <para></para>
69    /// </summary>
70    /// <param name="node">
71    /// <para>The node.</para>
72    /// <para></para>
73    /// </param>
74    /// <returns>
75    /// <para>The ref link</para>
76    /// <para></para>
77    /// </returns>
78    [MethodImpl(MethodImplOptions.AggressiveInlining)]
79    protected override ref TLink GetRightReference(TLink node) => ref
80    ↪ LinksIndexParts[node].RightAsTarget;
81
82    /// <summary>
83    /// <para>
84    /// Gets the left using the specified node.
85    /// </para>
86    /// <para></para>
87    /// </summary>
88    /// <param name="node">
89    /// <para>The node.</para>
90    /// <para></para>
91    /// </param>
92    /// <returns>
93    /// <para>The link</para>
94    /// <para></para>
95    /// </returns>
96    [MethodImpl(MethodImplOptions.AggressiveInlining)]
97    protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsTarget;
98
99    /// <summary>
100    /// <para>
101    /// Gets the right using the specified node.
102    /// </para>
103    /// <para></para>
104    /// </summary>
105    /// <param name="node">
106    /// <para>The node.</para>
107    /// <para></para>
108    /// </param>
109    /// <returns>
110    /// <para>The link</para>

```

```

105     /// <para></para>
106     /// </returns>
107     [MethodImpl(MethodImplOptions.AggressiveInlining)]
108     protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsTarget;
109
110     /// <summary>
111     /// <para>
112     /// Sets the left using the specified node.
113     /// </para>
114     /// <para></para>
115     /// </summary>
116     /// <param name="node">
117     /// <para>The node.</para>
118     /// <para></para>
119     /// </param>
120     /// <param name="left">
121     /// <para>The left.</para>
122     /// <para></para>
123     /// </param>
124     [MethodImpl(MethodImplOptions.AggressiveInlining)]
125     protected override void SetLeft(TLink node, TLink left) =>
126         ↪ LinksIndexParts[node].LeftAsTarget = left;
127
128     /// <summary>
129     /// <para>
130     /// Sets the right using the specified node.
131     /// </para>
132     /// <para></para>
133     /// </summary>
134     /// <param name="node">
135     /// <para>The node.</para>
136     /// <para></para>
137     /// </param>
138     /// <param name="right">
139     /// <para>The right.</para>
140     /// <para></para>
141     /// </param>
142     [MethodImpl(MethodImplOptions.AggressiveInlining)]
143     protected override void SetRight(TLink node, TLink right) =>
144         ↪ LinksIndexParts[node].RightAsTarget = right;
145
146     /// <summary>
147     /// <para>
148     /// Gets the size using the specified node.
149     /// </para>
150     /// <para></para>
151     /// </summary>
152     /// <param name="node">
153     /// <para>The node.</para>
154     /// <para></para>
155     /// </param>
156     /// <returns>
157     /// <para>The link</para>
158     /// <para></para>
159     /// </returns>
160     [MethodImpl(MethodImplOptions.AggressiveInlining)]
161     protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsTarget;
162
163     /// <summary>
164     /// <para>
165     /// Sets the size using the specified node.
166     /// </para>
167     /// <para></para>
168     /// </summary>
169     /// <param name="node">
170     /// <para>The node.</para>
171     /// <para></para>
172     /// </param>
173     /// <param name="size">
174     /// <para>The size.</para>
175     /// <para></para>
176     /// </param>
177     [MethodImpl(MethodImplOptions.AggressiveInlining)]
178     protected override void SetSize(TLink node, TLink size) =>
179         ↪ LinksIndexParts[node].SizeAsTarget = size;

```

```

180    /// Gets the tree root.
181    /// </para>
182    /// <para></para>
183    /// </summary>
184    /// <returns>
185    /// <para>The link</para>
186    /// <para></para>
187    /// </returns>
188    [MethodImpl(MethodImplOptions.AggressiveInlining)]
189    protected override TLink GetTreeRoot() => Header->RootAsTarget;
190
191    /// <summary>
192    /// <para>
193    /// Gets the base part value using the specified node.
194    /// </para>
195    /// <para></para>
196    /// </summary>
197    /// <param name="node">
198    /// <para>The node.</para>
199    /// <para></para>
200    /// </param>
201    /// <returns>
202    /// <para>The link</para>
203    /// <para></para>
204    /// </returns>
205    [MethodImpl(MethodImplOptions.AggressiveInlining)]
206    protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Target;
207
208    /// <summary>
209    /// <para>
210    /// Determines whether this instance first is to the left of second.
211    /// </para>
212    /// <para></para>
213    /// </summary>
214    /// <param name="firstSource">
215    /// <para>The first source.</para>
216    /// <para></para>
217    /// </param>
218    /// <param name="firstTarget">
219    /// <para>The first target.</para>
220    /// <para></para>
221    /// </param>
222    /// <param name="secondSource">
223    /// <para>The second source.</para>
224    /// <para></para>
225    /// </param>
226    /// <param name="secondTarget">
227    /// <para>The second target.</para>
228    /// <para></para>
229    /// </param>
230    /// <returns>
231    /// <para>The bool</para>
232    /// <para></para>
233    /// </returns>
234    [MethodImpl(MethodImplOptions.AggressiveInlining)]
235    protected override bool FirstIsToLeftOfSecond(TLink firstSource, TLink firstTarget,
236    ↪ TLink secondSource, TLink secondTarget)
237    => firstTarget < secondTarget || firstTarget == secondTarget && firstSource <
238    ↪ secondSource;
239
240    /// <summary>
241    /// <para>
242    /// Determines whether this instance first is to the right of second.
243    /// </para>
244    /// <para></para>
245    /// </summary>
246    /// <param name="firstSource">
247    /// <para>The first source.</para>
248    /// <para></para>
249    /// </param>
250    /// <param name="firstTarget">
251    /// <para>The first target.</para>
252    /// <para></para>
253    /// </param>
254    /// <param name="secondSource">
255    /// <para>The second source.</para>
256    /// <para></para>
257    /// </param>

```

```

256     /// <param name="secondTarget">
257     /// <para>The second target.</para>
258     /// <para></para>
259     /// </param>
260     /// <returns>
261     /// <para>The bool</para>
262     /// <para></para>
263     /// </returns>
264     [MethodImpl(MethodImplOptions.AggressiveInlining)]
265     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
    ↪ TLink secondSource, TLink secondTarget)
266     => firstTarget > secondTarget || firstTarget == secondTarget && firstSource >
    ↪ secondSource;

267     /// <summary>
268     /// <para>
269     /// Clears the node using the specified node.
270     /// </para>
271     /// <para></para>
272     /// </summary>
273     /// <param name="node">
274     /// <para>The node.</para>
275     /// <para></para>
276     /// </param>
277     [MethodImpl(MethodImplOptions.AggressiveInlining)]
278     protected override void ClearNode(TLink node)
279     {
280     {
281         ref var link = ref LinksIndexParts[node];
282         link.LeftAsTarget = Zero;
283         link.RightAsTarget = Zero;
284         link.SizeAsTarget = Zero;
285     }
286     }
287 }

```

## 1.52 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32ExternalLinksTargetsSizeBalancedTreeMethods

```

1 using System.Runtime.CompilerServices;
2 using TLink = System.UInt32;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6 namespace Platform.Data.Doublets.Memory.Split.Specific
7 {
8     /// <summary>
9     /// <para>
10     /// Represents the int 32 external links targets size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt32ExternalLinksSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt32ExternalLinksTargetsSizeBalancedTreeMethods :
    ↪ UInt32ExternalLinksSizeBalancedTreeMethodsBase
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="UInt32ExternalLinksTargetsSizeBalancedTreeMethods"/>
    ↪ instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="constants">
24         /// <para>A constants.</para>
25         /// <para></para>
26         /// </param>
27         /// <param name="linksDataParts">
28         /// <para>A links data parts.</para>
29         /// <para></para>
30         /// </param>
31         /// <param name="linksIndexParts">
32         /// <para>A links index parts.</para>
33         /// <para></para>
34         /// </param>
35         /// <param name="header">
36         /// <para>A header.</para>
37         /// <para></para>
38         /// </param>
39         [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

40 public UInt32ExternalLinksTargetsSizeBalancedTreeMethods(LinksConstants<TLink>
    ↳ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
    ↳ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
    ↳ linksIndexParts, header) { }
41
42 /// <summary>
43 /// <para>
44 /// Gets the left reference using the specified node.
45 /// </para>
46 /// <para></para>
47 /// </summary>
48 /// <param name="node">
49 /// <para>The node.</para>
50 /// <para></para>
51 /// </param>
52 /// <returns>
53 /// <para>The ref link</para>
54 /// <para></para>
55 /// </returns>
56 [MethodImpl(MethodImplOptions.AggressiveInlining)]
57 protected override ref TLink GetLeftReference(TLink node) => ref
    ↳ LinksIndexParts[node].LeftAsTarget;
58
59 /// <summary>
60 /// <para>
61 /// Gets the right reference using the specified node.
62 /// </para>
63 /// <para></para>
64 /// </summary>
65 /// <param name="node">
66 /// <para>The node.</para>
67 /// <para></para>
68 /// </param>
69 /// <returns>
70 /// <para>The ref link</para>
71 /// <para></para>
72 /// </returns>
73 [MethodImpl(MethodImplOptions.AggressiveInlining)]
74 protected override ref TLink GetRightReference(TLink node) => ref
    ↳ LinksIndexParts[node].RightAsTarget;
75
76 /// <summary>
77 /// <para>
78 /// Gets the left using the specified node.
79 /// </para>
80 /// <para></para>
81 /// </summary>
82 /// <param name="node">
83 /// <para>The node.</para>
84 /// <para></para>
85 /// </param>
86 /// <returns>
87 /// <para>The link</para>
88 /// <para></para>
89 /// </returns>
90 [MethodImpl(MethodImplOptions.AggressiveInlining)]
91 protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsTarget;
92
93 /// <summary>
94 /// <para>
95 /// Gets the right using the specified node.
96 /// </para>
97 /// <para></para>
98 /// </summary>
99 /// <param name="node">
100 /// <para>The node.</para>
101 /// <para></para>
102 /// </param>
103 /// <returns>
104 /// <para>The link</para>
105 /// <para></para>
106 /// </returns>
107 [MethodImpl(MethodImplOptions.AggressiveInlining)]
108 protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsTarget;
109
110 /// <summary>
111 /// <para>
112 /// Sets the left using the specified node.

```



```

113     /// </para>
114     /// <para></para>
115     /// </summary>
116     /// <param name="node">
117     /// <para>The node.</para>
118     /// <para></para>
119     /// </param>
120     /// <param name="left">
121     /// <para>The left.</para>
122     /// <para></para>
123     /// </param>
124     [MethodImpl(MethodImplOptions.AggressiveInlining)]
125     protected override void SetLeft(TLink node, TLink left) =>
126         ↪ LinksIndexParts[node].LeftAsTarget = left;
127
128     /// <summary>
129     /// <para>
130     /// Sets the right using the specified node.
131     /// </para>
132     /// <para></para>
133     /// </summary>
134     /// <param name="node">
135     /// <para>The node.</para>
136     /// <para></para>
137     /// </param>
138     /// <param name="right">
139     /// <para>The right.</para>
140     /// <para></para>
141     /// </param>
142     [MethodImpl(MethodImplOptions.AggressiveInlining)]
143     protected override void SetRight(TLink node, TLink right) =>
144         ↪ LinksIndexParts[node].RightAsTarget = right;
145
146     /// <summary>
147     /// <para>
148     /// Gets the size using the specified node.
149     /// </para>
150     /// <para></para>
151     /// </summary>
152     /// <param name="node">
153     /// <para>The node.</para>
154     /// <para></para>
155     /// </param>
156     /// <returns>
157     /// <para>The link</para>
158     /// <para></para>
159     /// </returns>
160     [MethodImpl(MethodImplOptions.AggressiveInlining)]
161     protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsTarget;
162
163     /// <summary>
164     /// <para>
165     /// Sets the size using the specified node.
166     /// </para>
167     /// <para></para>
168     /// </summary>
169     /// <param name="node">
170     /// <para>The node.</para>
171     /// <para></para>
172     /// </param>
173     /// <param name="size">
174     /// <para>The size.</para>
175     /// <para></para>
176     /// </param>
177     [MethodImpl(MethodImplOptions.AggressiveInlining)]
178     protected override void SetSize(TLink node, TLink size) =>
179         ↪ LinksIndexParts[node].SizeAsTarget = size;
180
181     /// <summary>
182     /// <para>
183     /// Gets the tree root.
184     /// </para>
185     /// <para></para>
186     /// </summary>
187     /// <returns>
188     /// <para>The link</para>
189     /// <para></para>
190     /// </returns>

```

```

188 [MethodImpl(MethodImplOptions.AggressiveInlining)]
189 protected override TLink GetTreeRoot() => Header->RootAsTarget;
190
191 /// <summary>
192 /// <para>
193 /// Gets the base part value using the specified node.
194 /// </para>
195 /// <para></para>
196 /// </summary>
197 /// <param name="node">
198 /// <para>The node.</para>
199 /// <para></para>
200 /// </param>
201 /// <returns>
202 /// <para>The link</para>
203 /// <para></para>
204 /// </returns>
205 [MethodImpl(MethodImplOptions.AggressiveInlining)]
206 protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Target;
207
208 /// <summary>
209 /// <para>
210 /// Determines whether this instance first is to the left of second.
211 /// </para>
212 /// <para></para>
213 /// </summary>
214 /// <param name="firstSource">
215 /// <para>The first source.</para>
216 /// <para></para>
217 /// </param>
218 /// <param name="firstTarget">
219 /// <para>The first target.</para>
220 /// <para></para>
221 /// </param>
222 /// <param name="secondSource">
223 /// <para>The second source.</para>
224 /// <para></para>
225 /// </param>
226 /// <param name="secondTarget">
227 /// <para>The second target.</para>
228 /// <para></para>
229 /// </param>
230 /// <returns>
231 /// <para>The bool</para>
232 /// <para></para>
233 /// </returns>
234 [MethodImpl(MethodImplOptions.AggressiveInlining)]
235 protected override bool FirstIsToLeftOfSecond(TLink firstSource, TLink firstTarget,
236     ↪ TLink secondSource, TLink secondTarget)
237     => firstTarget < secondTarget || firstTarget == secondTarget && firstSource <
238     ↪ secondSource;
239
240 /// <summary>
241 /// <para>
242 /// Determines whether this instance first is to the right of second.
243 /// </para>
244 /// <para></para>
245 /// </summary>
246 /// <param name="firstSource">
247 /// <para>The first source.</para>
248 /// <para></para>
249 /// </param>
250 /// <param name="firstTarget">
251 /// <para>The first target.</para>
252 /// <para></para>
253 /// </param>
254 /// <param name="secondSource">
255 /// <para>The second source.</para>
256 /// <para></para>
257 /// </param>
258 /// <param name="secondTarget">
259 /// <para>The second target.</para>
260 /// <para></para>
261 /// </param>
262 /// <returns>
263 /// <para>The bool</para>
264 /// <para></para>
265 /// </returns>

```

```

264 [MethodImpl(MethodImplOptions.AggressiveInlining)]
265 protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
    ↳ TLink secondSource, TLink secondTarget)
266 => firstTarget > secondTarget || firstTarget == secondTarget && firstSource >
    ↳ secondSource;
267
268 /// <summary>
269 /// <para>
270 /// Clears the node using the specified node.
271 /// </para>
272 /// <para></para>
273 /// </summary>
274 /// <param name="node">
275 /// <para>The node.</para>
276 /// <para></para>
277 /// </param>
278 [MethodImpl(MethodImplOptions.AggressiveInlining)]
279 protected override void ClearNode(TLink node)
280 {
281     ref var link = ref LinksIndexParts[node];
282     link.LeftAsTarget = Zero;
283     link.RightAsTarget = Zero;
284     link.SizeAsTarget = Zero;
285 }
286 }
287 }

```

### 1.53 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32InternalLinksRecursionlessSizeBalancedTreeMethodsBase

```

1 using System.Runtime.CompilerServices;
2 using Platform.Data.Doublets.Memory.Split.Generic;
3 using TLink = System.UInt32;
4
5 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7 namespace Platform.Data.Doublets.Memory.Split.Specific
8 {
9     /// <summary>
10    /// <para>
11    /// Represents the int 32 internal links recursionless size balanced tree methods base.
12    /// </para>
13    /// <para></para>
14    /// </summary>
15    /// <seealso cref="InternalLinksRecursionlessSizeBalancedTreeMethodsBase{TLink}" />
16    public unsafe abstract class UInt32InternalLinksRecursionlessSizeBalancedTreeMethodsBase :
    ↳ InternalLinksRecursionlessSizeBalancedTreeMethodsBase<TLink>
17    {
18        /// <summary>
19        /// <para>
20        /// The links data parts.
21        /// </para>
22        /// <para></para>
23        /// </summary>
24        protected new readonly RawLinkDataPart<TLink>* LinksDataParts;
25        /// <summary>
26        /// <para>
27        /// The links index parts.
28        /// </para>
29        /// <para></para>
30        /// </summary>
31        protected new readonly RawLinkIndexPart<TLink>* LinksIndexParts;
32        /// <summary>
33        /// <para>
34        /// The header.
35        /// </para>
36        /// <para></para>
37        /// </summary>
38        protected new readonly LinksHeader<TLink>* Header;
39
40        /// <summary>
41        /// <para>
42        /// Initializes a new <see
    ↳ cref="UInt32InternalLinksRecursionlessSizeBalancedTreeMethodsBase" /> instance.
43        /// </para>
44        /// <para></para>
45        /// </summary>
46        /// <param name="constants">
47        /// <para>A constants.</para>
48        /// <para></para>
49        /// </param>

```

```

50     /// <param name="linksDataParts">
51     /// <para>A links data parts.</para>
52     /// </para>
53     /// </param>
54     /// <param name="linksIndexParts">
55     /// <para>A links index parts.</para>
56     /// </para>
57     /// </param>
58     /// <param name="header">
59     /// <para>A header.</para>
60     /// </para>
61     /// </param>
62     [MethodImpl(MethodImplOptions.AggressiveInlining)]
63     protected
64     ↪ UInt32 InternalLinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<TLink>
65     ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
66     ↪ linksIndexParts, LinksHeader<TLink>* header)
67     : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
68     {
69         LinksDataParts = linksDataParts;
70         LinksIndexParts = linksIndexParts;
71         Header = header;
72     }
73
74     /// <summary>
75     /// <para>
76     /// Gets the zero.
77     /// </para>
78     /// </summary>
79     /// <returns>
80     /// <para>The link</para>
81     /// </returns>
82     [MethodImpl(MethodImplOptions.AggressiveInlining)]
83     protected override TLink GetZero() => 0U;
84
85     /// <summary>
86     /// <para>
87     /// Determines whether this instance equal to zero.
88     /// </para>
89     /// </summary>
90     /// <param name="value">
91     /// <para>The value.</para>
92     /// </para>
93     /// </param>
94     /// <returns>
95     /// <para>The bool</para>
96     /// </returns>
97     [MethodImpl(MethodImplOptions.AggressiveInlining)]
98     protected override bool EqualToZero(TLink value) => value == 0U;
99
100     /// <summary>
101     /// <para>
102     /// Determines whether this instance are equal.
103     /// </para>
104     /// </summary>
105     /// <param name="first">
106     /// <para>The first.</para>
107     /// </para>
108     /// </param>
109     /// <param name="second">
110     /// <para>The second.</para>
111     /// </para>
112     /// </param>
113     /// <returns>
114     /// <para>The bool</para>
115     /// </returns>
116     [MethodImpl(MethodImplOptions.AggressiveInlining)]
117     protected override bool AreEqual(TLink first, TLink second) => first == second;
118
119     /// <summary>
120     /// <para>
121     /// Determines whether this instance greater than zero.

```

```

125     /// </para>
126     /// <para></para>
127     /// </summary>
128     /// <param name="value">
129     /// <para>The value.</para>
130     /// <para></para>
131     /// </param>
132     /// <returns>
133     /// <para>The bool</para>
134     /// <para></para>
135     /// </returns>
136     [MethodImpl(MethodImplOptions.AggressiveInlining)]
137     protected override bool GreaterThanZero(TLink value) => value > 0U;
138
139     /// <summary>
140     /// <para>
141     /// Determines whether this instance greater than.
142     /// </para>
143     /// <para></para>
144     /// </summary>
145     /// <param name="first">
146     /// <para>The first.</para>
147     /// <para></para>
148     /// </param>
149     /// <param name="second">
150     /// <para>The second.</para>
151     /// <para></para>
152     /// </param>
153     /// <returns>
154     /// <para>The bool</para>
155     /// <para></para>
156     /// </returns>
157     [MethodImpl(MethodImplOptions.AggressiveInlining)]
158     protected override bool GreaterThan(TLink first, TLink second) => first > second;
159
160     /// <summary>
161     /// <para>
162     /// Determines whether this instance greater or equal than.
163     /// </para>
164     /// <para></para>
165     /// </summary>
166     /// <param name="first">
167     /// <para>The first.</para>
168     /// <para></para>
169     /// </param>
170     /// <param name="second">
171     /// <para>The second.</para>
172     /// <para></para>
173     /// </param>
174     /// <returns>
175     /// <para>The bool</para>
176     /// <para></para>
177     /// </returns>
178     [MethodImpl(MethodImplOptions.AggressiveInlining)]
179     protected override bool GreaterOrEqualThan(TLink first, TLink second) => first >= second;
180
181     /// <summary>
182     /// <para>
183     /// Determines whether this instance greater or equal than zero.
184     /// </para>
185     /// <para></para>
186     /// </summary>
187     /// <param name="value">
188     /// <para>The value.</para>
189     /// <para></para>
190     /// </param>
191     /// <returns>
192     /// <para>The bool</para>
193     /// <para></para>
194     /// </returns>
195     [MethodImpl(MethodImplOptions.AggressiveInlining)]
196     protected override bool GreaterOrEqualThanZero(TLink value) => true; // value >= 0 is
197     ↪ always true for ulong
198
199     /// <summary>
200     /// <para>
201     /// Determines whether this instance less or equal than zero.
202     /// </para>

```

```

202     /// <para></para>
203     /// </summary>
204     /// <param name="value">
205     /// <para>The value.</para>
206     /// <para></para>
207     /// </param>
208     /// <returns>
209     /// <para>The bool</para>
210     /// <para></para>
211     /// </returns>
212     [MethodImpl(MethodImplOptions.AggressiveInlining)]
213     protected override bool LessOrEqualThanZero(TLink value) => value == 0UL; // value is
    ↪ always >= 0 for ulong
214
215     /// <summary>
216     /// <para>
217     /// Determines whether this instance less or equal than.
218     /// </para>
219     /// <para></para>
220     /// </summary>
221     /// <param name="first">
222     /// <para>The first.</para>
223     /// <para></para>
224     /// </param>
225     /// <param name="second">
226     /// <para>The second.</para>
227     /// <para></para>
228     /// </param>
229     /// <returns>
230     /// <para>The bool</para>
231     /// <para></para>
232     /// </returns>
233     [MethodImpl(MethodImplOptions.AggressiveInlining)]
234     protected override bool LessOrEqualThan(TLink first, TLink second) => first <= second;
235
236     /// <summary>
237     /// <para>
238     /// Determines whether this instance less than zero.
239     /// </para>
240     /// <para></para>
241     /// </summary>
242     /// <param name="value">
243     /// <para>The value.</para>
244     /// <para></para>
245     /// </param>
246     /// <returns>
247     /// <para>The bool</para>
248     /// <para></para>
249     /// </returns>
250     [MethodImpl(MethodImplOptions.AggressiveInlining)]
251     protected override bool LessThanZero(TLink value) => false; // value < 0 is always false
    ↪ for ulong
252
253     /// <summary>
254     /// <para>
255     /// Determines whether this instance less than.
256     /// </para>
257     /// <para></para>
258     /// </summary>
259     /// <param name="first">
260     /// <para>The first.</para>
261     /// <para></para>
262     /// </param>
263     /// <param name="second">
264     /// <para>The second.</para>
265     /// <para></para>
266     /// </param>
267     /// <returns>
268     /// <para>The bool</para>
269     /// <para></para>
270     /// </returns>
271     [MethodImpl(MethodImplOptions.AggressiveInlining)]
272     protected override bool LessThan(TLink first, TLink second) => first < second;
273
274     /// <summary>
275     /// <para>
276     /// Increments the value.
277     /// </para>

```

```

278     /// <para></para>
279     /// </summary>
280     /// <param name="value">
281     /// <para>The value.</para>
282     /// <para></para>
283     /// </param>
284     /// <returns>
285     /// <para>The link</para>
286     /// <para></para>
287     /// </returns>
288     [MethodImpl(MethodImplOptions.AggressiveInlining)]
289     protected override TLink Increment(TLink value) => ++value;
290
291     /// <summary>
292     /// <para>
293     /// Decrements the value.
294     /// </para>
295     /// <para></para>
296     /// </summary>
297     /// <param name="value">
298     /// <para>The value.</para>
299     /// <para></para>
300     /// </param>
301     /// <returns>
302     /// <para>The link</para>
303     /// <para></para>
304     /// </returns>
305     [MethodImpl(MethodImplOptions.AggressiveInlining)]
306     protected override TLink Decrement(TLink value) => --value;
307
308     /// <summary>
309     /// <para>
310     /// Adds the first.
311     /// </para>
312     /// <para></para>
313     /// </summary>
314     /// <param name="first">
315     /// <para>The first.</para>
316     /// <para></para>
317     /// </param>
318     /// <param name="second">
319     /// <para>The second.</para>
320     /// <para></para>
321     /// </param>
322     /// <returns>
323     /// <para>The link</para>
324     /// <para></para>
325     /// </returns>
326     [MethodImpl(MethodImplOptions.AggressiveInlining)]
327     protected override TLink Add(TLink first, TLink second) => first + second;
328
329     /// <summary>
330     /// <para>
331     /// Subtracts the first.
332     /// </para>
333     /// <para></para>
334     /// </summary>
335     /// <param name="first">
336     /// <para>The first.</para>
337     /// <para></para>
338     /// </param>
339     /// <param name="second">
340     /// <para>The second.</para>
341     /// <para></para>
342     /// </param>
343     /// <returns>
344     /// <para>The link</para>
345     /// <para></para>
346     /// </returns>
347     [MethodImpl(MethodImplOptions.AggressiveInlining)]
348     protected override TLink Subtract(TLink first, TLink second) => first - second;
349
350     /// <summary>
351     /// <para>
352     /// Gets the link data part reference using the specified link.
353     /// </para>
354     /// <para></para>
355     /// </summary>

```

```

356     /// <param name="link">
357     /// <para>The link.</para>
358     /// <para></para>
359     /// </param>
360     /// <returns>
361     /// <para>A ref raw link data part of t link</para>
362     /// <para></para>
363     /// </returns>
364     [MethodImpl(MethodImplOptions.AggressiveInlining)]
365     protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
        ↪ ref LinksDataParts[link];
366
367     /// <summary>
368     /// <para>
369     /// Gets the link index part reference using the specified link.
370     /// </para>
371     /// <para></para>
372     /// </summary>
373     /// <param name="link">
374     /// <para>The link.</para>
375     /// <para></para>
376     /// </param>
377     /// <returns>
378     /// <para>A ref raw link index part of t link</para>
379     /// <para></para>
380     /// </returns>
381     [MethodImpl(MethodImplOptions.AggressiveInlining)]
382     protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
        ↪ ref LinksIndexParts[link];
383
384     /// <summary>
385     /// <para>
386     /// Determines whether this instance first is to the left of second.
387     /// </para>
388     /// <para></para>
389     /// </summary>
390     /// <param name="first">
391     /// <para>The first.</para>
392     /// <para></para>
393     /// </param>
394     /// <param name="second">
395     /// <para>The second.</para>
396     /// <para></para>
397     /// </param>
398     /// <returns>
399     /// <para>The bool</para>
400     /// <para></para>
401     /// </returns>
402     [MethodImpl(MethodImplOptions.AggressiveInlining)]
403     protected override bool FirstIsToLeftOfSecond(TLink first, TLink second) =>
        ↪ GetKeyPartValue(first) < GetKeyPartValue(second);
404
405     /// <summary>
406     /// <para>
407     /// Determines whether this instance first is to the right of second.
408     /// </para>
409     /// <para></para>
410     /// </summary>
411     /// <param name="first">
412     /// <para>The first.</para>
413     /// <para></para>
414     /// </param>
415     /// <param name="second">
416     /// <para>The second.</para>
417     /// <para></para>
418     /// </param>
419     /// <returns>
420     /// <para>The bool</para>
421     /// <para></para>
422     /// </returns>
423     [MethodImpl(MethodImplOptions.AggressiveInlining)]
424     protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second) =>
        ↪ GetKeyPartValue(first) > GetKeyPartValue(second);
425 }
426

```



## 1.54 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32InternalLinksSizeBalancedTreeMethodsBase.

```

1  using System.Runtime.CompilerServices;
2  using Platform.Data.Doublets.Memory.Split.Generic;
3  using TLink = System.UInt32;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Doublets.Memory.Split.Specific
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the int 32 internal links size balanced tree methods base.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     /// <seealso cref="InternalLinksSizeBalancedTreeMethodsBase{TLink}"/>
16     public unsafe abstract class UInt32InternalLinksSizeBalancedTreeMethodsBase :
17     ↪ InternalLinksSizeBalancedTreeMethodsBase<TLink>
18     {
19         /// <summary>
20         /// <para>
21         /// The links data parts.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         protected new readonly RawLinkDataPart<TLink>* LinksDataParts;
26         /// <summary>
27         /// <para>
28         /// The links index parts.
29         /// </para>
30         /// <para></para>
31         /// </summary>
32         protected new readonly RawLinkIndexPart<TLink>* LinksIndexParts;
33         /// <summary>
34         /// <para>
35         /// The header.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         protected new readonly LinksHeader<TLink>* Header;
40
41         /// <summary>
42         /// <para>
43         /// Initializes a new <see cref="UInt32InternalLinksSizeBalancedTreeMethodsBase"/>
44         ↪ instance.
45         /// </para>
46         /// <para></para>
47         /// </summary>
48         /// <param name="constants">
49         /// <para>A constants.</para>
50         /// <para></para>
51         /// </param>
52         /// <param name="linksDataParts">
53         /// <para>A links data parts.</para>
54         /// <para></para>
55         /// </param>
56         /// <param name="linksIndexParts">
57         /// <para>A links index parts.</para>
58         /// <para></para>
59         /// </param>
60         /// <param name="header">
61         /// <para>A header.</para>
62         /// <para></para>
63         /// </param>
64         [MethodImpl(MethodImplOptions.AggressiveInlining)]
65         protected UInt32InternalLinksSizeBalancedTreeMethodsBase(LinksConstants<TLink>
66         ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
67         ↪ linksIndexParts, LinksHeader<TLink>* header)
68         : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
69         {
70             LinksDataParts = linksDataParts;
71             LinksIndexParts = linksIndexParts;
72             Header = header;
73         }
74
75         /// <summary>
76         /// <para>
77         /// Gets the zero.
78         /// </para>

```

```

75     /// <para></para>
76     /// </summary>
77     /// <returns>
78     /// <para>The link</para>
79     /// <para></para>
80     /// </returns>
81     [MethodImpl(MethodImplOptions.AggressiveInlining)]
82     protected override TLink GetZero() => OU;
83
84     /// <summary>
85     /// <para>
86     /// Determines whether this instance equal to zero.
87     /// </para>
88     /// <para></para>
89     /// </summary>
90     /// <param name="value">
91     /// <para>The value.</para>
92     /// <para></para>
93     /// </param>
94     /// <returns>
95     /// <para>The bool</para>
96     /// <para></para>
97     /// </returns>
98     [MethodImpl(MethodImplOptions.AggressiveInlining)]
99     protected override bool EqualToZero(TLink value) => value == OU;
100
101     /// <summary>
102     /// <para>
103     /// Determines whether this instance are equal.
104     /// </para>
105     /// <para></para>
106     /// </summary>
107     /// <param name="first">
108     /// <para>The first.</para>
109     /// <para></para>
110     /// </param>
111     /// <param name="second">
112     /// <para>The second.</para>
113     /// <para></para>
114     /// </param>
115     /// <returns>
116     /// <para>The bool</para>
117     /// <para></para>
118     /// </returns>
119     [MethodImpl(MethodImplOptions.AggressiveInlining)]
120     protected override bool AreEqual(TLink first, TLink second) => first == second;
121
122     /// <summary>
123     /// <para>
124     /// Determines whether this instance greater than zero.
125     /// </para>
126     /// <para></para>
127     /// </summary>
128     /// <param name="value">
129     /// <para>The value.</para>
130     /// <para></para>
131     /// </param>
132     /// <returns>
133     /// <para>The bool</para>
134     /// <para></para>
135     /// </returns>
136     [MethodImpl(MethodImplOptions.AggressiveInlining)]
137     protected override bool GreaterThanZero(TLink value) => value > OU;
138
139     /// <summary>
140     /// <para>
141     /// Determines whether this instance greater than.
142     /// </para>
143     /// <para></para>
144     /// </summary>
145     /// <param name="first">
146     /// <para>The first.</para>
147     /// <para></para>
148     /// </param>
149     /// <param name="second">
150     /// <para>The second.</para>
151     /// <para></para>
152     /// </param>

```

```

153     /// <returns>
154     /// <para>The bool</para>
155     /// <para></para>
156     /// </returns>
157     [MethodImpl(MethodImplOptions.AggressiveInlining)]
158     protected override bool GreaterThan(TLink first, TLink second) => first > second;
159
160     /// <summary>
161     /// <para>
162     /// Determines whether this instance greater or equal than.
163     /// </para>
164     /// <para></para>
165     /// </summary>
166     /// <param name="first">
167     /// <para>The first.</para>
168     /// <para></para>
169     /// </param>
170     /// <param name="second">
171     /// <para>The second.</para>
172     /// <para></para>
173     /// </param>
174     /// <returns>
175     /// <para>The bool</para>
176     /// <para></para>
177     /// </returns>
178     [MethodImpl(MethodImplOptions.AggressiveInlining)]
179     protected override bool GreaterOrEqualThan(TLink first, TLink second) => first >= second;
180
181     /// <summary>
182     /// <para>
183     /// Determines whether this instance greater or equal than zero.
184     /// </para>
185     /// <para></para>
186     /// </summary>
187     /// <param name="value">
188     /// <para>The value.</para>
189     /// <para></para>
190     /// </param>
191     /// <returns>
192     /// <para>The bool</para>
193     /// <para></para>
194     /// </returns>
195     [MethodImpl(MethodImplOptions.AggressiveInlining)]
196     protected override bool GreaterOrEqualThanZero(TLink value) => true; // value >= 0 is
197     ↪ always true for ulong
198
199     /// <summary>
200     /// <para>
201     /// Determines whether this instance less or equal than zero.
202     /// </para>
203     /// <para></para>
204     /// </summary>
205     /// <param name="value">
206     /// <para>The value.</para>
207     /// <para></para>
208     /// </param>
209     /// <returns>
210     /// <para>The bool</para>
211     /// <para></para>
212     /// </returns>
213     [MethodImpl(MethodImplOptions.AggressiveInlining)]
214     protected override bool LessOrEqualThanZero(TLink value) => value == 0UL; // value is
215     ↪ always >= 0 for ulong
216
217     /// <summary>
218     /// <para>
219     /// Determines whether this instance less or equal than.
220     /// </para>
221     /// <para></para>
222     /// </summary>
223     /// <param name="first">
224     /// <para>The first.</para>
225     /// <para></para>
226     /// </param>
227     /// <param name="second">
228     /// <para>The second.</para>
229     /// <para></para>
230     /// </param>

```

```

229    /// <returns>
230    /// <para>The bool</para>
231    /// <para></para>
232    /// </returns>
233    [MethodImpl(MethodImplOptions.AggressiveInlining)]
234    protected override bool LessOrEqualThan(TLink first, TLink second) => first <= second;
235
236    /// <summary>
237    /// <para>
238    /// Determines whether this instance less than zero.
239    /// </para>
240    /// <para></para>
241    /// </summary>
242    /// <param name="value">
243    /// <para>The value.</para>
244    /// <para></para>
245    /// </param>
246    /// <returns>
247    /// <para>The bool</para>
248    /// <para></para>
249    /// </returns>
250    [MethodImpl(MethodImplOptions.AggressiveInlining)]
251    protected override bool LessThanZero(TLink value) => false; // value < 0 is always false
    ↪ for ulong
252
253    /// <summary>
254    /// <para>
255    /// Determines whether this instance less than.
256    /// </para>
257    /// <para></para>
258    /// </summary>
259    /// <param name="first">
260    /// <para>The first.</para>
261    /// <para></para>
262    /// </param>
263    /// <param name="second">
264    /// <para>The second.</para>
265    /// <para></para>
266    /// </param>
267    /// <returns>
268    /// <para>The bool</para>
269    /// <para></para>
270    /// </returns>
271    [MethodImpl(MethodImplOptions.AggressiveInlining)]
272    protected override bool LessThan(TLink first, TLink second) => first < second;
273
274    /// <summary>
275    /// <para>
276    /// Increments the value.
277    /// </para>
278    /// <para></para>
279    /// </summary>
280    /// <param name="value">
281    /// <para>The value.</para>
282    /// <para></para>
283    /// </param>
284    /// <returns>
285    /// <para>The link</para>
286    /// <para></para>
287    /// </returns>
288    [MethodImpl(MethodImplOptions.AggressiveInlining)]
289    protected override TLink Increment(TLink value) => ++value;
290
291    /// <summary>
292    /// <para>
293    /// Decrements the value.
294    /// </para>
295    /// <para></para>
296    /// </summary>
297    /// <param name="value">
298    /// <para>The value.</para>
299    /// <para></para>
300    /// </param>
301    /// <returns>
302    /// <para>The link</para>
303    /// <para></para>
304    /// </returns>
305    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

306     protected override TLink Decrement(TLink value) => --value;
307
308     /// <summary>
309     /// <para>
310     /// Adds the first.
311     /// </para>
312     /// <para></para>
313     /// </summary>
314     /// <param name="first">
315     /// <para>The first.</para>
316     /// <para></para>
317     /// </param>
318     /// <param name="second">
319     /// <para>The second.</para>
320     /// <para></para>
321     /// </param>
322     /// <returns>
323     /// <para>The link</para>
324     /// <para></para>
325     /// </returns>
326     [MethodImpl(MethodImplOptions.AggressiveInlining)]
327     protected override TLink Add(TLink first, TLink second) => first + second;
328
329     /// <summary>
330     /// <para>
331     /// Subtracts the first.
332     /// </para>
333     /// <para></para>
334     /// </summary>
335     /// <param name="first">
336     /// <para>The first.</para>
337     /// <para></para>
338     /// </param>
339     /// <param name="second">
340     /// <para>The second.</para>
341     /// <para></para>
342     /// </param>
343     /// <returns>
344     /// <para>The link</para>
345     /// <para></para>
346     /// </returns>
347     [MethodImpl(MethodImplOptions.AggressiveInlining)]
348     protected override TLink Subtract(TLink first, TLink second) => first - second;
349
350     /// <summary>
351     /// <para>
352     /// Gets the link data part reference using the specified link.
353     /// </para>
354     /// <para></para>
355     /// </summary>
356     /// <param name="link">
357     /// <para>The link.</para>
358     /// <para></para>
359     /// </param>
360     /// <returns>
361     /// <para>A ref raw link data part of t link</para>
362     /// <para></para>
363     /// </returns>
364     [MethodImpl(MethodImplOptions.AggressiveInlining)]
365     protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
366     ↪ ref LinksDataParts[link];
367
368     /// <summary>
369     /// <para>
370     /// Gets the link index part reference using the specified link.
371     /// </para>
372     /// <para></para>
373     /// </summary>
374     /// <param name="link">
375     /// <para>The link.</para>
376     /// <para></para>
377     /// </param>
378     /// <returns>
379     /// <para>A ref raw link index part of t link</para>
380     /// <para></para>
381     /// </returns>
382     [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

382     protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
383         ↪ ref LinksIndexParts[link];
384
385     /// <summary>
386     /// <para>
387     /// Determines whether this instance first is to the left of second.
388     /// </para>
389     /// </summary>
390     /// <param name="first">
391     /// <para>The first.</para>
392     /// </param>
393     /// <param name="second">
394     /// <para>The second.</para>
395     /// </param>
396     /// <returns>
397     /// <para>The bool</para>
398     /// </returns>
399     [MethodImpl(MethodImplOptions.AggressiveInlining)]
400     protected override bool FirstIsToLeftOfSecond(TLink first, TLink second) =>
401         ↪ GetKeyPartValue(first) < GetKeyPartValue(second);
402
403     /// <summary>
404     /// <para>
405     /// Determines whether this instance first is to the right of second.
406     /// </para>
407     /// </summary>
408     /// <param name="first">
409     /// <para>The first.</para>
410     /// </param>
411     /// <param name="second">
412     /// <para>The second.</para>
413     /// </param>
414     /// <returns>
415     /// <para>The bool</para>
416     /// </returns>
417     [MethodImpl(MethodImplOptions.AggressiveInlining)]
418     protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second) =>
419         ↪ GetKeyPartValue(first) > GetKeyPartValue(second);
420 }
421 }
422 }

```

## 1.55 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32InternalLinksSourcesLinkedListMethods.cs

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt32;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Generic
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 32 internal links sources linked list methods.
11     /// </para>
12     /// </summary>
13     /// <seealso cref="InternalLinksSourcesLinkedListMethods{TLink}"/>
14     public unsafe class UInt32InternalLinksSourcesLinkedListMethods :
15         ↪ InternalLinksSourcesLinkedListMethods<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// The links data parts.
20         /// </para>
21         /// </summary>
22         private readonly RawLinkDataPart<TLink>* _linksDataParts;
23         /// <summary>
24         /// <para>
25         /// The links index parts.
26         /// </para>
27     }

```

```

28     /// <para></para>
29     /// </summary>
30     private readonly RawLinkIndexPart<TLink>* _linksIndexParts;
31
32     /// <summary>
33     /// <para>
34     /// Initializes a new <see cref="UInt32InternalLinksSourcesLinkedListMethods"/> instance.
35     /// </para>
36     /// <para></para>
37     /// </summary>
38     /// <param name="constants">
39     /// <para>A constants.</para>
40     /// <para></para>
41     /// </param>
42     /// <param name="linksDataParts">
43     /// <para>A links data parts.</para>
44     /// <para></para>
45     /// </param>
46     /// <param name="linksIndexParts">
47     /// <para>A links index parts.</para>
48     /// <para></para>
49     /// </param>
50     [MethodImpl(MethodImplOptions.AggressiveInlining)]
51     public UInt32InternalLinksSourcesLinkedListMethods(LinksConstants<TLink> constants,
52     ↪ RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>* linksIndexParts)
53     : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts)
54     {
55         _linksDataParts = linksDataParts;
56         _linksIndexParts = linksIndexParts;
57     }
58
59     /// <summary>
60     /// <para>
61     /// Gets the link data part reference using the specified link.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     /// <param name="link">
66     /// <para>The link.</para>
67     /// <para></para>
68     /// </param>
69     /// <returns>
70     /// <para>A ref raw link data part of t link</para>
71     /// <para></para>
72     /// </returns>
73     [MethodImpl(MethodImplOptions.AggressiveInlining)]
74     protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
75     ↪ ref _linksDataParts[link];
76
77     /// <summary>
78     /// <para>
79     /// Gets the link index part reference using the specified link.
80     /// </para>
81     /// <para></para>
82     /// </summary>
83     /// <param name="link">
84     /// <para>The link.</para>
85     /// <para></para>
86     /// </param>
87     /// <returns>
88     /// <para>A ref raw link index part of t link</para>
89     /// <para></para>
90     /// </returns>
91     [MethodImpl(MethodImplOptions.AggressiveInlining)]
92     protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
93     ↪ ref _linksIndexParts[link];
94 }
95
96 }

```

## 1.56 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32InternalLinksSourcesRecursionlessSizeBalance

```

1 using System.Runtime.CompilerServices;
2 using TLink = System.UInt32;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6 namespace Platform.Data.Doublets.Memory.Split.Specific
7 {
8     /// <summary>

```

```

9  /// <para>
10  /// Represents the int 32 internal links sources recursionless size balanced tree methods.
11  /// </para>
12  /// <para></para>
13  /// </summary>
14  /// <seealso cref="UInt32InternalLinksRecursionlessSizeBalancedTreeMethodsBase"/>
15  public unsafe class UInt32InternalLinksSourcesRecursionlessSizeBalancedTreeMethods :
16  {
17      /// <summary>
18      /// <para>
19      /// Initializes a new <see
20      ↪ cref="UInt32InternalLinksSourcesRecursionlessSizeBalancedTreeMethods"/> instance.
21      /// </para>
22      /// <para></para>
23      /// </summary>
24      /// <param name="constants">
25      /// <para>A constants.</para>
26      /// <para></para>
27      /// </param>
28      /// <param name="linksDataParts">
29      /// <para>A links data parts.</para>
30      /// <para></para>
31      /// </param>
32      /// <param name="linksIndexParts">
33      /// <para>A links index parts.</para>
34      /// <para></para>
35      /// </param>
36      /// <param name="header">
37      /// <para>A header.</para>
38      /// <para></para>
39      /// </param>
40      [MethodImpl(MethodImplOptions.AggressiveInlining)]
41      public
42      ↪ UInt32InternalLinksSourcesRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
43      ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
44      ↪ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
45      ↪ linksIndexParts, header) { }
46
47      /// <summary>
48      /// <para>
49      /// Gets the left reference using the specified node.
50      /// </para>
51      /// <para></para>
52      /// </summary>
53      /// <param name="node">
54      /// <para>The node.</para>
55      /// <para></para>
56      /// </param>
57      /// <returns>
58      /// <para>The ref link</para>
59      /// <para></para>
60      /// </returns>
61      [MethodImpl(MethodImplOptions.AggressiveInlining)]
62      protected override ref TLink GetLeftReference(TLink node) => ref
63      ↪ LinksIndexParts[node].LeftAsSource;
64
65      /// <summary>
66      /// <para>
67      /// Gets the right reference using the specified node.
68      /// </para>
69      /// <para></para>
70      /// </summary>
71      /// <param name="node">
72      /// <para>The node.</para>
73      /// <para></para>
74      /// </param>
75      /// <returns>
76      /// <para>The ref link</para>
77      /// <para></para>
78      /// </returns>
79      [MethodImpl(MethodImplOptions.AggressiveInlining)]
80      protected override ref TLink GetRightReference(TLink node) => ref
81      ↪ LinksIndexParts[node].RightAsSource;
82
83      /// <summary>
84      /// <para>
85      /// Gets the left using the specified node.

```



```

79     /// </para>
80     /// <para></para>
81     /// </summary>
82     /// <param name="node">
83     /// <para>The node.</para>
84     /// <para></para>
85     /// </param>
86     /// <returns>
87     /// <para>The link</para>
88     /// <para></para>
89     /// </returns>
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsSource;
92
93     /// <summary>
94     /// <para>
95     /// Gets the right using the specified node.
96     /// </para>
97     /// <para></para>
98     /// </summary>
99     /// <param name="node">
100    /// <para>The node.</para>
101    /// <para></para>
102    /// </param>
103    /// <returns>
104    /// <para>The link</para>
105    /// <para></para>
106    /// </returns>
107    [MethodImpl(MethodImplOptions.AggressiveInlining)]
108    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsSource;
109
110    /// <summary>
111    /// <para>
112    /// Sets the left using the specified node.
113    /// </para>
114    /// <para></para>
115    /// </summary>
116    /// <param name="node">
117    /// <para>The node.</para>
118    /// <para></para>
119    /// </param>
120    /// <param name="left">
121    /// <para>The left.</para>
122    /// <para></para>
123    /// </param>
124    [MethodImpl(MethodImplOptions.AggressiveInlining)]
125    protected override void SetLeft(TLink node, TLink left) =>
126        ↳ LinksIndexParts[node].LeftAsSource = left;
127
128    /// <summary>
129    /// <para>
130    /// Sets the right using the specified node.
131    /// </para>
132    /// <para></para>
133    /// </summary>
134    /// <param name="node">
135    /// <para>The node.</para>
136    /// <para></para>
137    /// </param>
138    /// <param name="right">
139    /// <para>The right.</para>
140    /// <para></para>
141    /// </param>
142    [MethodImpl(MethodImplOptions.AggressiveInlining)]
143    protected override void SetRight(TLink node, TLink right) =>
144        ↳ LinksIndexParts[node].RightAsSource = right;
145
146    /// <summary>
147    /// <para>
148    /// Gets the size using the specified node.
149    /// </para>
150    /// <para></para>
151    /// </summary>
152    /// <param name="node">
153    /// <para>The node.</para>
154    /// <para></para>
155    /// </param>
156    /// <returns>

```

```

155     /// <para>The link</para>
156     /// <para></para>
157     /// </returns>
158     [MethodImpl(MethodImplOptions.AggressiveInlining)]
159     protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsSource;
160
161     /// <summary>
162     /// <para>
163     /// Sets the size using the specified node.
164     /// </para>
165     /// <para></para>
166     /// </summary>
167     /// <param name="node">
168     /// <para>The node.</para>
169     /// <para></para>
170     /// </param>
171     /// <param name="size">
172     /// <para>The size.</para>
173     /// <para></para>
174     /// </param>
175     [MethodImpl(MethodImplOptions.AggressiveInlining)]
176     protected override void SetSize(TLink node, TLink size) =>
177         ↳ LinksIndexParts[node].SizeAsSource = size;
178
179     /// <summary>
180     /// <para>
181     /// Gets the tree root using the specified node.
182     /// </para>
183     /// <para></para>
184     /// </summary>
185     /// <param name="node">
186     /// <para>The node.</para>
187     /// <para></para>
188     /// </param>
189     /// <returns>
190     /// <para>The link</para>
191     /// <para></para>
192     /// </returns>
193     [MethodImpl(MethodImplOptions.AggressiveInlining)]
194     protected override TLink GetTreeRoot(TLink node) => LinksIndexParts[node].RootAsSource;
195
196     /// <summary>
197     /// <para>
198     /// Gets the base part value using the specified node.
199     /// </para>
200     /// <para></para>
201     /// </summary>
202     /// <param name="node">
203     /// <para>The node.</para>
204     /// <para></para>
205     /// </param>
206     /// <returns>
207     /// <para>The link</para>
208     /// <para></para>
209     /// </returns>
210     [MethodImpl(MethodImplOptions.AggressiveInlining)]
211     protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Source;
212
213     /// <summary>
214     /// <para>
215     /// Gets the key part value using the specified node.
216     /// </para>
217     /// <para></para>
218     /// </summary>
219     /// <param name="node">
220     /// <para>The node.</para>
221     /// <para></para>
222     /// </param>
223     /// <returns>
224     /// <para>The link</para>
225     /// <para></para>
226     /// </returns>
227     [MethodImpl(MethodImplOptions.AggressiveInlining)]
228     protected override TLink GetKeyPartValue(TLink node) => LinksDataParts[node].Target;
229
230     /// <summary>
231     /// <para>
232     /// Clears the node using the specified node.

```

```

232     /// </para>
233     /// <para></para>
234     /// </summary>
235     /// <param name="node">
236     /// <para>The node.</para>
237     /// <para></para>
238     /// </param>
239     [MethodImpl(MethodImplOptions.AggressiveInlining)]
240     protected override void ClearNode(TLink node)
241     {
242         ref var link = ref LinksIndexParts[node];
243         link.LeftAsSource = Zero;
244         link.RightAsSource = Zero;
245         link.SizeAsSource = Zero;
246     }
247
248     /// <summary>
249     /// <para>
250     /// Searches the source.
251     /// </para>
252     /// <para></para>
253     /// </summary>
254     /// <param name="source">
255     /// <para>The source.</para>
256     /// <para></para>
257     /// </param>
258     /// <param name="target">
259     /// <para>The target.</para>
260     /// <para></para>
261     /// </param>
262     /// <returns>
263     /// <para>The link</para>
264     /// <para></para>
265     /// </returns>
266     public override TLink Search(TLink source, TLink target) =>
267         ↪ SearchCore(GetTreeRoot(source), target);
268 }

```

## 1.57 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32InternalLinksSourcesSizeBalancedTreeMethod

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt32;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 32 internal links sources size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt32InternalLinksSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt32InternalLinksSourcesSizeBalancedTreeMethods :
16         ↪ UInt32InternalLinksSizeBalancedTreeMethodsBase
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see cref="UInt32InternalLinksSourcesSizeBalancedTreeMethods"/>
21         ↪ instance.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         /// <param name="constants">
26         /// <para>A constants.</para>
27         /// <para></para>
28         /// </param>
29         /// <param name="linksDataParts">
30         /// <para>A links data parts.</para>
31         /// <para></para>
32         /// </param>
33         /// <param name="linksIndexParts">
34         /// <para>A links index parts.</para>
35         /// <para></para>
36         /// </param>
37         /// <param name="header">
38         /// <para>A header.</para>
39         /// <para></para>
40         /// </param>

```

```

37     /// <para></para>
38     /// </param>
39     [MethodImpl(MethodImplOptions.AggressiveInlining)]
40     public UInt32InternalLinksSourcesSizeBalancedTreeMethods(LinksConstants<TLink>
        ↳ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
        ↳ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
        ↳ linksIndexParts, header) { }
41
42     /// <summary>
43     /// <para>
44     /// Gets the left reference using the specified node.
45     /// </para>
46     /// <para></para>
47     /// </summary>
48     /// <param name="node">
49     /// <para>The node.</para>
50     /// <para></para>
51     /// </param>
52     /// <returns>
53     /// <para>The ref link</para>
54     /// <para></para>
55     /// </returns>
56     [MethodImpl(MethodImplOptions.AggressiveInlining)]
57     protected override ref TLink GetLeftReference(TLink node) => ref
        ↳ LinksIndexParts[node].LeftAsSource;
58
59     /// <summary>
60     /// <para>
61     /// Gets the right reference using the specified node.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     /// <param name="node">
66     /// <para>The node.</para>
67     /// <para></para>
68     /// </param>
69     /// <returns>
70     /// <para>The ref link</para>
71     /// <para></para>
72     /// </returns>
73     [MethodImpl(MethodImplOptions.AggressiveInlining)]
74     protected override ref TLink GetRightReference(TLink node) => ref
        ↳ LinksIndexParts[node].RightAsSource;
75
76     /// <summary>
77     /// <para>
78     /// Gets the left using the specified node.
79     /// </para>
80     /// <para></para>
81     /// </summary>
82     /// <param name="node">
83     /// <para>The node.</para>
84     /// <para></para>
85     /// </param>
86     /// <returns>
87     /// <para>The link</para>
88     /// <para></para>
89     /// </returns>
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsSource;
92
93     /// <summary>
94     /// <para>
95     /// Gets the right using the specified node.
96     /// </para>
97     /// <para></para>
98     /// </summary>
99     /// <param name="node">
100    /// <para>The node.</para>
101    /// <para></para>
102    /// </param>
103    /// <returns>
104    /// <para>The link</para>
105    /// <para></para>
106    /// </returns>
107    [MethodImpl(MethodImplOptions.AggressiveInlining)]
108    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsSource;
109

```

```

110    /// <summary>
111    /// <para>
112    /// Sets the left using the specified node.
113    /// </para>
114    /// <para></para>
115    /// </summary>
116    /// <param name="node">
117    /// <para>The node.</para>
118    /// <para></para>
119    /// </param>
120    /// <param name="left">
121    /// <para>The left.</para>
122    /// <para></para>
123    /// </param>
124    [MethodImpl(MethodImplOptions.AggressiveInlining)]
125    protected override void SetLeft(TLink node, TLink left) =>
126        ↪ LinksIndexParts[node].LeftAsSource = left;
127
128    /// <summary>
129    /// <para>
130    /// Sets the right using the specified node.
131    /// </para>
132    /// <para></para>
133    /// </summary>
134    /// <param name="node">
135    /// <para>The node.</para>
136    /// <para></para>
137    /// </param>
138    /// <param name="right">
139    /// <para>The right.</para>
140    /// <para></para>
141    /// </param>
142    [MethodImpl(MethodImplOptions.AggressiveInlining)]
143    protected override void SetRight(TLink node, TLink right) =>
144        ↪ LinksIndexParts[node].RightAsSource = right;
145
146    /// <summary>
147    /// <para>
148    /// Gets the size using the specified node.
149    /// </para>
150    /// <para></para>
151    /// </summary>
152    /// <param name="node">
153    /// <para>The node.</para>
154    /// <para></para>
155    /// </param>
156    /// <returns>
157    /// <para>The link</para>
158    /// <para></para>
159    /// </returns>
160    [MethodImpl(MethodImplOptions.AggressiveInlining)]
161    protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsSource;
162
163    /// <summary>
164    /// <para>
165    /// Sets the size using the specified node.
166    /// </para>
167    /// <para></para>
168    /// </summary>
169    /// <param name="node">
170    /// <para>The node.</para>
171    /// <para></para>
172    /// </param>
173    /// <param name="size">
174    /// <para>The size.</para>
175    /// <para></para>
176    /// </param>
177    [MethodImpl(MethodImplOptions.AggressiveInlining)]
178    protected override void SetSize(TLink node, TLink size) =>
179        ↪ LinksIndexParts[node].SizeAsSource = size;
180
181    /// <summary>
182    /// <para>
183    /// Gets the tree root using the specified node.
184    /// </para>
185    /// <para></para>
186    /// </summary>
187    /// <param name="node">

```

```

185    /// <para>The node.</para>
186    /// <para></para>
187    /// </param>
188    /// <returns>
189    /// <para>The link</para>
190    /// <para></para>
191    /// </returns>
192    [MethodImpl(MethodImplOptions.AggressiveInlining)]
193    protected override TLink GetTreeRoot(TLink node) => LinksIndexParts[node].RootAsSource;
194
195    /// <summary>
196    /// <para>
197    /// Gets the base part value using the specified node.
198    /// </para>
199    /// <para></para>
200    /// </summary>
201    /// <param name="node">
202    /// <para>The node.</para>
203    /// <para></para>
204    /// </param>
205    /// <returns>
206    /// <para>The link</para>
207    /// <para></para>
208    /// </returns>
209    [MethodImpl(MethodImplOptions.AggressiveInlining)]
210    protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Source;
211
212    /// <summary>
213    /// <para>
214    /// Gets the key part value using the specified node.
215    /// </para>
216    /// <para></para>
217    /// </summary>
218    /// <param name="node">
219    /// <para>The node.</para>
220    /// <para></para>
221    /// </param>
222    /// <returns>
223    /// <para>The link</para>
224    /// <para></para>
225    /// </returns>
226    [MethodImpl(MethodImplOptions.AggressiveInlining)]
227    protected override TLink GetKeyPartValue(TLink node) => LinksDataParts[node].Target;
228
229    /// <summary>
230    /// <para>
231    /// Clears the node using the specified node.
232    /// </para>
233    /// <para></para>
234    /// </summary>
235    /// <param name="node">
236    /// <para>The node.</para>
237    /// <para></para>
238    /// </param>
239    [MethodImpl(MethodImplOptions.AggressiveInlining)]
240    protected override void ClearNode(TLink node)
241    {
242        ref var link = ref LinksIndexParts[node];
243        link.LeftAsSource = Zero;
244        link.RightAsSource = Zero;
245        link.SizeAsSource = Zero;
246    }
247
248    /// <summary>
249    /// <para>
250    /// Searches the source.
251    /// </para>
252    /// <para></para>
253    /// </summary>
254    /// <param name="source">
255    /// <para>The source.</para>
256    /// <para></para>
257    /// </param>
258    /// <param name="target">
259    /// <para>The target.</para>
260    /// <para></para>
261    /// </param>
262    /// </returns>

```

```

263     /// <para>The link</para>
264     /// <para></para>
265     /// </returns>
266     public override TLink Search(TLink source, TLink target) =>
        ↪ SearchCore(GetTreeRoot(source), target);
267 }
268 }

```

## 1.58 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32InternalLinksTargetsRecursionlessSizeBalancedTreeMethodsBase

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt32;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 32 internal links targets recursionless size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt32InternalLinksRecursionlessSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt32InternalLinksTargetsRecursionlessSizeBalancedTreeMethods :
        ↪ UInt32InternalLinksRecursionlessSizeBalancedTreeMethodsBase
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see
        ↪ cref="UInt32InternalLinksTargetsRecursionlessSizeBalancedTreeMethods"/> instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="constants">
24         /// <para>A constants.</para>
25         /// <para></para>
26         /// </param>
27         /// <param name="linksDataParts">
28         /// <para>A links data parts.</para>
29         /// <para></para>
30         /// </param>
31         /// <param name="linksIndexParts">
32         /// <para>A links index parts.</para>
33         /// <para></para>
34         /// </param>
35         /// <param name="header">
36         /// <para>A header.</para>
37         /// <para></para>
38         /// </param>
39         [MethodImpl(MethodImplOptions.AggressiveInlining)]
40         public
        ↪ UInt32InternalLinksTargetsRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
        ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
        ↪ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
        ↪ linksIndexParts, header) { }
41
42         /// <summary>
43         /// <para>
44         /// Gets the left reference using the specified node.
45         /// </para>
46         /// <para></para>
47         /// </summary>
48         /// <param name="node">
49         /// <para>The node.</para>
50         /// <para></para>
51         /// </param>
52         /// <returns>
53         /// <para>The ref link</para>
54         /// <para></para>
55         /// </returns>
56         [MethodImpl(MethodImplOptions.AggressiveInlining)]
57         protected override ref TLink GetLeftReference(TLink node) => ref
        ↪ LinksIndexParts[node].LeftAsTarget;
58
59         /// <summary>
60         /// <para>
61         /// Gets the right reference using the specified node.
62         /// </para>

```

```

63     /// <para></para>
64     /// </summary>
65     /// <param name="node">
66     /// <para>The node.</para>
67     /// <para></para>
68     /// </param>
69     /// <returns>
70     /// <para>The ref link</para>
71     /// <para></para>
72     /// </returns>
73     [MethodImpl(MethodImplOptions.AggressiveInlining)]
74     protected override ref TLink GetRightReference(TLink node) => ref
75     ↪ LinksIndexParts[node].RightAsTarget;
76
77     /// <summary>
78     /// <para>
79     /// Gets the left using the specified node.
80     /// </para>
81     /// <para></para>
82     /// </summary>
83     /// <param name="node">
84     /// <para>The node.</para>
85     /// <para></para>
86     /// </param>
87     /// <returns>
88     /// <para>The link</para>
89     /// <para></para>
90     /// </returns>
91     [MethodImpl(MethodImplOptions.AggressiveInlining)]
92     protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsTarget;
93
94     /// <summary>
95     /// <para>
96     /// Gets the right using the specified node.
97     /// </para>
98     /// <para></para>
99     /// </summary>
100    /// <param name="node">
101    /// <para>The node.</para>
102    /// <para></para>
103    /// </param>
104    /// <returns>
105    /// <para>The link</para>
106    /// <para></para>
107    /// </returns>
108    [MethodImpl(MethodImplOptions.AggressiveInlining)]
109    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsTarget;
110
111    /// <summary>
112    /// <para>
113    /// Sets the left using the specified node.
114    /// </para>
115    /// <para></para>
116    /// </summary>
117    /// <param name="node">
118    /// <para>The node.</para>
119    /// <para></para>
120    /// </param>
121    /// <param name="left">
122    /// <para>The left.</para>
123    /// <para></para>
124    /// </param>
125    [MethodImpl(MethodImplOptions.AggressiveInlining)]
126    protected override void SetLeft(TLink node, TLink left) =>
127    ↪ LinksIndexParts[node].LeftAsTarget = left;
128
129    /// <summary>
130    /// <para>
131    /// Sets the right using the specified node.
132    /// </para>
133    /// <para></para>
134    /// </summary>
135    /// <param name="node">
136    /// <para>The node.</para>
137    /// <para></para>
138    /// </param>
139    /// <param name="right">
140    /// <para>The right.</para>

```



```

139     /// <para></para>
140     /// </param>
141     [MethodImpl(MethodImplOptions.AggressiveInlining)]
142     protected override void SetRight(TLink node, TLink right) =>
143         ↳ LinksIndexParts[node].RightAsTarget = right;
144
145     /// <summary>
146     /// <para>
147     /// Gets the size using the specified node.
148     /// </para>
149     /// </summary>
150     /// <param name="node">
151     /// <para>The node.</para>
152     /// </para>
153     /// </param>
154     /// <returns>
155     /// <para>The link</para>
156     /// </returns>
157     [MethodImpl(MethodImplOptions.AggressiveInlining)]
158     protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsTarget;
159
160     /// <summary>
161     /// <para>
162     /// Sets the size using the specified node.
163     /// </para>
164     /// </summary>
165     /// <param name="node">
166     /// <para>The node.</para>
167     /// </para>
168     /// <param name="size">
169     /// <para>The size.</para>
170     /// </para>
171     [MethodImpl(MethodImplOptions.AggressiveInlining)]
172     protected override void SetSize(TLink node, TLink size) =>
173         ↳ LinksIndexParts[node].SizeAsTarget = size;
174
175     /// <summary>
176     /// <para>
177     /// Gets the tree root using the specified node.
178     /// </para>
179     /// </summary>
180     /// <param name="node">
181     /// <para>The node.</para>
182     /// </para>
183     /// </param>
184     /// <returns>
185     /// <para>The link</para>
186     /// </returns>
187     [MethodImpl(MethodImplOptions.AggressiveInlining)]
188     protected override TLink GetTreeRoot(TLink node) => LinksIndexParts[node].RootAsTarget;
189
190     /// <summary>
191     /// <para>
192     /// Gets the base part value using the specified node.
193     /// </para>
194     /// </summary>
195     /// <param name="node">
196     /// <para>The node.</para>
197     /// </para>
198     /// </param>
199     /// <returns>
200     /// <para>The link</para>
201     /// </returns>
202     [MethodImpl(MethodImplOptions.AggressiveInlining)]
203     protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Target;
204
205     /// <summary>
206     /// <para>
207     /// Gets the key part value using the specified node.

```

```

215     /// </para>
216     /// <para></para>
217     /// </summary>
218     /// <param name="node">
219     /// <para>The node.</para>
220     /// <para></para>
221     /// </param>
222     /// <returns>
223     /// <para>The link</para>
224     /// <para></para>
225     /// </returns>
226     [MethodImpl(MethodImplOptions.AggressiveInlining)]
227     protected override TLink GetKeyPartValue(TLink node) => LinksDataParts[node].Source;
228
229     /// <summary>
230     /// <para>
231     /// Clears the node using the specified node.
232     /// </para>
233     /// <para></para>
234     /// </summary>
235     /// <param name="node">
236     /// <para>The node.</para>
237     /// <para></para>
238     /// </param>
239     [MethodImpl(MethodImplOptions.AggressiveInlining)]
240     protected override void ClearNode(TLink node)
241     {
242         ref var link = ref LinksIndexParts[node];
243         link.LeftAsTarget = Zero;
244         link.RightAsTarget = Zero;
245         link.SizeAsTarget = Zero;
246     }
247
248     /// <summary>
249     /// <para>
250     /// Searches the source.
251     /// </para>
252     /// <para></para>
253     /// </summary>
254     /// <param name="source">
255     /// <para>The source.</para>
256     /// <para></para>
257     /// </param>
258     /// <param name="target">
259     /// <para>The target.</para>
260     /// <para></para>
261     /// </param>
262     /// <returns>
263     /// <para>The link</para>
264     /// <para></para>
265     /// </returns>
266     public override TLink Search(TLink source, TLink target) =>
267         ↪ SearchCore(GetTreeRoot(target), source);
268 }

```

## 1.59 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32InternalLinksTargetsSizeBalancedTreeMethod

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt32;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 32 internal links targets size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt32InternalLinksSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt32InternalLinksTargetsSizeBalancedTreeMethods :
16         ↪ UInt32InternalLinksSizeBalancedTreeMethodsBase
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see cref="UInt32InternalLinksTargetsSizeBalancedTreeMethods"/>
21         ↪ instance.
22         /// </para>

```

```

21    /// <para></para>
22    /// </summary>
23    /// <param name="constants">
24    /// <para>A constants.</para>
25    /// <para></para>
26    /// </param>
27    /// <param name="linksDataParts">
28    /// <para>A links data parts.</para>
29    /// <para></para>
30    /// </param>
31    /// <param name="linksIndexParts">
32    /// <para>A links index parts.</para>
33    /// <para></para>
34    /// </param>
35    /// <param name="header">
36    /// <para>A header.</para>
37    /// <para></para>
38    /// </param>
39    [MethodImpl(MethodImplOptions.AggressiveInlining)]
40    public UInt32InternalLinksTargetsSizeBalancedTreeMethods(LinksConstants<TLink>
    ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
    ↪ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
    ↪ linksIndexParts, header) { }
41
42    /// <summary>
43    /// <para>
44    /// Gets the left reference using the specified node.
45    /// </para>
46    /// <para></para>
47    /// </summary>
48    /// <param name="node">
49    /// <para>The node.</para>
50    /// <para></para>
51    /// </param>
52    /// <returns>
53    /// <para>The ref link</para>
54    /// <para></para>
55    /// </returns>
56    [MethodImpl(MethodImplOptions.AggressiveInlining)]
57    protected override ref TLink GetLeftReference(TLink node) => ref
    ↪ LinksIndexParts[node].LeftAsTarget;
58
59    /// <summary>
60    /// <para>
61    /// Gets the right reference using the specified node.
62    /// </para>
63    /// <para></para>
64    /// </summary>
65    /// <param name="node">
66    /// <para>The node.</para>
67    /// <para></para>
68    /// </param>
69    /// <returns>
70    /// <para>The ref link</para>
71    /// <para></para>
72    /// </returns>
73    [MethodImpl(MethodImplOptions.AggressiveInlining)]
74    protected override ref TLink GetRightReference(TLink node) => ref
    ↪ LinksIndexParts[node].RightAsTarget;
75
76    /// <summary>
77    /// <para>
78    /// Gets the left using the specified node.
79    /// </para>
80    /// <para></para>
81    /// </summary>
82    /// <param name="node">
83    /// <para>The node.</para>
84    /// <para></para>
85    /// </param>
86    /// <returns>
87    /// <para>The link</para>
88    /// <para></para>
89    /// </returns>
90    [MethodImpl(MethodImplOptions.AggressiveInlining)]
91    protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsTarget;
92
93    /// <summary>

```

```

94     /// <para>
95     /// Gets the right using the specified node.
96     /// </para>
97     /// <para></para>
98     /// </summary>
99     /// <param name="node">
100    /// <para>The node.</para>
101    /// <para></para>
102    /// </param>
103    /// <returns>
104    /// <para>The link</para>
105    /// <para></para>
106    /// </returns>
107    [MethodImpl(MethodImplOptions.AggressiveInlining)]
108    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsTarget;
109
110    /// <summary>
111    /// <para>
112    /// Sets the left using the specified node.
113    /// </para>
114    /// <para></para>
115    /// </summary>
116    /// <param name="node">
117    /// <para>The node.</para>
118    /// <para></para>
119    /// </param>
120    /// <param name="left">
121    /// <para>The left.</para>
122    /// <para></para>
123    /// </param>
124    [MethodImpl(MethodImplOptions.AggressiveInlining)]
125    protected override void SetLeft(TLink node, TLink left) =>
126        ↳ LinksIndexParts[node].LeftAsTarget = left;
127
128    /// <summary>
129    /// <para>
130    /// Sets the right using the specified node.
131    /// </para>
132    /// <para></para>
133    /// </summary>
134    /// <param name="node">
135    /// <para>The node.</para>
136    /// <para></para>
137    /// </param>
138    /// <param name="right">
139    /// <para>The right.</para>
140    /// <para></para>
141    /// </param>
142    [MethodImpl(MethodImplOptions.AggressiveInlining)]
143    protected override void SetRight(TLink node, TLink right) =>
144        ↳ LinksIndexParts[node].RightAsTarget = right;
145
146    /// <summary>
147    /// <para>
148    /// Gets the size using the specified node.
149    /// </para>
150    /// <para></para>
151    /// </summary>
152    /// <param name="node">
153    /// <para>The node.</para>
154    /// <para></para>
155    /// </param>
156    /// <returns>
157    /// <para>The link</para>
158    /// <para></para>
159    /// </returns>
160    [MethodImpl(MethodImplOptions.AggressiveInlining)]
161    protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsTarget;
162
163    /// <summary>
164    /// <para>
165    /// Sets the size using the specified node.
166    /// </para>
167    /// <para></para>
168    /// </summary>
169    /// <param name="node">
170    /// <para>The node.</para>
171    /// <para></para>

```

```

170    /// </param>
171    /// <param name="size">
172    /// <para>The size.</para>
173    /// <para></para>
174    /// </param>
175    [MethodImpl(MethodImplOptions.AggressiveInlining)]
176    protected override void SetSize(TLink node, TLink size) =>
177        ↳ LinksIndexParts[node].SizeAsTarget = size;
178
179    /// <summary>
180    /// <para>
181    /// Gets the tree root using the specified node.
182    /// </para>
183    /// <para></para>
184    /// </summary>
185    /// <param name="node">
186    /// <para>The node.</para>
187    /// <para></para>
188    /// </param>
189    /// <returns>
190    /// <para>The link</para>
191    /// <para></para>
192    /// </returns>
193    [MethodImpl(MethodImplOptions.AggressiveInlining)]
194    protected override TLink GetTreeRoot(TLink node) => LinksIndexParts[node].RootAsTarget;
195
196    /// <summary>
197    /// <para>
198    /// Gets the base part value using the specified node.
199    /// </para>
200    /// <para></para>
201    /// </summary>
202    /// <param name="node">
203    /// <para>The node.</para>
204    /// <para></para>
205    /// </param>
206    /// <returns>
207    /// <para>The link</para>
208    /// <para></para>
209    /// </returns>
210    [MethodImpl(MethodImplOptions.AggressiveInlining)]
211    protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Target;
212
213    /// <summary>
214    /// <para>
215    /// Gets the key part value using the specified node.
216    /// </para>
217    /// <para></para>
218    /// </summary>
219    /// <param name="node">
220    /// <para>The node.</para>
221    /// <para></para>
222    /// </param>
223    /// <returns>
224    /// <para>The link</para>
225    /// <para></para>
226    /// </returns>
227    [MethodImpl(MethodImplOptions.AggressiveInlining)]
228    protected override TLink GetKeyPartValue(TLink node) => LinksDataParts[node].Source;
229
230    /// <summary>
231    /// <para>
232    /// Clears the node using the specified node.
233    /// </para>
234    /// <para></para>
235    /// </summary>
236    /// <param name="node">
237    /// <para>The node.</para>
238    /// <para></para>
239    /// </param>
240    [MethodImpl(MethodImplOptions.AggressiveInlining)]
241    protected override void ClearNode(TLink node)
242    {
243        ref var link = ref LinksIndexParts[node];
244        link.LeftAsTarget = Zero;
245        link.RightAsTarget = Zero;
246        link.SizeAsTarget = Zero;
247    }

```

```

247
248     /// <summary>
249     /// <para>
250     /// Searches the source.
251     /// </para>
252     /// <para></para>
253     /// </summary>
254     /// <param name="source">
255     /// <para>The source.</para>
256     /// <para></para>
257     /// </param>
258     /// <param name="target">
259     /// <para>The target.</para>
260     /// <para></para>
261     /// </param>
262     /// <returns>
263     /// <para>The link</para>
264     /// <para></para>
265     /// </returns>
266     public override TLink Search(TLink source, TLink target) =>
        ↪ SearchCore(GetTreeRoot(target), source);
267     }
268 }

```

## 1.60 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32SplitMemoryLinks.cs

```

1  using System;
2  using System.Runtime.CompilerServices;
3  using Platform.Singletons;
4  using Platform.Memory;
5  using Platform.Data.Doublets.Memory.Split.Generic;
6  using TLink = System.UInt32;
7
8  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
9
10 namespace Platform.Data.Doublets.Memory.Split.Specific
11 {
12     /// <summary>
13     /// <para>
14     /// Represents the int 32 split memory links.
15     /// </para>
16     /// <para></para>
17     /// </summary>
18     /// <seealso cref="SplitMemoryLinksBase{TLink}" />
19     public unsafe class UInt32SplitMemoryLinks : SplitMemoryLinksBase<TLink>
20     {
21         /// <summary>
22         /// <para>
23         /// The create internal source tree methods.
24         /// </para>
25         /// <para></para>
26         /// </summary>
27         private readonly Func<ILinksTreeMethods<TLink>> _createInternalSourceTreeMethods;
28         /// <summary>
29         /// <para>
30         /// The create external source tree methods.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         private readonly Func<ILinksTreeMethods<TLink>> _createExternalSourceTreeMethods;
35         /// <summary>
36         /// <para>
37         /// The create internal target tree methods.
38         /// </para>
39         /// <para></para>
40         /// </summary>
41         private readonly Func<ILinksTreeMethods<TLink>> _createInternalTargetTreeMethods;
42         /// <summary>
43         /// <para>
44         /// The create external target tree methods.
45         /// </para>
46         /// <para></para>
47         /// </summary>
48         private readonly Func<ILinksTreeMethods<TLink>> _createExternalTargetTreeMethods;
49         /// <summary>
50         /// <para>
51         /// The header.
52         /// </para>
53         /// <para></para>
54         /// </summary>

```

```

55 private LinksHeader<TLink>* _header;
56 /// <summary>
57 /// <para>
58 /// The links data parts.
59 /// </para>
60 /// <para></para>
61 /// </summary>
62 private RawLinkDataPart<TLink>* _linksDataParts;
63 /// <summary>
64 /// <para>
65 /// The links index parts.
66 /// </para>
67 /// <para></para>
68 /// </summary>
69 private RawLinkIndexPart<TLink>* _linksIndexParts;
70
71 /// <summary>
72 /// <para>
73 /// Initializes a new <see cref="UInt32SplitMemoryLinks"/> instance.
74 /// </para>
75 /// <para></para>
76 /// </summary>
77 /// <param name="dataMemory">
78 /// <para>A data memory.</para>
79 /// <para></para>
80 /// </param>
81 /// <param name="indexMemory">
82 /// <para>A index memory.</para>
83 /// <para></para>
84 /// </param>
85 [MethodImpl(MethodImplOptions.AggressiveInlining)]
86 public UInt32SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
    ↪ indexMemory) : this(dataMemory, indexMemory, DefaultLinksSizeStep) { }
87
88 /// <summary>
89 /// <para>
90 /// Initializes a new <see cref="UInt32SplitMemoryLinks"/> instance.
91 /// </para>
92 /// <para></para>
93 /// </summary>
94 /// <param name="dataMemory">
95 /// <para>A data memory.</para>
96 /// <para></para>
97 /// </param>
98 /// <param name="indexMemory">
99 /// <para>A index memory.</para>
100 /// <para></para>
101 /// </param>
102 /// <param name="memoryReservationStep">
103 /// <para>A memory reservation step.</para>
104 /// <para></para>
105 /// </param>
106 [MethodImpl(MethodImplOptions.AggressiveInlining)]
107 public UInt32SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
    ↪ indexMemory, long memoryReservationStep) : this(dataMemory, indexMemory,
    ↪ memoryReservationStep, Default<LinksConstants<TLink>>.Instance,
    ↪ IndexTreeType.Default, useLinkedList: true) { }
108
109 /// <summary>
110 /// <para>
111 /// Initializes a new <see cref="UInt32SplitMemoryLinks"/> instance.
112 /// </para>
113 /// <para></para>
114 /// </summary>
115 /// <param name="dataMemory">
116 /// <para>A data memory.</para>
117 /// <para></para>
118 /// </param>
119 /// <param name="indexMemory">
120 /// <para>A index memory.</para>
121 /// <para></para>
122 /// </param>
123 /// <param name="memoryReservationStep">
124 /// <para>A memory reservation step.</para>
125 /// <para></para>
126 /// </param>
127 /// <param name="constants">
128 /// <para>A constants.</para>

```

```

129 /// <para></para>
130 /// </param>
131 [MethodImpl(MethodImplOptions.AggressiveInlining)]
132 public UInt32SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
    ↳ indexMemory, long memoryReservationStep, LinksConstants<TLink> constants) :
    ↳ this(dataMemory, indexMemory, memoryReservationStep, constants,
    ↳ IndexTreeType.Default, useLinkedList: true) { }

133
134 /// <summary>
135 /// <para>
136 /// Initializes a new <see cref="UInt32SplitMemoryLinks"/> instance.
137 /// </para>
138 /// <para></para>
139 /// </summary>
140 /// <param name="dataMemory">
141 /// <para>A data memory.</para>
142 /// <para></para>
143 /// </param>
144 /// <param name="indexMemory">
145 /// <para>A index memory.</para>
146 /// <para></para>
147 /// </param>
148 /// <param name="memoryReservationStep">
149 /// <para>A memory reservation step.</para>
150 /// <para></para>
151 /// </param>
152 /// <param name="constants">
153 /// <para>A constants.</para>
154 /// <para></para>
155 /// </param>
156 /// <param name="indexTreeType">
157 /// <para>A index tree type.</para>
158 /// <para></para>
159 /// </param>
160 /// <param name="useLinkedList">
161 /// <para>A use linked list.</para>
162 /// <para></para>
163 /// </param>
164 [MethodImpl(MethodImplOptions.AggressiveInlining)]
165 public UInt32SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
    ↳ indexMemory, long memoryReservationStep, LinksConstants<TLink> constants,
    ↳ IndexTreeType indexTreeType, bool useLinkedList) : base(dataMemory, indexMemory,
    ↳ memoryReservationStep, constants, useLinkedList)
166 {
167     if (indexTreeType == IndexTreeType.SizeBalancedTree)
168     {
169         _createInternalSourceTreeMethods = () => new
            ↳ UInt32InternalLinksSourcesSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
170         _createExternalSourceTreeMethods = () => new
            ↳ UInt32ExternalLinksSourcesSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
171         _createInternalTargetTreeMethods = () => new
            ↳ UInt32InternalLinksTargetsSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
172         _createExternalTargetTreeMethods = () => new
            ↳ UInt32ExternalLinksTargetsSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
173     }
174     else
175     {
176         _createInternalSourceTreeMethods = () => new
            ↳ UInt32InternalLinksSourcesRecursionlessSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
177         _createExternalSourceTreeMethods = () => new
            ↳ UInt32ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
178         _createInternalTargetTreeMethods = () => new
            ↳ UInt32InternalLinksTargetsRecursionlessSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
179         _createExternalTargetTreeMethods = () => new
            ↳ UInt32ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
180     }
181     Init(dataMemory, indexMemory);
182 }
183

```



```

184    /// <summary>
185    /// <para>
186    /// Sets the pointers using the specified data memory.
187    /// </para>
188    /// <para></para>
189    /// </summary>
190    /// <param name="dataMemory">
191    /// <para>The data memory.</para>
192    /// <para></para>
193    /// </param>
194    /// <param name="indexMemory">
195    /// <para>The index memory.</para>
196    /// <para></para>
197    /// </param>
198    [MethodImpl(MethodImplOptions.AggressiveInlining)]
199    protected override void SetPointers(IResizableDirectMemory dataMemory,
200    ↪ IResizableDirectMemory indexMemory)
201    {
202        _linksDataParts = (RawLinkDataPart<TLink>*)dataMemory.Pointer;
203        _linksIndexParts = (RawLinkIndexPart<TLink>*)indexMemory.Pointer;
204        _header = (LinksHeader<TLink>*)indexMemory.Pointer;
205        if (_useLinkedList)
206        {
207            InternalSourcesListMethods = new
208            ↪ UInt32InternalLinksSourcesLinkedListMethods(Constants, _linksDataParts,
209            ↪ _linksIndexParts);
210        }
211        else
212        {
213            InternalSourcesTreeMethods = _createInternalSourceTreeMethods();
214        }
215        ExternalSourcesTreeMethods = _createExternalSourceTreeMethods();
216        InternalTargetsTreeMethods = _createInternalTargetTreeMethods();
217        ExternalTargetsTreeMethods = _createExternalTargetTreeMethods();
218        UnusedLinksListMethods = new UInt32UnusedLinksListMethods(_linksDataParts, _header);
219    }
220
221    /// <summary>
222    /// <para>
223    /// Resets the pointers.
224    /// </para>
225    /// <para></para>
226    /// </summary>
227    [MethodImpl(MethodImplOptions.AggressiveInlining)]
228    protected override void ResetPointers()
229    {
230        base.ResetPointers();
231        _linksDataParts = null;
232        _linksIndexParts = null;
233        _header = null;
234    }
235
236    /// <summary>
237    /// <para>
238    /// Gets the header reference.
239    /// </para>
240    /// <para></para>
241    /// </summary>
242    /// <returns>
243    /// <para>A ref links header of t link</para>
244    /// <para></para>
245    /// </returns>
246    [MethodImpl(MethodImplOptions.AggressiveInlining)]
247    protected override ref LinksHeader<TLink> GetHeaderReference() => ref *_header;
248
249    /// <summary>
250    /// <para>
251    /// Gets the link data part reference using the specified link index.
252    /// </para>
253    /// <para></para>
254    /// </summary>
255    /// <param name="linkIndex">
256    /// <para>The link index.</para>
257    /// <para></para>
258    /// </param>
259    /// <returns>
260    /// <para>A ref raw link data part of t link</para>
261    /// <para></para>

```

```

259     /// </returns>
260     [MethodImpl(MethodImplOptions.AggressiveInlining)]
261     protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink linkIndex)
262     ↪ => ref _linksDataParts[linkIndex];
263
264     /// <summary>
265     /// <para>
266     /// Gets the link index part reference using the specified link index.
267     /// </para>
268     /// <para></para>
269     /// </summary>
270     /// <param name="linkIndex">
271     /// <para>The link index.</para>
272     /// </param>
273     /// <returns>
274     /// <para>A ref raw link index part of t link</para>
275     /// <para></para>
276     /// </returns>
277     [MethodImpl(MethodImplOptions.AggressiveInlining)]
278     protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink
279     ↪ linkIndex) => ref _linksIndexParts[linkIndex];
280
281     /// <summary>
282     /// <para>
283     /// Determines whether this instance are equal.
284     /// </para>
285     /// <para></para>
286     /// </summary>
287     /// <param name="first">
288     /// <para>The first.</para>
289     /// <para></para>
290     /// </param>
291     /// <param name="second">
292     /// <para>The second.</para>
293     /// <para></para>
294     /// </param>
295     /// <returns>
296     /// <para>The bool</para>
297     /// <para></para>
298     /// </returns>
299     [MethodImpl(MethodImplOptions.AggressiveInlining)]
300     protected override bool AreEqual(TLink first, TLink second) => first == second;
301
302     /// <summary>
303     /// <para>
304     /// Determines whether this instance less than.
305     /// </para>
306     /// <para></para>
307     /// </summary>
308     /// <param name="first">
309     /// <para>The first.</para>
310     /// <para></para>
311     /// </param>
312     /// <param name="second">
313     /// <para>The second.</para>
314     /// <para></para>
315     /// </param>
316     /// <returns>
317     /// <para>The bool</para>
318     /// <para></para>
319     /// </returns>
320     [MethodImpl(MethodImplOptions.AggressiveInlining)]
321     protected override bool LessThan(TLink first, TLink second) => first < second;
322
323     /// <summary>
324     /// <para>
325     /// Determines whether this instance less or equal than.
326     /// </para>
327     /// <para></para>
328     /// </summary>
329     /// <param name="first">
330     /// <para>The first.</para>
331     /// <para></para>
332     /// </param>
333     /// <param name="second">
334     /// <para>The second.</para>
335     /// <para></para>
336     /// </param>
337     /// <returns>
338     /// <para>The bool</para>
339     /// <para></para>
340     /// </returns>

```

```

335     /// </param>
336     /// <returns>
337     /// <para>The bool</para>
338     /// <para></para>
339     /// </returns>
340     [MethodImpl(MethodImplOptions.AggressiveInlining)]
341     protected override bool LessOrEqualThan(TLink first, TLink second) => first <= second;
342
343     /// <summary>
344     /// <para>
345     /// Determines whether this instance greater than.
346     /// </para>
347     /// <para></para>
348     /// </summary>
349     /// <param name="first">
350     /// <para>The first.</para>
351     /// <para></para>
352     /// </param>
353     /// <param name="second">
354     /// <para>The second.</para>
355     /// <para></para>
356     /// </param>
357     /// <returns>
358     /// <para>The bool</para>
359     /// <para></para>
360     /// </returns>
361     [MethodImpl(MethodImplOptions.AggressiveInlining)]
362     protected override bool GreaterThan(TLink first, TLink second) => first > second;
363
364     /// <summary>
365     /// <para>
366     /// Determines whether this instance greater or equal than.
367     /// </para>
368     /// <para></para>
369     /// </summary>
370     /// <param name="first">
371     /// <para>The first.</para>
372     /// <para></para>
373     /// </param>
374     /// <param name="second">
375     /// <para>The second.</para>
376     /// <para></para>
377     /// </param>
378     /// <returns>
379     /// <para>The bool</para>
380     /// <para></para>
381     /// </returns>
382     [MethodImpl(MethodImplOptions.AggressiveInlining)]
383     protected override bool GreaterOrEqualThan(TLink first, TLink second) => first >= second;
384
385     /// <summary>
386     /// <para>
387     /// Gets the zero.
388     /// </para>
389     /// <para></para>
390     /// </summary>
391     /// <returns>
392     /// <para>The link</para>
393     /// <para></para>
394     /// </returns>
395     [MethodImpl(MethodImplOptions.AggressiveInlining)]
396     protected override TLink GetZero() => 0U;
397
398     /// <summary>
399     /// <para>
400     /// Gets the one.
401     /// </para>
402     /// <para></para>
403     /// </summary>
404     /// <returns>
405     /// <para>The link</para>
406     /// <para></para>
407     /// </returns>
408     [MethodImpl(MethodImplOptions.AggressiveInlining)]
409     protected override TLink GetOne() => 1U;
410
411     /// <summary>
412     /// <para>

```

```

413     /// Converts the to int 64 using the specified value.
414     /// </para>
415     /// <para></para>
416     /// </summary>
417     /// <param name="value">
418     /// <para>The value.</para>
419     /// <para></para>
420     /// </param>
421     /// <returns>
422     /// <para>The long</para>
423     /// <para></para>
424     /// </returns>
425     [MethodImpl(MethodImplOptions.AggressiveInlining)]
426     protected override long ConvertToInt64(TLink value) => value;
427
428     /// <summary>
429     /// <para>
430     /// Converts the to address using the specified value.
431     /// </para>
432     /// <para></para>
433     /// </summary>
434     /// <param name="value">
435     /// <para>The value.</para>
436     /// <para></para>
437     /// </param>
438     /// <returns>
439     /// <para>The link</para>
440     /// <para></para>
441     /// </returns>
442     [MethodImpl(MethodImplOptions.AggressiveInlining)]
443     protected override TLink ConvertToAddress(long value) => (TLink)value;
444
445     /// <summary>
446     /// <para>
447     /// Adds the first.
448     /// </para>
449     /// <para></para>
450     /// </summary>
451     /// <param name="first">
452     /// <para>The first.</para>
453     /// <para></para>
454     /// </param>
455     /// <param name="second">
456     /// <para>The second.</para>
457     /// <para></para>
458     /// </param>
459     /// <returns>
460     /// <para>The link</para>
461     /// <para></para>
462     /// </returns>
463     [MethodImpl(MethodImplOptions.AggressiveInlining)]
464     protected override TLink Add(TLink first, TLink second) => first + second;
465
466     /// <summary>
467     /// <para>
468     /// Subtracts the first.
469     /// </para>
470     /// <para></para>
471     /// </summary>
472     /// <param name="first">
473     /// <para>The first.</para>
474     /// <para></para>
475     /// </param>
476     /// <param name="second">
477     /// <para>The second.</para>
478     /// <para></para>
479     /// </param>
480     /// <returns>
481     /// <para>The link</para>
482     /// <para></para>
483     /// </returns>
484     [MethodImpl(MethodImplOptions.AggressiveInlining)]
485     protected override TLink Subtract(TLink first, TLink second) => first - second;
486
487     /// <summary>
488     /// <para>
489     /// Increments the link.
490     /// </para>

```

```

491     /// <para></para>
492     /// </summary>
493     /// <param name="link">
494     /// <para>The link.</para>
495     /// <para></para>
496     /// </param>
497     /// <returns>
498     /// <para>The link</para>
499     /// <para></para>
500     /// </returns>
501     [MethodImpl(MethodImplOptions.AggressiveInlining)]
502     protected override TLink Increment(TLink link) => ++link;
503
504     /// <summary>
505     /// <para>
506     /// Decrements the link.
507     /// </para>
508     /// <para></para>
509     /// </summary>
510     /// <param name="link">
511     /// <para>The link.</para>
512     /// <para></para>
513     /// </param>
514     /// <returns>
515     /// <para>The link</para>
516     /// <para></para>
517     /// </returns>
518     [MethodImpl(MethodImplOptions.AggressiveInlining)]
519     protected override TLink Decrement(TLink link) => --link;
520 }
521 }

```

#### 1.61 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32UnusedLinksListMethods.cs

```

1  using System.Runtime.CompilerServices;
2  using Platform.Data.Doublets.Memory.Split.Generic;
3  using TLink = System.UInt32;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Doublets.Memory.Split.Specific
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the int 32 unused links list methods.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     /// <seealso cref="UnusedLinksListMethods{TLink}"/>
16     public unsafe class UInt32UnusedLinksListMethods : UnusedLinksListMethods<TLink>
17     {
18         /// <summary>
19         /// <para>
20         /// The links.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         private readonly RawLinkDataPart<TLink>* _links;
25         /// <summary>
26         /// <para>
27         /// The header.
28         /// </para>
29         /// <para></para>
30         /// </summary>
31         private readonly LinksHeader<TLink>* _header;
32
33         /// <summary>
34         /// <para>
35         /// Initializes a new <see cref="UInt32UnusedLinksListMethods"/> instance.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         /// <param name="links">
40         /// <para>A links.</para>
41         /// <para></para>
42         /// </param>
43         /// <param name="header">
44         /// <para>A header.</para>
45         /// <para></para>
46         /// </param>

```

```

47     [MethodImpl(MethodImplOptions.AggressiveInlining)]
48     public UInt32UnusedLinksListMethods(RawLinkDataPart<TLink>* links, LinksHeader<TLink>*
    ↪ header)
49         : base((byte*)links, (byte*)header)
50     {
51         _links = links;
52         _header = header;
53     }
54
55     /// <summary>
56     /// <para>
57     /// Gets the link data part reference using the specified link.
58     /// </para>
59     /// <para></para>
60     /// </summary>
61     /// <param name="link">
62     /// <para>The link.</para>
63     /// <para></para>
64     /// </param>
65     /// <returns>
66     /// <para>A ref raw link data part of t link</para>
67     /// <para></para>
68     /// </returns>
69     [MethodImpl(MethodImplOptions.AggressiveInlining)]
70     protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
    ↪ ref _links[link];
71
72     /// <summary>
73     /// <para>
74     /// Gets the header reference.
75     /// </para>
76     /// <para></para>
77     /// </summary>
78     /// <returns>
79     /// <para>A ref links header of t link</para>
80     /// <para></para>
81     /// </returns>
82     [MethodImpl(MethodImplOptions.AggressiveInlining)]
83     protected override ref LinksHeader<TLink> GetHeaderReference() => ref *_header;
84 }
85 }

```

## 1.62 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64ExternalLinksRecursionlessSizeBalancedTree

```

1  using System.Runtime.CompilerServices;
2  using Platform.Data.Doublets.Memory.Split.Generic;
3  using TLink = System.UInt64;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Doublets.Memory.Split.Specific
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the int 64 external links recursionless size balanced tree methods base.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     /// <seealso cref="ExternalLinksRecursionlessSizeBalancedTreeMethodsBase{TLink}"/>
16     /// <seealso cref="ILinksTreeMethods{TLink}"/>
17     public unsafe abstract class UInt64ExternalLinksRecursionlessSizeBalancedTreeMethodsBase :
    ↪ ExternalLinksRecursionlessSizeBalancedTreeMethodsBase<TLink>, ILinksTreeMethods<TLink>
18     {
19         /// <summary>
20         /// <para>
21         /// The links data parts.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         protected new readonly RawLinkDataPart<TLink>* LinksDataParts;
26         /// <summary>
27         /// <para>
28         /// The links index parts.
29         /// </para>
30         /// <para></para>
31         /// </summary>
32         protected new readonly RawLinkIndexPart<TLink>* LinksIndexParts;
33         /// <summary>
34         /// <para>
35         /// The header.

```

```

36    /// </para>
37    /// <para></para>
38    /// </summary>
39    protected new readonly LinksHeader<TLink>* Header;
40
41    /// <summary>
42    /// <para>
43    /// Initializes a new <see
44    ↪ cref="UInt64ExternalLinksRecursionlessSizeBalancedTreeMethodsBase"/> instance.
45    /// </para>
46    /// <para></para>
47    /// </summary>
48    /// <param name="constants">
49    /// <para>A constants.</para>
50    /// </param>
51    /// <param name="linksDataParts">
52    /// <para>A links data parts.</para>
53    /// <para></para>
54    /// </param>
55    /// <param name="linksIndexParts">
56    /// <para>A links index parts.</para>
57    /// <para></para>
58    /// </param>
59    /// <param name="header">
60    /// <para>A header.</para>
61    /// <para></para>
62    /// </param>
63    [MethodImpl(MethodImplOptions.AggressiveInlining)]
64    protected
65    ↪ UInt64ExternalLinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<TLink>
66    ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
67    ↪ linksIndexParts, LinksHeader<TLink>* header)
68    : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
69    {
70    LinksDataParts = linksDataParts;
71    LinksIndexParts = linksIndexParts;
72    Header = header;
73    }
74
75    /// <summary>
76    /// <para>
77    /// Gets the zero.
78    /// </para>
79    /// <para></para>
80    /// </summary>
81    /// <returns>
82    /// <para>The ulong</para>
83    /// <para></para>
84    /// </returns>
85    [MethodImpl(MethodImplOptions.AggressiveInlining)]
86    protected override ulong GetZero() => 0UL;
87
88    /// <summary>
89    /// <para>
90    /// Determines whether this instance equal to zero.
91    /// </para>
92    /// <para></para>
93    /// </summary>
94    /// <param name="value">
95    /// <para>The value.</para>
96    /// <para></para>
97    /// </param>
98    /// <returns>
99    /// <para>The bool</para>
100    /// <para></para>
101    /// </returns>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    protected override bool EqualToZero(ulong value) => value == 0UL;
104
105    /// <summary>
106    /// <para>
107    /// Determines whether this instance are equal.
108    /// </para>
109    /// <para></para>
110    /// </summary>
111    /// <param name="first">
112    /// <para>The first.</para>

```

```

110    /// <para></para>
111    /// </param>
112    /// <param name="second">
113    /// <para>The second.</para>
114    /// <para></para>
115    /// </param>
116    /// <returns>
117    /// <para>The bool</para>
118    /// <para></para>
119    /// </returns>
120    [MethodImpl(MethodImplOptions.AggressiveInlining)]
121    protected override bool AreEqual(ulong first, ulong second) => first == second;
122
123    /// <summary>
124    /// <para>
125    /// Determines whether this instance greater than zero.
126    /// </para>
127    /// <para></para>
128    /// </summary>
129    /// <param name="value">
130    /// <para>The value.</para>
131    /// <para></para>
132    /// </param>
133    /// <returns>
134    /// <para>The bool</para>
135    /// <para></para>
136    /// </returns>
137    [MethodImpl(MethodImplOptions.AggressiveInlining)]
138    protected override bool GreaterThanZero(ulong value) => value > 0UL;
139
140    /// <summary>
141    /// <para>
142    /// Determines whether this instance greater than.
143    /// </para>
144    /// <para></para>
145    /// </summary>
146    /// <param name="first">
147    /// <para>The first.</para>
148    /// <para></para>
149    /// </param>
150    /// <param name="second">
151    /// <para>The second.</para>
152    /// <para></para>
153    /// </param>
154    /// <returns>
155    /// <para>The bool</para>
156    /// <para></para>
157    /// </returns>
158    [MethodImpl(MethodImplOptions.AggressiveInlining)]
159    protected override bool GreaterThan(ulong first, ulong second) => first > second;
160
161    /// <summary>
162    /// <para>
163    /// Determines whether this instance greater or equal than.
164    /// </para>
165    /// <para></para>
166    /// </summary>
167    /// <param name="first">
168    /// <para>The first.</para>
169    /// <para></para>
170    /// </param>
171    /// <param name="second">
172    /// <para>The second.</para>
173    /// <para></para>
174    /// </param>
175    /// <returns>
176    /// <para>The bool</para>
177    /// <para></para>
178    /// </returns>
179    [MethodImpl(MethodImplOptions.AggressiveInlining)]
180    protected override bool GreaterOrEqualThan(ulong first, ulong second) => first >= second;
181
182    /// <summary>
183    /// <para>
184    /// Determines whether this instance greater or equal than zero.
185    /// </para>
186    /// <para></para>
187    /// </summary>

```



```

188     /// <param name="value">
189     /// <para>The value.</para>
190     /// <para></para>
191     /// </param>
192     /// <returns>
193     /// <para>The bool</para>
194     /// <para></para>
195     /// </returns>
196     [MethodImpl(MethodImplOptions.AggressiveInlining)]
197     protected override bool GreaterOrEqualThanZero(ulong value) => true; // value >= 0 is
    ↪ always true for ulong

198     /// <summary>
199     /// <para>
200     /// Determines whether this instance less or equal than zero.
201     /// </para>
202     /// <para></para>
203     /// </summary>
204     /// <param name="value">
205     /// <para>The value.</para>
206     /// <para></para>
207     /// </param>
208     /// <returns>
209     /// <para>The bool</para>
210     /// <para></para>
211     /// </returns>
212     [MethodImpl(MethodImplOptions.AggressiveInlining)]
213     protected override bool LessOrEqualThanZero(ulong value) => value == 0UL; // value is
214     ↪ always >= 0 for ulong

215     /// <summary>
216     /// <para>
217     /// Determines whether this instance less or equal than.
218     /// </para>
219     /// <para></para>
220     /// </summary>
221     /// <param name="first">
222     /// <para>The first.</para>
223     /// <para></para>
224     /// </param>
225     /// <param name="second">
226     /// <para>The second.</para>
227     /// <para></para>
228     /// </param>
229     /// <returns>
230     /// <para>The bool</para>
231     /// <para></para>
232     /// </returns>
233     [MethodImpl(MethodImplOptions.AggressiveInlining)]
234     protected override bool LessOrEqualThan(ulong first, ulong second) => first <= second;

235     /// <summary>
236     /// <para>
237     /// Determines whether this instance less than zero.
238     /// </para>
239     /// <para></para>
240     /// </summary>
241     /// <param name="value">
242     /// <para>The value.</para>
243     /// <para></para>
244     /// </param>
245     /// <returns>
246     /// <para>The bool</para>
247     /// <para></para>
248     /// </returns>
249     [MethodImpl(MethodImplOptions.AggressiveInlining)]
250     protected override bool LessThanZero(ulong value) => false; // value < 0 is always false
251     ↪ for ulong

252     /// <summary>
253     /// <para>
254     /// Determines whether this instance less than.
255     /// </para>
256     /// <para></para>
257     /// </summary>
258     /// <param name="first">
259     /// <para>The first.</para>
260     /// <para></para>
261     /// </param>
262     /// <para></para>

```

```

263     /// </param>
264     /// <param name="second">
265     /// <para>The second.</para>
266     /// <para></para>
267     /// </param>
268     /// <returns>
269     /// <para>The bool</para>
270     /// <para></para>
271     /// </returns>
272     [MethodImpl(MethodImplOptions.AggressiveInlining)]
273     protected override bool LessThan(ulong first, ulong second) => first < second;
274
275     /// <summary>
276     /// <para>
277     /// Increments the value.
278     /// </para>
279     /// <para></para>
280     /// </summary>
281     /// <param name="value">
282     /// <para>The value.</para>
283     /// <para></para>
284     /// </param>
285     /// <returns>
286     /// <para>The ulong</para>
287     /// <para></para>
288     /// </returns>
289     [MethodImpl(MethodImplOptions.AggressiveInlining)]
290     protected override ulong Increment(ulong value) => ++value;
291
292     /// <summary>
293     /// <para>
294     /// Decrements the value.
295     /// </para>
296     /// <para></para>
297     /// </summary>
298     /// <param name="value">
299     /// <para>The value.</para>
300     /// <para></para>
301     /// </param>
302     /// <returns>
303     /// <para>The ulong</para>
304     /// <para></para>
305     /// </returns>
306     [MethodImpl(MethodImplOptions.AggressiveInlining)]
307     protected override ulong Decrement(ulong value) => --value;
308
309     /// <summary>
310     /// <para>
311     /// Adds the first.
312     /// </para>
313     /// <para></para>
314     /// </summary>
315     /// <param name="first">
316     /// <para>The first.</para>
317     /// <para></para>
318     /// </param>
319     /// <param name="second">
320     /// <para>The second.</para>
321     /// <para></para>
322     /// </param>
323     /// <returns>
324     /// <para>The ulong</para>
325     /// <para></para>
326     /// </returns>
327     [MethodImpl(MethodImplOptions.AggressiveInlining)]
328     protected override ulong Add(ulong first, ulong second) => first + second;
329
330     /// <summary>
331     /// <para>
332     /// Subtracts the first.
333     /// </para>
334     /// <para></para>
335     /// </summary>
336     /// <param name="first">
337     /// <para>The first.</para>
338     /// <para></para>
339     /// </param>
340     /// <param name="second">

```

```

341    /// <para>The second.</para>
342    /// <para></para>
343    /// </param>
344    /// <returns>
345    /// <para>The ulong</para>
346    /// <para></para>
347    /// </returns>
348    [MethodImpl(MethodImplOptions.AggressiveInlining)]
349    protected override ulong Subtract(ulong first, ulong second) => first - second;
350
351    /// <summary>
352    /// <para>
353    /// Gets the header reference.
354    /// </para>
355    /// <para></para>
356    /// </summary>
357    /// <returns>
358    /// <para>A ref links header of t link</para>
359    /// <para></para>
360    /// </returns>
361    [MethodImpl(MethodImplOptions.AggressiveInlining)]
362    protected override ref LinksHeader<TLink> GetHeaderReference() => ref *Header;
363
364    /// <summary>
365    /// <para>
366    /// Gets the link data part reference using the specified link.
367    /// </para>
368    /// <para></para>
369    /// </summary>
370    /// <param name="link">
371    /// <para>The link.</para>
372    /// <para></para>
373    /// </param>
374    /// <returns>
375    /// <para>A ref raw link data part of t link</para>
376    /// <para></para>
377    /// </returns>
378    [MethodImpl(MethodImplOptions.AggressiveInlining)]
379    protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
380        ↪ ref LinksDataParts[link];
381
382    /// <summary>
383    /// <para>
384    /// Gets the link index part reference using the specified link.
385    /// </para>
386    /// <para></para>
387    /// </summary>
388    /// <param name="link">
389    /// <para>The link.</para>
390    /// <para></para>
391    /// </param>
392    /// <returns>
393    /// <para>A ref raw link index part of t link</para>
394    /// <para></para>
395    /// </returns>
396    [MethodImpl(MethodImplOptions.AggressiveInlining)]
397    protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
398        ↪ ref LinksIndexParts[link];
399
400    /// <summary>
401    /// <para>
402    /// Determines whether this instance first is to the left of second.
403    /// </para>
404    /// <para></para>
405    /// </summary>
406    /// <param name="first">
407    /// <para>The first.</para>
408    /// <para></para>
409    /// </param>
410    /// <param name="second">
411    /// <para>The second.</para>
412    /// <para></para>
413    /// </param>
414    /// <returns>
415    /// <para>The bool</para>
416    /// <para></para>
417    /// </returns>
418    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

417     protected override bool FirstIsToTheLeftOfSecond(TLink first, TLink second)
418     {
419         ref var firstLink = ref LinksDataParts[first];
420         ref var secondLink = ref LinksDataParts[second];
421         return FirstIsToTheLeftOfSecond(firstLink.Source, firstLink.Target,
422             ↪ secondLink.Source, secondLink.Target);
423     }
424     /// <summary>
425     /// <para>
426     /// Determines whether this instance first is to the right of second.
427     /// </para>
428     /// <para></para>
429     /// </summary>
430     /// <param name="first">
431     /// <para>The first.</para>
432     /// <para></para>
433     /// </param>
434     /// <param name="second">
435     /// <para>The second.</para>
436     /// <para></para>
437     /// </param>
438     /// <returns>
439     /// <para>The bool</para>
440     /// <para></para>
441     /// </returns>
442     [MethodImpl(MethodImplOptions.AggressiveInlining)]
443     protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second)
444     {
445         ref var firstLink = ref LinksDataParts[first];
446         ref var secondLink = ref LinksDataParts[second];
447         return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
448             ↪ secondLink.Source, secondLink.Target);
449     }
450 }

```

### 1.63 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64ExternalLinksSizeBalancedTreeMethodsBase

```

1  using System.Runtime.CompilerServices;
2  using Platform.Data.Doublets.Memory.Split.Generic;
3  using TLink = System.UInt64;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Doublets.Memory.Split.Specific
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the int 64 external links size balanced tree methods base.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     /// <seealso cref="ExternalLinksSizeBalancedTreeMethodsBase{TLink}"/>
16     /// <seealso cref="ILinksTreeMethods{TLink}"/>
17     public unsafe abstract class UInt64ExternalLinksSizeBalancedTreeMethodsBase :
18         ↪ ExternalLinksSizeBalancedTreeMethodsBase<TLink>, ILinksTreeMethods<TLink>
19     {
20         /// <summary>
21         /// <para>
22         /// The links data parts.
23         /// </para>
24         /// <para></para>
25         /// </summary>
26         protected new readonly RawLinkDataPart<TLink>* LinksDataParts;
27         /// <summary>
28         /// <para>
29         /// The links index parts.
30         /// </para>
31         /// <para></para>
32         /// </summary>
33         protected new readonly RawLinkIndexPart<TLink>* LinksIndexParts;
34         /// <summary>
35         /// <para>
36         /// The header.
37         /// </para>
38         /// <para></para>
39         /// </summary>
40         protected new readonly LinksHeader<TLink>* Header;

```

```

40
41     /// <summary>
42     /// <para>
43     /// Initializes a new <see cref="UInt64ExternalLinksSizeBalancedTreeMethodsBase"/>
44     ↪ instance.
45     /// </para>
46     /// <para></para>
47     /// </summary>
48     /// <param name="constants">
49     /// <para>A constants.</para>
50     /// <para></para>
51     /// </param>
52     /// <param name="linksDataParts">
53     /// <para>A links data parts.</para>
54     /// <para></para>
55     /// </param>
56     /// <param name="linksIndexParts">
57     /// <para>A links index parts.</para>
58     /// <para></para>
59     /// </param>
60     /// <param name="header">
61     /// <para>A header.</para>
62     /// <para></para>
63     /// </param>
64     [MethodImpl(MethodImplOptions.AggressiveInlining)]
65     protected UInt64ExternalLinksSizeBalancedTreeMethodsBase(LinksConstants<TLink>
66     ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
67     ↪ linksIndexParts, LinksHeader<TLink>* header)
68     : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
69     {
70         LinksDataParts = linksDataParts;
71         LinksIndexParts = linksIndexParts;
72         Header = header;
73     }
74
75     /// <summary>
76     /// <para>
77     /// Gets the zero.
78     /// </para>
79     /// <para></para>
80     /// </summary>
81     /// <returns>
82     /// <para>The ulong</para>
83     /// <para></para>
84     /// </returns>
85     [MethodImpl(MethodImplOptions.AggressiveInlining)]
86     protected override ulong GetZero() => 0UL;
87
88     /// <summary>
89     /// <para>
90     /// Determines whether this instance equal to zero.
91     /// </para>
92     /// <para></para>
93     /// </summary>
94     /// <param name="value">
95     /// <para>The value.</para>
96     /// <para></para>
97     /// </param>
98     /// <returns>
99     /// <para>The bool</para>
100    /// <para></para>
101    /// </returns>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    protected override bool EqualToZero(ulong value) => value == 0UL;
104
105    /// <summary>
106    /// <para>
107    /// Determines whether this instance are equal.
108    /// </para>
109    /// <para></para>
110    /// </summary>
111    /// <param name="first">
112    /// <para>The first.</para>
113    /// <para></para>
114    /// </param>
115    /// <param name="second">
116    /// <para>The second.</para>
117    /// <para></para>
118    /// </param>

```

```

115     /// </param>
116     /// <returns>
117     /// <para>The bool</para>
118     /// <para></para>
119     /// </returns>
120     [MethodImpl(MethodImplOptions.AggressiveInlining)]
121     protected override bool AreEqual(ulong first, ulong second) => first == second;
122
123     /// <summary>
124     /// <para>
125     /// Determines whether this instance greater than zero.
126     /// </para>
127     /// <para></para>
128     /// </summary>
129     /// <param name="value">
130     /// <para>The value.</para>
131     /// <para></para>
132     /// </param>
133     /// <returns>
134     /// <para>The bool</para>
135     /// <para></para>
136     /// </returns>
137     [MethodImpl(MethodImplOptions.AggressiveInlining)]
138     protected override bool GreaterThanZero(ulong value) => value > 0UL;
139
140     /// <summary>
141     /// <para>
142     /// Determines whether this instance greater than.
143     /// </para>
144     /// <para></para>
145     /// </summary>
146     /// <param name="first">
147     /// <para>The first.</para>
148     /// <para></para>
149     /// </param>
150     /// <param name="second">
151     /// <para>The second.</para>
152     /// <para></para>
153     /// </param>
154     /// <returns>
155     /// <para>The bool</para>
156     /// <para></para>
157     /// </returns>
158     [MethodImpl(MethodImplOptions.AggressiveInlining)]
159     protected override bool GreaterThan(ulong first, ulong second) => first > second;
160
161     /// <summary>
162     /// <para>
163     /// Determines whether this instance greater or equal than.
164     /// </para>
165     /// <para></para>
166     /// </summary>
167     /// <param name="first">
168     /// <para>The first.</para>
169     /// <para></para>
170     /// </param>
171     /// <param name="second">
172     /// <para>The second.</para>
173     /// <para></para>
174     /// </param>
175     /// <returns>
176     /// <para>The bool</para>
177     /// <para></para>
178     /// </returns>
179     [MethodImpl(MethodImplOptions.AggressiveInlining)]
180     protected override bool GreaterOrEqualThan(ulong first, ulong second) => first >= second;
181
182     /// <summary>
183     /// <para>
184     /// Determines whether this instance greater or equal than zero.
185     /// </para>
186     /// <para></para>
187     /// </summary>
188     /// <param name="value">
189     /// <para>The value.</para>
190     /// <para></para>
191     /// </param>
192     /// <returns>

```

```

193     /// <para>The bool</para>
194     /// <para></para>
195     /// </returns>
196     [MethodImpl(MethodImplOptions.AggressiveInlining)]
197     protected override bool GreaterOrEqualThanZero(ulong value) => true; // value >= 0 is
    ↪ always true for ulong
198
199     /// <summary>
200     /// <para>
201     /// Determines whether this instance less or equal than zero.
202     /// </para>
203     /// <para></para>
204     /// </summary>
205     /// <param name="value">
206     /// <para>The value.</para>
207     /// <para></para>
208     /// </param>
209     /// <returns>
210     /// <para>The bool</para>
211     /// <para></para>
212     /// </returns>
213     [MethodImpl(MethodImplOptions.AggressiveInlining)]
214     protected override bool LessOrEqualThanZero(ulong value) => value == 0UL; // value is
    ↪ always >= 0 for ulong
215
216     /// <summary>
217     /// <para>
218     /// Determines whether this instance less or equal than.
219     /// </para>
220     /// <para></para>
221     /// </summary>
222     /// <param name="first">
223     /// <para>The first.</para>
224     /// <para></para>
225     /// </param>
226     /// <param name="second">
227     /// <para>The second.</para>
228     /// <para></para>
229     /// </param>
230     /// <returns>
231     /// <para>The bool</para>
232     /// <para></para>
233     /// </returns>
234     [MethodImpl(MethodImplOptions.AggressiveInlining)]
235     protected override bool LessOrEqualThan(ulong first, ulong second) => first <= second;
236
237     /// <summary>
238     /// <para>
239     /// Determines whether this instance less than zero.
240     /// </para>
241     /// <para></para>
242     /// </summary>
243     /// <param name="value">
244     /// <para>The value.</para>
245     /// <para></para>
246     /// </param>
247     /// <returns>
248     /// <para>The bool</para>
249     /// <para></para>
250     /// </returns>
251     [MethodImpl(MethodImplOptions.AggressiveInlining)]
252     protected override bool LessThanZero(ulong value) => false; // value < 0 is always false
    ↪ for ulong
253
254     /// <summary>
255     /// <para>
256     /// Determines whether this instance less than.
257     /// </para>
258     /// <para></para>
259     /// </summary>
260     /// <param name="first">
261     /// <para>The first.</para>
262     /// <para></para>
263     /// </param>
264     /// <param name="second">
265     /// <para>The second.</para>
266     /// <para></para>
267     /// </param>

```

```

268    /// <returns>
269    /// <para>The bool</para>
270    /// <para></para>
271    /// </returns>
272    [MethodImpl(MethodImplOptions.AggressiveInlining)]
273    protected override bool LessThan(ulong first, ulong second) => first < second;
274
275    /// <summary>
276    /// <para>
277    /// Increments the value.
278    /// </para>
279    /// <para></para>
280    /// </summary>
281    /// <param name="value">
282    /// <para>The value.</para>
283    /// <para></para>
284    /// </param>
285    /// <returns>
286    /// <para>The ulong</para>
287    /// <para></para>
288    /// </returns>
289    [MethodImpl(MethodImplOptions.AggressiveInlining)]
290    protected override ulong Increment(ulong value) => ++value;
291
292    /// <summary>
293    /// <para>
294    /// Decrements the value.
295    /// </para>
296    /// <para></para>
297    /// </summary>
298    /// <param name="value">
299    /// <para>The value.</para>
300    /// <para></para>
301    /// </param>
302    /// <returns>
303    /// <para>The ulong</para>
304    /// <para></para>
305    /// </returns>
306    [MethodImpl(MethodImplOptions.AggressiveInlining)]
307    protected override ulong Decrement(ulong value) => --value;
308
309    /// <summary>
310    /// <para>
311    /// Adds the first.
312    /// </para>
313    /// <para></para>
314    /// </summary>
315    /// <param name="first">
316    /// <para>The first.</para>
317    /// <para></para>
318    /// </param>
319    /// <param name="second">
320    /// <para>The second.</para>
321    /// <para></para>
322    /// </param>
323    /// <returns>
324    /// <para>The ulong</para>
325    /// <para></para>
326    /// </returns>
327    [MethodImpl(MethodImplOptions.AggressiveInlining)]
328    protected override ulong Add(ulong first, ulong second) => first + second;
329
330    /// <summary>
331    /// <para>
332    /// Subtracts the first.
333    /// </para>
334    /// <para></para>
335    /// </summary>
336    /// <param name="first">
337    /// <para>The first.</para>
338    /// <para></para>
339    /// </param>
340    /// <param name="second">
341    /// <para>The second.</para>
342    /// <para></para>
343    /// </param>
344    /// <returns>
345    /// <para>The ulong</para>

```



```

346    /// <para></para>
347    /// </returns>
348    [MethodImpl(MethodImplOptions.AggressiveInlining)]
349    protected override ulong Subtract(ulong first, ulong second) => first - second;
350
351    /// <summary>
352    /// <para>
353    /// Gets the header reference.
354    /// </para>
355    /// <para></para>
356    /// </summary>
357    /// <returns>
358    /// <para>A ref links header of t link</para>
359    /// <para></para>
360    /// </returns>
361    [MethodImpl(MethodImplOptions.AggressiveInlining)]
362    protected override ref LinksHeader<TLink> GetHeaderReference() => ref *Header;
363
364    /// <summary>
365    /// <para>
366    /// Gets the link data part reference using the specified link.
367    /// </para>
368    /// <para></para>
369    /// </summary>
370    /// <param name="link">
371    /// <para>The link.</para>
372    /// <para></para>
373    /// </param>
374    /// <returns>
375    /// <para>A ref raw link data part of t link</para>
376    /// <para></para>
377    /// </returns>
378    [MethodImpl(MethodImplOptions.AggressiveInlining)]
379    protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
380        ↪ ref LinksDataParts[link];
381
382    /// <summary>
383    /// <para>
384    /// Gets the link index part reference using the specified link.
385    /// </para>
386    /// <para></para>
387    /// </summary>
388    /// <param name="link">
389    /// <para>The link.</para>
390    /// <para></para>
391    /// </param>
392    /// <returns>
393    /// <para>A ref raw link index part of t link</para>
394    /// <para></para>
395    /// </returns>
396    [MethodImpl(MethodImplOptions.AggressiveInlining)]
397    protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
398        ↪ ref LinksIndexParts[link];
399
400    /// <summary>
401    /// <para>
402    /// Determines whether this instance first is to the left of second.
403    /// </para>
404    /// <para></para>
405    /// </summary>
406    /// <param name="first">
407    /// <para>The first.</para>
408    /// <para></para>
409    /// </param>
410    /// <param name="second">
411    /// <para>The second.</para>
412    /// <para></para>
413    /// </param>
414    /// <returns>
415    /// <para>The bool</para>
416    /// <para></para>
417    /// </returns>
418    [MethodImpl(MethodImplOptions.AggressiveInlining)]
419    protected override bool FirstIsToLeftOfSecond(TLink first, TLink second)
420    {
421        ref var firstLink = ref LinksDataParts[first];
422        ref var secondLink = ref LinksDataParts[second];

```

```

421         return FirstIsToTheLeftOfSecond(firstLink.Source, firstLink.Target,
        ↪ secondLink.Source, secondLink.Target);
422     }
423
424     /// <summary>
425     /// <para>
426     /// Determines whether this instance first is to the right of second.
427     /// </para>
428     /// <para></para>
429     /// </summary>
430     /// <param name="first">
431     /// <para>The first.</para>
432     /// <para></para>
433     /// </param>
434     /// <param name="second">
435     /// <para>The second.</para>
436     /// <para></para>
437     /// </param>
438     /// <returns>
439     /// <para>The bool</para>
440     /// <para></para>
441     /// </returns>
442     [MethodImpl(MethodImplOptions.AggressiveInlining)]
443     protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second)
444     {
445         ref var firstLink = ref LinksDataParts[first];
446         ref var secondLink = ref LinksDataParts[second];
447         return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
        ↪ secondLink.Source, secondLink.Target);
448     }
449 }
450 }

```

#### 1.64 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64ExternalLinksSourcesRecursionlessSizeBalanced

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt64;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 64 external links sources recursionless size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt64ExternalLinksRecursionlessSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt64ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods :
        ↪ UInt64ExternalLinksRecursionlessSizeBalancedTreeMethodsBase
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see
        ↪ cref="UInt64ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods"/> instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="constants">
24         /// <para>A constants.</para>
25         /// <para></para>
26         /// </param>
27         /// <param name="linksDataParts">
28         /// <para>A links data parts.</para>
29         /// <para></para>
30         /// </param>
31         /// <param name="linksIndexParts">
32         /// <para>A links index parts.</para>
33         /// <para></para>
34         /// </param>
35         /// <param name="header">
36         /// <para>A header.</para>
37         /// <para></para>
38         /// </param>
39         [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

40 public
    ↳ UInt64ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
    ↳ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
    ↳ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
    ↳ linksIndexParts, header) { }
41
42 /// <summary>
43 /// <para>
44 /// Gets the left reference using the specified node.
45 /// </para>
46 /// <para></para>
47 /// </summary>
48 /// <param name="node">
49 /// <para>The node.</para>
50 /// <para></para>
51 /// </param>
52 /// <returns>
53 /// <para>The ref link</para>
54 /// <para></para>
55 /// </returns>
56 [MethodImpl(MethodImplOptions.AggressiveInlining)]
57 protected override ref TLink GetLeftReference(TLink node) => ref
    ↳ LinksIndexParts[node].LeftAsSource;
58
59 /// <summary>
60 /// <para>
61 /// Gets the right reference using the specified node.
62 /// </para>
63 /// <para></para>
64 /// </summary>
65 /// <param name="node">
66 /// <para>The node.</para>
67 /// <para></para>
68 /// </param>
69 /// <returns>
70 /// <para>The ref link</para>
71 /// <para></para>
72 /// </returns>
73 [MethodImpl(MethodImplOptions.AggressiveInlining)]
74 protected override ref TLink GetRightReference(TLink node) => ref
    ↳ LinksIndexParts[node].RightAsSource;
75
76 /// <summary>
77 /// <para>
78 /// Gets the left using the specified node.
79 /// </para>
80 /// <para></para>
81 /// </summary>
82 /// <param name="node">
83 /// <para>The node.</para>
84 /// <para></para>
85 /// </param>
86 /// <returns>
87 /// <para>The link</para>
88 /// <para></para>
89 /// </returns>
90 [MethodImpl(MethodImplOptions.AggressiveInlining)]
91 protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsSource;
92
93 /// <summary>
94 /// <para>
95 /// Gets the right using the specified node.
96 /// </para>
97 /// <para></para>
98 /// </summary>
99 /// <param name="node">
100 /// <para>The node.</para>
101 /// <para></para>
102 /// </param>
103 /// <returns>
104 /// <para>The link</para>
105 /// <para></para>
106 /// </returns>
107 [MethodImpl(MethodImplOptions.AggressiveInlining)]
108 protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsSource;
109
110 /// <summary>
111 /// <para>

```

```

112    /// Sets the left using the specified node.
113    /// </para>
114    /// <para></para>
115    /// </summary>
116    /// <param name="node">
117    /// <para>The node.</para>
118    /// <para></para>
119    /// </param>
120    /// <param name="left">
121    /// <para>The left.</para>
122    /// <para></para>
123    /// </param>
124    [MethodImpl(MethodImplOptions.AggressiveInlining)]
125    protected override void SetLeft(TLink node, TLink left) =>
126        ↳ LinksIndexParts[node].LeftAsSource = left;
127
128    /// <summary>
129    /// <para>
130    /// Sets the right using the specified node.
131    /// </para>
132    /// <para></para>
133    /// </summary>
134    /// <param name="node">
135    /// <para>The node.</para>
136    /// <para></para>
137    /// </param>
138    /// <param name="right">
139    /// <para>The right.</para>
140    /// <para></para>
141    /// </param>
142    [MethodImpl(MethodImplOptions.AggressiveInlining)]
143    protected override void SetRight(TLink node, TLink right) =>
144        ↳ LinksIndexParts[node].RightAsSource = right;
145
146    /// <summary>
147    /// <para>
148    /// Gets the size using the specified node.
149    /// </para>
150    /// <para></para>
151    /// </summary>
152    /// <param name="node">
153    /// <para>The node.</para>
154    /// <para></para>
155    /// </param>
156    /// <returns>
157    /// <para>The link</para>
158    /// <para></para>
159    /// </returns>
160    [MethodImpl(MethodImplOptions.AggressiveInlining)]
161    protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsSource;
162
163    /// <summary>
164    /// <para>
165    /// Sets the size using the specified node.
166    /// </para>
167    /// <para></para>
168    /// </summary>
169    /// <param name="node">
170    /// <para>The node.</para>
171    /// <para></para>
172    /// </param>
173    /// <param name="size">
174    /// <para>The size.</para>
175    /// <para></para>
176    /// </param>
177    [MethodImpl(MethodImplOptions.AggressiveInlining)]
178    protected override void SetSize(TLink node, TLink size) =>
179        ↳ LinksIndexParts[node].SizeAsSource = size;
180
181    /// <summary>
182    /// <para>
183    /// Gets the tree root.
184    /// </para>
185    /// <para></para>
186    /// </summary>
187    /// <returns>
188    /// <para>The link</para>
189    /// <para></para>

```

```

187     /// </returns>
188     [MethodImpl(MethodImplOptions.AggressiveInlining)]
189     protected override TLink GetTreeRoot() => Header->RootAsSource;
190
191     /// <summary>
192     /// <para>
193     /// Gets the base part value using the specified node.
194     /// </para>
195     /// <para></para>
196     /// </summary>
197     /// <param name="node">
198     /// <para>The node.</para>
199     /// <para></para>
200     /// </param>
201     /// <returns>
202     /// <para>The link</para>
203     /// <para></para>
204     /// </returns>
205     [MethodImpl(MethodImplOptions.AggressiveInlining)]
206     protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Source;
207
208     /// <summary>
209     /// <para>
210     /// Determines whether this instance first is to the left of second.
211     /// </para>
212     /// <para></para>
213     /// </summary>
214     /// <param name="firstSource">
215     /// <para>The first source.</para>
216     /// <para></para>
217     /// </param>
218     /// <param name="firstTarget">
219     /// <para>The first target.</para>
220     /// <para></para>
221     /// </param>
222     /// <param name="secondSource">
223     /// <para>The second source.</para>
224     /// <para></para>
225     /// </param>
226     /// <param name="secondTarget">
227     /// <para>The second target.</para>
228     /// <para></para>
229     /// </param>
230     /// <returns>
231     /// <para>The bool</para>
232     /// <para></para>
233     /// </returns>
234     [MethodImpl(MethodImplOptions.AggressiveInlining)]
235     protected override bool FirstIsToTheLeftOfSecond(TLink firstSource, TLink firstTarget,
236     ↪ TLink secondSource, TLink secondTarget)
237     => firstSource < secondSource || firstSource == secondSource && firstTarget <
238     ↪ secondTarget;
239
240     /// <summary>
241     /// <para>
242     /// Determines whether this instance first is to the right of second.
243     /// </para>
244     /// <para></para>
245     /// </summary>
246     /// <param name="firstSource">
247     /// <para>The first source.</para>
248     /// <para></para>
249     /// </param>
250     /// <param name="firstTarget">
251     /// <para>The first target.</para>
252     /// <para></para>
253     /// </param>
254     /// <param name="secondSource">
255     /// <para>The second source.</para>
256     /// <para></para>
257     /// </param>
258     /// <param name="secondTarget">
259     /// <para>The second target.</para>
260     /// <para></para>
261     /// </param>
262     /// <returns>
263     /// <para>The bool</para>
264     /// <para></para>
265     /// </returns>

```

```

263     /// </returns>
264     [MethodImpl(MethodImplOptions.AggressiveInlining)]
265     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
266         ↪ TLink secondSource, TLink secondTarget)
267         => firstSource > secondSource || firstSource == secondSource && firstTarget >
268         ↪ secondTarget;
269
270     /// <summary>
271     /// <para>
272     /// Clears the node using the specified node.
273     /// </para>
274     /// <para></para>
275     /// </summary>
276     /// <param name="node">
277     /// <para>The node.</para>
278     /// <para></para>
279     /// </param>
280     [MethodImpl(MethodImplOptions.AggressiveInlining)]
281     protected override void ClearNode(TLink node)
282     {
283         ref var link = ref LinksIndexParts[node];
284         link.LeftAsSource = Zero;
285         link.RightAsSource = Zero;
286         link.SizeAsSource = Zero;
287     }
288 }

```

## 1.65 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64ExternalLinksSourcesSizeBalancedTreeMethods

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt64;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 64 external links sources size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt64ExternalLinksSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt64ExternalLinksSourcesSizeBalancedTreeMethods :
16         ↪ UInt64ExternalLinksSizeBalancedTreeMethodsBase
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see cref="UInt64ExternalLinksSourcesSizeBalancedTreeMethods"/>
21         ↪ instance.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         /// <param name="constants">
26         /// <para>A constants.</para>
27         /// <para></para>
28         /// </param>
29         /// <param name="linksDataParts">
30         /// <para>A links data parts.</para>
31         /// <para></para>
32         /// </param>
33         /// <param name="linksIndexParts">
34         /// <para>A links index parts.</para>
35         /// <para></para>
36         /// </param>
37         /// <param name="header">
38         /// <para>A header.</para>
39         /// <para></para>
40         /// </param>
41         [MethodImpl(MethodImplOptions.AggressiveInlining)]
42         public UInt64ExternalLinksSourcesSizeBalancedTreeMethods(LinksConstants<TLink>
43             ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
44             ↪ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
45             ↪ linksIndexParts, header) { }
46
47         /// <summary>
48         /// <para>
49         /// Gets the left reference using the specified node.
50         /// </para>

```

```

46     /// <para></para>
47     /// </summary>
48     /// <param name="node">
49     /// <para>The node.</para>
50     /// <para></para>
51     /// </param>
52     /// <returns>
53     /// <para>The ref link</para>
54     /// <para></para>
55     /// </returns>
56     [MethodImpl(MethodImplOptions.AggressiveInlining)]
57     protected override ref TLink GetLeftReference(TLink node) => ref
    ↪ LinksIndexParts[node].LeftAsSource;

58
59     /// <summary>
60     /// <para>
61     /// Gets the right reference using the specified node.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     /// <param name="node">
66     /// <para>The node.</para>
67     /// <para></para>
68     /// </param>
69     /// <returns>
70     /// <para>The ref link</para>
71     /// <para></para>
72     /// </returns>
73     [MethodImpl(MethodImplOptions.AggressiveInlining)]
74     protected override ref TLink GetRightReference(TLink node) => ref
    ↪ LinksIndexParts[node].RightAsSource;

75
76     /// <summary>
77     /// <para>
78     /// Gets the left using the specified node.
79     /// </para>
80     /// <para></para>
81     /// </summary>
82     /// <param name="node">
83     /// <para>The node.</para>
84     /// <para></para>
85     /// </param>
86     /// <returns>
87     /// <para>The link</para>
88     /// <para></para>
89     /// </returns>
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsSource;
92
93     /// <summary>
94     /// <para>
95     /// Gets the right using the specified node.
96     /// </para>
97     /// <para></para>
98     /// </summary>
99     /// <param name="node">
100    /// <para>The node.</para>
101    /// <para></para>
102    /// </param>
103    /// <returns>
104    /// <para>The link</para>
105    /// <para></para>
106    /// </returns>
107    [MethodImpl(MethodImplOptions.AggressiveInlining)]
108    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsSource;
109
110    /// <summary>
111    /// <para>
112    /// Sets the left using the specified node.
113    /// </para>
114    /// <para></para>
115    /// </summary>
116    /// <param name="node">
117    /// <para>The node.</para>
118    /// <para></para>
119    /// </param>
120    /// <param name="left">
121    /// <para>The left.</para>

```

```

122     /// <para></para>
123     /// </param>
124     [MethodImpl(MethodImplOptions.AggressiveInlining)]
125     protected override void SetLeft(TLink node, TLink left) =>
126         ↳ LinksIndexParts[node].LeftAsSource = left;
127
128     /// <summary>
129     /// <para>
130     /// Sets the right using the specified node.
131     /// </para>
132     /// </summary>
133     /// <param name="node">
134     /// <para>The node.</para>
135     /// </para>
136     /// </param>
137     /// <param name="right">
138     /// <para>The right.</para>
139     /// </para>
140     /// </param>
141     [MethodImpl(MethodImplOptions.AggressiveInlining)]
142     protected override void SetRight(TLink node, TLink right) =>
143         ↳ LinksIndexParts[node].RightAsSource = right;
144
145     /// <summary>
146     /// <para>
147     /// Gets the size using the specified node.
148     /// </para>
149     /// </summary>
150     /// <param name="node">
151     /// <para>The node.</para>
152     /// </para>
153     /// </param>
154     /// <returns>
155     /// <para>The link</para>
156     /// </returns>
157     [MethodImpl(MethodImplOptions.AggressiveInlining)]
158     protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsSource;
159
160     /// <summary>
161     /// <para>
162     /// Sets the size using the specified node.
163     /// </para>
164     /// </summary>
165     /// <param name="node">
166     /// <para>The node.</para>
167     /// </para>
168     /// </param>
169     /// <param name="size">
170     /// <para>The size.</para>
171     /// </para>
172     /// </param>
173     [MethodImpl(MethodImplOptions.AggressiveInlining)]
174     protected override void SetSize(TLink node, TLink size) =>
175         ↳ LinksIndexParts[node].SizeAsSource = size;
176
177     /// <summary>
178     /// <para>
179     /// Gets the tree root.
180     /// </para>
181     /// </summary>
182     /// <returns>
183     /// <para>The link</para>
184     /// </returns>
185     [MethodImpl(MethodImplOptions.AggressiveInlining)]
186     protected override TLink GetTreeRoot() => Header->RootAsSource;
187
188     /// <summary>
189     /// <para>
190     /// Gets the base part value using the specified node.
191     /// </para>
192     /// </summary>

```



```

197     /// <param name="node">
198     /// <para>The node.</para>
199     /// <para></para>
200     /// </param>
201     /// <returns>
202     /// <para>The link</para>
203     /// <para></para>
204     /// </returns>
205     [MethodImpl(MethodImplOptions.AggressiveInlining)]
206     protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Source;
207
208     /// <summary>
209     /// <para>
210     /// Determines whether this instance first is to the left of second.
211     /// </para>
212     /// <para></para>
213     /// </summary>
214     /// <param name="firstSource">
215     /// <para>The first source.</para>
216     /// <para></para>
217     /// </param>
218     /// <param name="firstTarget">
219     /// <para>The first target.</para>
220     /// <para></para>
221     /// </param>
222     /// <param name="secondSource">
223     /// <para>The second source.</para>
224     /// <para></para>
225     /// </param>
226     /// <param name="secondTarget">
227     /// <para>The second target.</para>
228     /// <para></para>
229     /// </param>
230     /// <returns>
231     /// <para>The bool</para>
232     /// <para></para>
233     /// </returns>
234     [MethodImpl(MethodImplOptions.AggressiveInlining)]
235     protected override bool FirstIsToLeftOfSecond(TLink firstSource, TLink firstTarget,
236     ↪ TLink secondSource, TLink secondTarget)
237     => firstSource < secondSource || firstSource == secondSource && firstTarget <
238     ↪ secondTarget;
239
240     /// <summary>
241     /// <para>
242     /// Determines whether this instance first is to the right of second.
243     /// </para>
244     /// <para></para>
245     /// </summary>
246     /// <param name="firstSource">
247     /// <para>The first source.</para>
248     /// <para></para>
249     /// </param>
250     /// <param name="firstTarget">
251     /// <para>The first target.</para>
252     /// <para></para>
253     /// </param>
254     /// <param name="secondSource">
255     /// <para>The second source.</para>
256     /// <para></para>
257     /// </param>
258     /// <param name="secondTarget">
259     /// <para>The second target.</para>
260     /// <para></para>
261     /// </param>
262     /// <returns>
263     /// <para>The bool</para>
264     /// <para></para>
265     /// </returns>
266     [MethodImpl(MethodImplOptions.AggressiveInlining)]
267     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
268     ↪ TLink secondSource, TLink secondTarget)
269     => firstSource > secondSource || firstSource == secondSource && firstTarget >
270     ↪ secondTarget;
271
272     /// <summary>
273     /// <para>
274     /// Clears the node using the specified node.

```

```

271     /// </para>
272     /// <para></para>
273     /// </summary>
274     /// <param name="node">
275     /// <para>The node.</para>
276     /// <para></para>
277     /// </param>
278     [MethodImpl(MethodImplOptions.AggressiveInlining)]
279     protected override void ClearNode(TLink node)
280     {
281         ref var link = ref LinksIndexParts[node];
282         link.LeftAsSource = Zero;
283         link.RightAsSource = Zero;
284         link.SizeAsSource = Zero;
285     }
286 }
287 }

```

## 1.66 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64ExternalLinksTargetsRecursionlessSizeBalancedTreeMethodsBase

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt64;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 64 external links targets recursionless size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt64ExternalLinksRecursionlessSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt64ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods :
16     ↪ UInt64ExternalLinksRecursionlessSizeBalancedTreeMethodsBase
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see
21         ↪ cref="UInt64ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods"/> instance.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         /// <param name="constants">
26         /// <para>A constants.</para>
27         /// <para></para>
28         /// </param>
29         /// <param name="linksDataParts">
30         /// <para>A links data parts.</para>
31         /// <para></para>
32         /// </param>
33         /// <param name="linksIndexParts">
34         /// <para>A links index parts.</para>
35         /// <para></para>
36         /// </param>
37         /// <param name="header">
38         /// <para>A header.</para>
39         /// <para></para>
40         /// </param>
41         [MethodImpl(MethodImplOptions.AggressiveInlining)]
42         public
43         ↪ UInt64ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
44         ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
45         ↪ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
46         ↪ linksIndexParts, header) { }
47
48         /// <summary>
49         /// <para>
50         /// Gets the left reference using the specified node.
51         /// </para>
52         /// <para></para>
53         /// </summary>
54         /// <param name="node">
55         /// <para>The node.</para>
56         /// <para></para>
57         /// </param>
58         /// <returns>
59         /// <para>The ref link</para>
60         /// <para></para>

```

```

55     /// </returns>
56     [MethodImpl(MethodImplOptions.AggressiveInlining)]
57     protected override ref TLink GetLeftReference(TLink node) => ref
    ↪ LinksIndexParts[node].LeftAsTarget;

58
59     /// <summary>
60     /// <para>
61     /// Gets the right reference using the specified node.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     /// <param name="node">
66     /// <para>The node.</para>
67     /// <para></para>
68     /// </param>
69     /// <returns>
70     /// <para>The ref link</para>
71     /// <para></para>
72     /// </returns>
73     [MethodImpl(MethodImplOptions.AggressiveInlining)]
74     protected override ref TLink GetRightReference(TLink node) => ref
    ↪ LinksIndexParts[node].RightAsTarget;

75
76     /// <summary>
77     /// <para>
78     /// Gets the left using the specified node.
79     /// </para>
80     /// <para></para>
81     /// </summary>
82     /// <param name="node">
83     /// <para>The node.</para>
84     /// <para></para>
85     /// </param>
86     /// <returns>
87     /// <para>The link</para>
88     /// <para></para>
89     /// </returns>
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsTarget;
92
93     /// <summary>
94     /// <para>
95     /// Gets the right using the specified node.
96     /// </para>
97     /// <para></para>
98     /// </summary>
99     /// <param name="node">
100    /// <para>The node.</para>
101    /// <para></para>
102    /// </param>
103    /// <returns>
104    /// <para>The link</para>
105    /// <para></para>
106    /// </returns>
107    [MethodImpl(MethodImplOptions.AggressiveInlining)]
108    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsTarget;
109
110    /// <summary>
111    /// <para>
112    /// Sets the left using the specified node.
113    /// </para>
114    /// <para></para>
115    /// </summary>
116    /// <param name="node">
117    /// <para>The node.</para>
118    /// <para></para>
119    /// </param>
120    /// <param name="left">
121    /// <para>The left.</para>
122    /// <para></para>
123    /// </param>
124    [MethodImpl(MethodImplOptions.AggressiveInlining)]
125    protected override void SetLeft(TLink node, TLink left) =>
    ↪ LinksIndexParts[node].LeftAsTarget = left;

126
127    /// <summary>
128    /// <para>
129    /// Sets the right using the specified node.

```

```

130    /// </para>
131    /// <para></para>
132    /// </summary>
133    /// <param name="node">
134    /// <para>The node.</para>
135    /// <para></para>
136    /// </param>
137    /// <param name="right">
138    /// <para>The right.</para>
139    /// <para></para>
140    /// </param>
141    [MethodImpl(MethodImplOptions.AggressiveInlining)]
142    protected override void SetRight(TLink node, TLink right) =>
143        ↪ LinksIndexParts[node].RightAsTarget = right;
144
145    /// <summary>
146    /// <para>
147    /// Gets the size using the specified node.
148    /// </para>
149    /// <para></para>
150    /// </summary>
151    /// <param name="node">
152    /// <para>The node.</para>
153    /// <para></para>
154    /// </param>
155    /// <returns>
156    /// <para>The link</para>
157    /// <para></para>
158    /// </returns>
159    [MethodImpl(MethodImplOptions.AggressiveInlining)]
160    protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsTarget;
161
162    /// <summary>
163    /// <para>
164    /// Sets the size using the specified node.
165    /// </para>
166    /// <para></para>
167    /// </summary>
168    /// <param name="node">
169    /// <para>The node.</para>
170    /// <para></para>
171    /// </param>
172    /// <param name="size">
173    /// <para>The size.</para>
174    /// <para></para>
175    /// </param>
176    [MethodImpl(MethodImplOptions.AggressiveInlining)]
177    protected override void SetSize(TLink node, TLink size) =>
178        ↪ LinksIndexParts[node].SizeAsTarget = size;
179
180    /// <summary>
181    /// <para>
182    /// Gets the tree root.
183    /// </para>
184    /// <para></para>
185    /// </summary>
186    /// <returns>
187    /// <para>The link</para>
188    /// <para></para>
189    /// </returns>
190    [MethodImpl(MethodImplOptions.AggressiveInlining)]
191    protected override TLink GetTreeRoot() => Header->RootAsTarget;
192
193    /// <summary>
194    /// <para>
195    /// Gets the base part value using the specified node.
196    /// </para>
197    /// <para></para>
198    /// </summary>
199    /// <param name="node">
200    /// <para>The node.</para>
201    /// <para></para>
202    /// </param>
203    /// <returns>
204    /// <para>The link</para>
205    /// <para></para>
206    /// </returns>
207    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

206     protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Target;
207
208     /// <summary>
209     /// <para>
210     /// Determines whether this instance first is to the left of second.
211     /// </para>
212     /// <para></para>
213     /// </summary>
214     /// <param name="firstSource">
215     /// <para>The first source.</para>
216     /// <para></para>
217     /// </param>
218     /// <param name="firstTarget">
219     /// <para>The first target.</para>
220     /// <para></para>
221     /// </param>
222     /// <param name="secondSource">
223     /// <para>The second source.</para>
224     /// <para></para>
225     /// </param>
226     /// <param name="secondTarget">
227     /// <para>The second target.</para>
228     /// <para></para>
229     /// </param>
230     /// <returns>
231     /// <para>The bool</para>
232     /// <para></para>
233     /// </returns>
234     [MethodImpl(MethodImplOptions.AggressiveInlining)]
235     protected override bool FirstIsToLeftOfSecond(TLink firstSource, TLink firstTarget,
236     ↪ TLink secondSource, TLink secondTarget)
237     => firstTarget < secondTarget || firstTarget == secondTarget && firstSource <
238     ↪ secondSource;
239
240     /// <summary>
241     /// <para>
242     /// Determines whether this instance first is to the right of second.
243     /// </para>
244     /// <para></para>
245     /// </summary>
246     /// <param name="firstSource">
247     /// <para>The first source.</para>
248     /// <para></para>
249     /// </param>
250     /// <param name="firstTarget">
251     /// <para>The first target.</para>
252     /// <para></para>
253     /// </param>
254     /// <param name="secondSource">
255     /// <para>The second source.</para>
256     /// <para></para>
257     /// </param>
258     /// <param name="secondTarget">
259     /// <para>The second target.</para>
260     /// <para></para>
261     /// </param>
262     /// <returns>
263     /// <para>The bool</para>
264     /// <para></para>
265     /// </returns>
266     [MethodImpl(MethodImplOptions.AggressiveInlining)]
267     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
268     ↪ TLink secondSource, TLink secondTarget)
269     => firstTarget > secondTarget || firstTarget == secondTarget && firstSource >
270     ↪ secondSource;
271
272     /// <summary>
273     /// <para>
274     /// Clears the node using the specified node.
275     /// </para>
276     /// <para></para>
277     /// </summary>
278     /// <param name="node">
279     /// <para>The node.</para>
280     /// <para></para>
281     /// </param>
282     [MethodImpl(MethodImplOptions.AggressiveInlining)]
283     protected override void ClearNode(TLink node)

```

```

280     {
281         ref var link = ref LinksIndexParts[node];
282         link.LeftAsTarget = Zero;
283         link.RightAsTarget = Zero;
284         link.SizeAsTarget = Zero;
285     }
286 }
287 }

```

## 1.67 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64ExternalLinksTargetsSizeBalancedTreeMethods

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt64;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 64 external links targets size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt64ExternalLinksSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt64ExternalLinksTargetsSizeBalancedTreeMethods :
16         ↳ UInt64ExternalLinksSizeBalancedTreeMethodsBase
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see cref="UInt64ExternalLinksTargetsSizeBalancedTreeMethods"/>
21         ↳ instance.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         /// <param name="constants">
26         /// <para>A constants.</para>
27         /// <para></para>
28         /// </param>
29         /// <param name="linksDataParts">
30         /// <para>A links data parts.</para>
31         /// <para></para>
32         /// </param>
33         /// <param name="linksIndexParts">
34         /// <para>A links index parts.</para>
35         /// <para></para>
36         /// </param>
37         /// <param name="header">
38         /// <para>A header.</para>
39         /// <para></para>
40         /// </param>
41         [MethodImpl(MethodImplOptions.AggressiveInlining)]
42         public UInt64ExternalLinksTargetsSizeBalancedTreeMethods(LinksConstants<TLink>
43             ↳ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
44             ↳ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
45             ↳ linksIndexParts, header) { }
46
47         /// <summary>
48         /// <para>
49         /// Gets the left reference using the specified node.
50         /// </para>
51         /// <para></para>
52         /// </summary>
53         /// <param name="node">
54         /// <para>The node.</para>
55         /// <para></para>
56         /// </param>
57         /// <returns>
58         /// <para>The ref link</para>
59         /// <para></para>
60         /// </returns>
61         [MethodImpl(MethodImplOptions.AggressiveInlining)]
62         protected override ref TLink GetLeftReference(TLink node) => ref
63             ↳ LinksIndexParts[node].LeftAsTarget;
64
65         /// <summary>
66         /// <para>
67         /// Gets the right reference using the specified node.
68         /// </para>
69         /// <para></para>
70         /// </summary>
71         /// <param name="node">
72         /// <para>The node.</para>
73         /// <para></para>
74         /// </param>
75         /// <returns>
76         /// <para>The ref link</para>
77         /// <para></para>
78         /// </returns>
79         [MethodImpl(MethodImplOptions.AggressiveInlining)]
80         protected override ref TLink GetRightReference(TLink node) => ref
81             ↳ LinksIndexParts[node].RightAsTarget;
82     }
83 }

```

```

64     /// </summary>
65     /// <param name="node">
66     /// <para>The node.</para>
67     /// <para></para>
68     /// </param>
69     /// <returns>
70     /// <para>The ref link</para>
71     /// <para></para>
72     /// </returns>
73     [MethodImpl(MethodImplOptions.AggressiveInlining)]
74     protected override ref TLink GetRightReference(TLink node) => ref
75     ↪ LinksIndexParts[node].RightAsTarget;
76
77     /// <summary>
78     /// <para>
79     /// Gets the left using the specified node.
80     /// </para>
81     /// <para></para>
82     /// </summary>
83     /// <param name="node">
84     /// <para>The node.</para>
85     /// <para></para>
86     /// </param>
87     /// <returns>
88     /// <para>The link</para>
89     /// <para></para>
90     /// </returns>
91     [MethodImpl(MethodImplOptions.AggressiveInlining)]
92     protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsTarget;
93
94     /// <summary>
95     /// <para>
96     /// Gets the right using the specified node.
97     /// </para>
98     /// <para></para>
99     /// </summary>
100    /// <param name="node">
101    /// <para>The node.</para>
102    /// <para></para>
103    /// </param>
104    /// <returns>
105    /// <para>The link</para>
106    /// <para></para>
107    /// </returns>
108    [MethodImpl(MethodImplOptions.AggressiveInlining)]
109    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsTarget;
110
111    /// <summary>
112    /// <para>
113    /// Sets the left using the specified node.
114    /// </para>
115    /// <para></para>
116    /// </summary>
117    /// <param name="node">
118    /// <para>The node.</para>
119    /// <para></para>
120    /// </param>
121    /// <param name="left">
122    /// <para>The left.</para>
123    /// <para></para>
124    /// </param>
125    [MethodImpl(MethodImplOptions.AggressiveInlining)]
126    protected override void SetLeft(TLink node, TLink left) =>
127    ↪ LinksIndexParts[node].LeftAsTarget = left;
128
129    /// <summary>
130    /// <para>
131    /// Sets the right using the specified node.
132    /// </para>
133    /// <para></para>
134    /// </summary>
135    /// <param name="node">
136    /// <para>The node.</para>
137    /// <para></para>
138    /// </param>
139    /// <param name="right">
140    /// <para>The right.</para>
141    /// <para></para>
142    /// </param>

```

```

140    /// </param>
141    [MethodImpl(MethodImplOptions.AggressiveInlining)]
142    protected override void SetRight(TLink node, TLink right) =>
143        ↳ LinksIndexParts[node].RightAsTarget = right;
144
145    /// <summary>
146    /// <para>
147    /// Gets the size using the specified node.
148    /// </para>
149    /// </summary>
150    /// <param name="node">
151    /// <para>The node.</para>
152    /// </para>
153    /// </param>
154    /// <returns>
155    /// <para>The link</para>
156    /// </returns>
157    [MethodImpl(MethodImplOptions.AggressiveInlining)]
158    protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsTarget;
159
160    /// <summary>
161    /// <para>
162    /// Sets the size using the specified node.
163    /// </para>
164    /// </summary>
165    /// <param name="node">
166    /// <para>The node.</para>
167    /// </para>
168    /// </param>
169    /// <param name="size">
170    /// <para>The size.</para>
171    /// </para>
172    /// </param>
173    [MethodImpl(MethodImplOptions.AggressiveInlining)]
174    protected override void SetSize(TLink node, TLink size) =>
175        ↳ LinksIndexParts[node].SizeAsTarget = size;
176
177    /// <summary>
178    /// <para>
179    /// Gets the tree root.
180    /// </para>
181    /// </summary>
182    /// <returns>
183    /// <para>The link</para>
184    /// </returns>
185    [MethodImpl(MethodImplOptions.AggressiveInlining)]
186    protected override TLink GetTreeRoot() => Header->RootAsTarget;
187
188    /// <summary>
189    /// <para>
190    /// Gets the base part value using the specified node.
191    /// </para>
192    /// </summary>
193    /// <param name="node">
194    /// <para>The node.</para>
195    /// </para>
196    /// </param>
197    /// <returns>
198    /// <para>The link</para>
199    /// </returns>
200    [MethodImpl(MethodImplOptions.AggressiveInlining)]
201    protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Target;
202
203    /// <summary>
204    /// <para>
205    /// Determines whether this instance first is to the left of second.
206    /// </para>
207    /// </summary>
208    /// <param name="firstSource">
209    /// <para>The first source.</para>
210    /// </para>
211    /// </param>
212    /// </summary>
213    /// <param name="secondSource">
214    /// <para>The second source.</para>
215    /// </para>
216    /// </param>
217    /// </summary>

```



```

216    /// <para></para>
217    /// </param>
218    /// <param name="firstTarget">
219    /// <para>The first target.</para>
220    /// <para></para>
221    /// </param>
222    /// <param name="secondSource">
223    /// <para>The second source.</para>
224    /// <para></para>
225    /// </param>
226    /// <param name="secondTarget">
227    /// <para>The second target.</para>
228    /// <para></para>
229    /// </param>
230    /// <returns>
231    /// <para>The bool</para>
232    /// <para></para>
233    /// </returns>
234    [MethodImpl(MethodImplOptions.AggressiveInlining)]
235    protected override bool FirstIsToLeftOfSecond(TLink firstSource, TLink firstTarget,
236    ↪ TLink secondSource, TLink secondTarget)
237    => firstTarget < secondTarget || firstTarget == secondTarget && firstSource <
238    ↪ secondSource;
239
240    /// <summary>
241    /// <para>
242    /// Determines whether this instance first is to the right of second.
243    /// </para>
244    /// <para></para>
245    /// </summary>
246    /// <param name="firstSource">
247    /// <para>The first source.</para>
248    /// <para></para>
249    /// </param>
250    /// <param name="firstTarget">
251    /// <para>The first target.</para>
252    /// <para></para>
253    /// </param>
254    /// <param name="secondSource">
255    /// <para>The second source.</para>
256    /// <para></para>
257    /// </param>
258    /// <param name="secondTarget">
259    /// <para>The second target.</para>
260    /// <para></para>
261    /// </param>
262    /// <returns>
263    /// <para>The bool</para>
264    /// <para></para>
265    /// </returns>
266    [MethodImpl(MethodImplOptions.AggressiveInlining)]
267    protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
268    ↪ TLink secondSource, TLink secondTarget)
269    => firstTarget > secondTarget || firstTarget == secondTarget && firstSource >
270    ↪ secondSource;
271
272    /// <summary>
273    /// <para>
274    /// Clears the node using the specified node.
275    /// </para>
276    /// <para></para>
277    /// </summary>
278    /// <param name="node">
279    /// <para>The node.</para>
280    /// <para></para>
281    /// </param>
282    [MethodImpl(MethodImplOptions.AggressiveInlining)]
283    protected override void ClearNode(TLink node)
284    {
285        ref var link = ref LinksIndexParts[node];
286        link.LeftAsTarget = Zero;
287        link.RightAsTarget = Zero;
288        link.SizeAsTarget = Zero;
289    }
290
291    }
292
293    }

```

1.68 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64InternalLinksRecursionlessSizeBalancedTreeM

```
1 using System.Runtime.CompilerServices;
2 using Platform.Data.Doublets.Memory.Split.Generic;
3 using TLink = System.UInt64;
4
5 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7 namespace Platform.Data.Doublets.Memory.Split.Specific
8 {
9     /// <summary>
10    /// <para>
11    /// Represents the int 64 internal links recursionless size balanced tree methods base.
12    /// </para>
13    /// <para></para>
14    /// </summary>
15    /// <seealso cref="InternalLinksRecursionlessSizeBalancedTreeMethodsBase{TLink}"/>
16    public unsafe abstract class UInt64InternalLinksRecursionlessSizeBalancedTreeMethodsBase :
17    ↪ InternalLinksRecursionlessSizeBalancedTreeMethodsBase<TLink>
18    {
19        /// <summary>
20        /// <para>
21        /// The links data parts.
22        /// </para>
23        /// <para></para>
24        /// </summary>
25        protected new readonly RawLinkDataPart<TLink>* LinksDataParts;
26        /// <summary>
27        /// <para>
28        /// The links index parts.
29        /// </para>
30        /// <para></para>
31        /// </summary>
32        protected new readonly RawLinkIndexPart<TLink>* LinksIndexParts;
33        /// <summary>
34        /// <para>
35        /// The header.
36        /// </para>
37        /// <para></para>
38        /// </summary>
39        protected new readonly LinksHeader<TLink>* Header;
40
41        /// <summary>
42        /// <para>
43        /// Initializes a new <see
44        ↪ cref="UInt64InternalLinksRecursionlessSizeBalancedTreeMethodsBase"/> instance.
45        /// </para>
46        /// <para></para>
47        /// </summary>
48        /// <param name="constants">
49        /// <para>A constants.</para>
50        /// <para></para>
51        /// </param>
52        /// <param name="linksDataParts">
53        /// <para>A links data parts.</para>
54        /// <para></para>
55        /// </param>
56        /// <param name="linksIndexParts">
57        /// <para>A links index parts.</para>
58        /// <para></para>
59        /// </param>
60        /// <param name="header">
61        /// <para>A header.</para>
62        /// <para></para>
63        /// </param>
64        [MethodImpl(MethodImplOptions.AggressiveInlining)]
65        protected
66        ↪ UInt64InternalLinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<TLink>
67        ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
68        ↪ linksIndexParts, LinksHeader<TLink>* header)
69        : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
70        {
71            LinksDataParts = linksDataParts;
72            LinksIndexParts = linksIndexParts;
73            Header = header;
74        }
75
76        /// <summary>
77        /// <para>
78        /// Gets the zero.
79        /// </para>
80        /// </summary>
81        public static TLink Zero;
```

```

74    /// </para>
75    /// <para></para>
76    /// </summary>
77    /// <returns>
78    /// <para>The ulong</para>
79    /// <para></para>
80    /// </returns>
81    [MethodImpl(MethodImplOptions.AggressiveInlining)]
82    protected override ulong GetZero() => OUL;
83
84    /// <summary>
85    /// <para>
86    /// Determines whether this instance equal to zero.
87    /// </para>
88    /// <para></para>
89    /// </summary>
90    /// <param name="value">
91    /// <para>The value.</para>
92    /// <para></para>
93    /// </param>
94    /// <returns>
95    /// <para>The bool</para>
96    /// <para></para>
97    /// </returns>
98    [MethodImpl(MethodImplOptions.AggressiveInlining)]
99    protected override bool EqualToZero(ulong value) => value == OUL;
100
101    /// <summary>
102    /// <para>
103    /// Determines whether this instance are equal.
104    /// </para>
105    /// <para></para>
106    /// </summary>
107    /// <param name="first">
108    /// <para>The first.</para>
109    /// <para></para>
110    /// </param>
111    /// <param name="second">
112    /// <para>The second.</para>
113    /// <para></para>
114    /// </param>
115    /// <returns>
116    /// <para>The bool</para>
117    /// <para></para>
118    /// </returns>
119    [MethodImpl(MethodImplOptions.AggressiveInlining)]
120    protected override bool AreEqual(ulong first, ulong second) => first == second;
121
122    /// <summary>
123    /// <para>
124    /// Determines whether this instance greater than zero.
125    /// </para>
126    /// <para></para>
127    /// </summary>
128    /// <param name="value">
129    /// <para>The value.</para>
130    /// <para></para>
131    /// </param>
132    /// <returns>
133    /// <para>The bool</para>
134    /// <para></para>
135    /// </returns>
136    [MethodImpl(MethodImplOptions.AggressiveInlining)]
137    protected override bool GreaterThanZero(ulong value) => value > OUL;
138
139    /// <summary>
140    /// <para>
141    /// Determines whether this instance greater than.
142    /// </para>
143    /// <para></para>
144    /// </summary>
145    /// <param name="first">
146    /// <para>The first.</para>
147    /// <para></para>
148    /// </param>
149    /// <param name="second">
150    /// <para>The second.</para>
151    /// <para></para>

```

```

152     /// </param>
153     /// <returns>
154     /// <para>The bool</para>
155     /// <para></para>
156     /// </returns>
157     [MethodImpl(MethodImplOptions.AggressiveInlining)]
158     protected override bool GreaterThan(ulong first, ulong second) => first > second;
159
160     /// <summary>
161     /// <para>
162     /// Determines whether this instance greater or equal than.
163     /// </para>
164     /// <para></para>
165     /// </summary>
166     /// <param name="first">
167     /// <para>The first.</para>
168     /// <para></para>
169     /// </param>
170     /// <param name="second">
171     /// <para>The second.</para>
172     /// <para></para>
173     /// </param>
174     /// <returns>
175     /// <para>The bool</para>
176     /// <para></para>
177     /// </returns>
178     [MethodImpl(MethodImplOptions.AggressiveInlining)]
179     protected override bool GreaterOrEqualThan(ulong first, ulong second) => first >= second;
180
181     /// <summary>
182     /// <para>
183     /// Determines whether this instance greater or equal than zero.
184     /// </para>
185     /// <para></para>
186     /// </summary>
187     /// <param name="value">
188     /// <para>The value.</para>
189     /// <para></para>
190     /// </param>
191     /// <returns>
192     /// <para>The bool</para>
193     /// <para></para>
194     /// </returns>
195     [MethodImpl(MethodImplOptions.AggressiveInlining)]
196     protected override bool GreaterOrEqualThanZero(ulong value) => true; // value >= 0 is
197     ↪ always true for ulong
198
199     /// <summary>
200     /// <para>
201     /// Determines whether this instance less or equal than zero.
202     /// </para>
203     /// <para></para>
204     /// </summary>
205     /// <param name="value">
206     /// <para>The value.</para>
207     /// <para></para>
208     /// </param>
209     /// <returns>
210     /// <para>The bool</para>
211     /// <para></para>
212     /// </returns>
213     [MethodImpl(MethodImplOptions.AggressiveInlining)]
214     protected override bool LessOrEqualThanZero(ulong value) => value == 0UL; // value is
215     ↪ always >= 0 for ulong
216
217     /// <summary>
218     /// <para>
219     /// Determines whether this instance less or equal than.
220     /// </para>
221     /// <para></para>
222     /// </summary>
223     /// <param name="first">
224     /// <para>The first.</para>
225     /// <para></para>
226     /// </param>
227     /// <param name="second">
228     /// <para>The second.</para>
229     /// <para></para>
230     /// </param>
231     /// <returns>
232     /// <para>The bool</para>
233     /// <para></para>
234     /// </returns>
235     [MethodImpl(MethodImplOptions.AggressiveInlining)]
236     protected override bool LessThan(ulong first, ulong second) => first < second;
237
238     /// <summary>
239     /// <para>
240     /// Determines whether this instance less than zero.
241     /// </para>
242     /// <para></para>
243     /// </summary>
244     /// <param name="value">
245     /// <para>The value.</para>
246     /// <para></para>
247     /// </param>
248     /// <returns>
249     /// <para>The bool</para>
250     /// <para></para>
251     /// </returns>
252     [MethodImpl(MethodImplOptions.AggressiveInlining)]
253     protected override bool LessThanZero(ulong value) => value < 0UL; // value < 0 is
254     ↪ always false for ulong

```

```

228     /// </param>
229     /// <returns>
230     /// <para>The bool</para>
231     /// <para></para>
232     /// </returns>
233     [MethodImpl(MethodImplOptions.AggressiveInlining)]
234     protected override bool LessOrEqualThan(ulong first, ulong second) => first <= second;
235
236     /// <summary>
237     /// <para>
238     /// Determines whether this instance less than zero.
239     /// </para>
240     /// <para></para>
241     /// </summary>
242     /// <param name="value">
243     /// <para>The value.</para>
244     /// <para></para>
245     /// </param>
246     /// <returns>
247     /// <para>The bool</para>
248     /// <para></para>
249     /// </returns>
250     [MethodImpl(MethodImplOptions.AggressiveInlining)]
251     protected override bool LessThanZero(ulong value) => false; // value < 0 is always false
252     ↪ for ulong
253
254     /// <summary>
255     /// <para>
256     /// Determines whether this instance less than.
257     /// </para>
258     /// <para></para>
259     /// </summary>
260     /// <param name="first">
261     /// <para>The first.</para>
262     /// <para></para>
263     /// </param>
264     /// <param name="second">
265     /// <para>The second.</para>
266     /// <para></para>
267     /// </param>
268     /// <returns>
269     /// <para>The bool</para>
270     /// <para></para>
271     /// </returns>
272     [MethodImpl(MethodImplOptions.AggressiveInlining)]
273     protected override bool LessThan(ulong first, ulong second) => first < second;
274
275     /// <summary>
276     /// <para>
277     /// Increments the value.
278     /// </para>
279     /// <para></para>
280     /// </summary>
281     /// <param name="value">
282     /// <para>The value.</para>
283     /// <para></para>
284     /// </param>
285     /// <returns>
286     /// <para>The ulong</para>
287     /// <para></para>
288     /// </returns>
289     [MethodImpl(MethodImplOptions.AggressiveInlining)]
290     protected override ulong Increment(ulong value) => ++value;
291
292     /// <summary>
293     /// <para>
294     /// Decrements the value.
295     /// </para>
296     /// <para></para>
297     /// </summary>
298     /// <param name="value">
299     /// <para>The value.</para>
300     /// <para></para>
301     /// </param>
302     /// <returns>
303     /// <para>The ulong</para>
304     /// <para></para>
305     /// </returns>

```

```

305 [MethodImpl(MethodImplOptions.AggressiveInlining)]
306 protected override ulong Decrement(ulong value) => --value;
307
308 /// <summary>
309 /// <para>
310 /// Adds the first.
311 /// </para>
312 /// <para></para>
313 /// </summary>
314 /// <param name="first">
315 /// <para>The first.</para>
316 /// <para></para>
317 /// </param>
318 /// <param name="second">
319 /// <para>The second.</para>
320 /// <para></para>
321 /// </param>
322 /// <returns>
323 /// <para>The ulong</para>
324 /// <para></para>
325 /// </returns>
326 [MethodImpl(MethodImplOptions.AggressiveInlining)]
327 protected override ulong Add(ulong first, ulong second) => first + second;
328
329 /// <summary>
330 /// <para>
331 /// Subtracts the first.
332 /// </para>
333 /// <para></para>
334 /// </summary>
335 /// <param name="first">
336 /// <para>The first.</para>
337 /// <para></para>
338 /// </param>
339 /// <param name="second">
340 /// <para>The second.</para>
341 /// <para></para>
342 /// </param>
343 /// <returns>
344 /// <para>The ulong</para>
345 /// <para></para>
346 /// </returns>
347 [MethodImpl(MethodImplOptions.AggressiveInlining)]
348 protected override ulong Subtract(ulong first, ulong second) => first - second;
349
350 /// <summary>
351 /// <para>
352 /// Gets the link data part reference using the specified link.
353 /// </para>
354 /// <para></para>
355 /// </summary>
356 /// <param name="link">
357 /// <para>The link.</para>
358 /// <para></para>
359 /// </param>
360 /// <returns>
361 /// <para>A ref raw link data part of t link</para>
362 /// <para></para>
363 /// </returns>
364 [MethodImpl(MethodImplOptions.AggressiveInlining)]
365 protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
    ↪ ref LinksDataParts[link];
366
367 /// <summary>
368 /// <para>
369 /// Gets the link index part reference using the specified link.
370 /// </para>
371 /// <para></para>
372 /// </summary>
373 /// <param name="link">
374 /// <para>The link.</para>
375 /// <para></para>
376 /// </param>
377 /// <returns>
378 /// <para>A ref raw link index part of t link</para>
379 /// <para></para>
380 /// </returns>
381 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

382     protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
383         ↪ ref LinksIndexParts[link];
384
385     /// <summary>
386     /// <para>
387     /// Determines whether this instance first is to the left of second.
388     /// </para>
389     /// </summary>
390     /// <param name="first">
391     /// <para>The first.</para>
392     /// </param>
393     /// <param name="second">
394     /// <para>The second.</para>
395     /// </param>
396     /// <returns>
397     /// <para>The bool</para>
398     /// </returns>
399     [MethodImpl(MethodImplOptions.AggressiveInlining)]
400     protected override bool FirstIsToLeftOfSecond(TLink first, TLink second) =>
401         ↪ GetKeyPartValue(first) < GetKeyPartValue(second);
402
403     /// <summary>
404     /// <para>
405     /// Determines whether this instance first is to the right of second.
406     /// </para>
407     /// </summary>
408     /// <param name="first">
409     /// <para>The first.</para>
410     /// </param>
411     /// <param name="second">
412     /// <para>The second.</para>
413     /// </param>
414     /// <returns>
415     /// <para>The bool</para>
416     /// </returns>
417     [MethodImpl(MethodImplOptions.AggressiveInlining)]
418     protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second) =>
419         ↪ GetKeyPartValue(first) > GetKeyPartValue(second);
420 }
421 }
422

```

## 1.69 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64InternalLinksSizeBalancedTreeMethodsBase.

```

1  using System.Runtime.CompilerServices;
2  using Platform.Data.Doublets.Memory.Split.Generic;
3  using TLink = System.UInt64;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Doublets.Memory.Split.Specific
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the int 64 internal links size balanced tree methods base.
12     /// </para>
13     /// </summary>
14     /// <seealso cref="InternalLinksSizeBalancedTreeMethodsBase{TLink}"/>
15     public unsafe abstract class UInt64InternalLinksSizeBalancedTreeMethodsBase :
16         ↪ InternalLinksSizeBalancedTreeMethodsBase<TLink>
17     {
18         /// <summary>
19         /// <para>
20         /// The links data parts.
21         /// </para>
22         /// </summary>
23         protected new readonly RawLinkDataPart<TLink>* LinksDataParts;
24
25         /// <summary>
26         /// <para>
27         /// The links index parts.

```

```

28     /// </para>
29     /// <para></para>
30     /// </summary>
31     protected new readonly RawLinkIndexPart<TLink>* LinksIndexParts;
32     /// <summary>
33     /// <para>
34     /// The header.
35     /// </para>
36     /// <para></para>
37     /// </summary>
38     protected new readonly LinksHeader<TLink>* Header;
39
40     /// <summary>
41     /// <para>
42     /// Initializes a new <see cref="UInt64InternalLinksSizeBalancedTreeMethodsBase"/>
43     ↪ instance.
44     /// </para>
45     /// <para></para>
46     /// </summary>
47     /// <param name="constants">
48     /// <para>A constants.</para>
49     /// <para></para>
50     /// </param>
51     /// <param name="linksDataParts">
52     /// <para>A links data parts.</para>
53     /// <para></para>
54     /// </param>
55     /// <param name="linksIndexParts">
56     /// <para>A links index parts.</para>
57     /// <para></para>
58     /// </param>
59     /// <param name="header">
60     /// <para>A header.</para>
61     /// <para></para>
62     /// </param>
63     [MethodImpl(MethodImplOptions.AggressiveInlining)]
64     protected UInt64InternalLinksSizeBalancedTreeMethodsBase(LinksConstants<TLink>
65     ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
66     ↪ linksIndexParts, LinksHeader<TLink>* header)
67     : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
68     {
69         LinksDataParts = linksDataParts;
70         LinksIndexParts = linksIndexParts;
71         Header = header;
72     }
73
74     /// <summary>
75     /// <para>
76     /// Gets the zero.
77     /// </para>
78     /// <para></para>
79     /// </summary>
80     /// <returns>
81     /// <para>The ulong</para>
82     /// <para></para>
83     /// </returns>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     protected override ulong GetZero() => 0UL;
86
87     /// <summary>
88     /// <para>
89     /// Determines whether this instance equal to zero.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <param name="value">
94     /// <para>The value.</para>
95     /// <para></para>
96     /// </param>
97     /// <returns>
98     /// <para>The bool</para>
99     /// <para></para>
100    /// </returns>
101    [MethodImpl(MethodImplOptions.AggressiveInlining)]
102    protected override bool EqualToZero(ulong value) => value == 0UL;
103
104    /// <summary>
105    /// <para>

```



```

103     /// Determines whether this instance are equal.
104     /// </para>
105     /// <para></para>
106     /// </summary>
107     /// <param name="first">
108     /// <para>The first.</para>
109     /// <para></para>
110     /// </param>
111     /// <param name="second">
112     /// <para>The second.</para>
113     /// <para></para>
114     /// </param>
115     /// <returns>
116     /// <para>The bool</para>
117     /// <para></para>
118     /// </returns>
119     [MethodImpl(MethodImplOptions.AggressiveInlining)]
120     protected override bool AreEqual(ulong first, ulong second) => first == second;
121
122     /// <summary>
123     /// <para>
124     /// Determines whether this instance greater than zero.
125     /// </para>
126     /// <para></para>
127     /// </summary>
128     /// <param name="value">
129     /// <para>The value.</para>
130     /// <para></para>
131     /// </param>
132     /// <returns>
133     /// <para>The bool</para>
134     /// <para></para>
135     /// </returns>
136     [MethodImpl(MethodImplOptions.AggressiveInlining)]
137     protected override bool GreaterThanZero(ulong value) => value > 0UL;
138
139     /// <summary>
140     /// <para>
141     /// Determines whether this instance greater than.
142     /// </para>
143     /// <para></para>
144     /// </summary>
145     /// <param name="first">
146     /// <para>The first.</para>
147     /// <para></para>
148     /// </param>
149     /// <param name="second">
150     /// <para>The second.</para>
151     /// <para></para>
152     /// </param>
153     /// <returns>
154     /// <para>The bool</para>
155     /// <para></para>
156     /// </returns>
157     [MethodImpl(MethodImplOptions.AggressiveInlining)]
158     protected override bool GreaterThan(ulong first, ulong second) => first > second;
159
160     /// <summary>
161     /// <para>
162     /// Determines whether this instance greater or equal than.
163     /// </para>
164     /// <para></para>
165     /// </summary>
166     /// <param name="first">
167     /// <para>The first.</para>
168     /// <para></para>
169     /// </param>
170     /// <param name="second">
171     /// <para>The second.</para>
172     /// <para></para>
173     /// </param>
174     /// <returns>
175     /// <para>The bool</para>
176     /// <para></para>
177     /// </returns>
178     [MethodImpl(MethodImplOptions.AggressiveInlining)]
179     protected override bool GreaterOrEqualThan(ulong first, ulong second) => first >= second;
180

```

```

181     /// <summary>
182     /// <para>
183     /// Determines whether this instance greater or equal than zero.
184     /// </para>
185     /// <para></para>
186     /// </summary>
187     /// <param name="value">
188     /// <para>The value.</para>
189     /// <para></para>
190     /// </param>
191     /// <returns>
192     /// <para>The bool</para>
193     /// <para></para>
194     /// </returns>
195     [MethodImpl(MethodImplOptions.AggressiveInlining)]
196     protected override bool GreaterOrEqualThanZero(ulong value) => true; // value >= 0 is
    ↳ always true for ulong
197
198     /// <summary>
199     /// <para>
200     /// Determines whether this instance less or equal than zero.
201     /// </para>
202     /// <para></para>
203     /// </summary>
204     /// <param name="value">
205     /// <para>The value.</para>
206     /// <para></para>
207     /// </param>
208     /// <returns>
209     /// <para>The bool</para>
210     /// <para></para>
211     /// </returns>
212     [MethodImpl(MethodImplOptions.AggressiveInlining)]
213     protected override bool LessOrEqualThanZero(ulong value) => value == 0UL; // value is
    ↳ always >= 0 for ulong
214
215     /// <summary>
216     /// <para>
217     /// Determines whether this instance less or equal than.
218     /// </para>
219     /// <para></para>
220     /// </summary>
221     /// <param name="first">
222     /// <para>The first.</para>
223     /// <para></para>
224     /// </param>
225     /// <param name="second">
226     /// <para>The second.</para>
227     /// <para></para>
228     /// </param>
229     /// <returns>
230     /// <para>The bool</para>
231     /// <para></para>
232     /// </returns>
233     [MethodImpl(MethodImplOptions.AggressiveInlining)]
234     protected override bool LessOrEqualThan(ulong first, ulong second) => first <= second;
235
236     /// <summary>
237     /// <para>
238     /// Determines whether this instance less than zero.
239     /// </para>
240     /// <para></para>
241     /// </summary>
242     /// <param name="value">
243     /// <para>The value.</para>
244     /// <para></para>
245     /// </param>
246     /// <returns>
247     /// <para>The bool</para>
248     /// <para></para>
249     /// </returns>
250     [MethodImpl(MethodImplOptions.AggressiveInlining)]
251     protected override bool LessThanZero(ulong value) => false; // value < 0 is always false
    ↳ for ulong
252
253     /// <summary>
254     /// <para>
255     /// Determines whether this instance less than.

```

```

256    /// </para>
257    /// <para></para>
258    /// </summary>
259    /// <param name="first">
260    /// <para>The first.</para>
261    /// <para></para>
262    /// </param>
263    /// <param name="second">
264    /// <para>The second.</para>
265    /// <para></para>
266    /// </param>
267    /// <returns>
268    /// <para>The bool</para>
269    /// <para></para>
270    /// </returns>
271    [MethodImpl(MethodImplOptions.AggressiveInlining)]
272    protected override bool LessThan(ulong first, ulong second) => first < second;
273
274    /// <summary>
275    /// <para>
276    /// Increments the value.
277    /// </para>
278    /// <para></para>
279    /// </summary>
280    /// <param name="value">
281    /// <para>The value.</para>
282    /// <para></para>
283    /// </param>
284    /// <returns>
285    /// <para>The ulong</para>
286    /// <para></para>
287    /// </returns>
288    [MethodImpl(MethodImplOptions.AggressiveInlining)]
289    protected override ulong Increment(ulong value) => ++value;
290
291    /// <summary>
292    /// <para>
293    /// Decrements the value.
294    /// </para>
295    /// <para></para>
296    /// </summary>
297    /// <param name="value">
298    /// <para>The value.</para>
299    /// <para></para>
300    /// </param>
301    /// <returns>
302    /// <para>The ulong</para>
303    /// <para></para>
304    /// </returns>
305    [MethodImpl(MethodImplOptions.AggressiveInlining)]
306    protected override ulong Decrement(ulong value) => --value;
307
308    /// <summary>
309    /// <para>
310    /// Adds the first.
311    /// </para>
312    /// <para></para>
313    /// </summary>
314    /// <param name="first">
315    /// <para>The first.</para>
316    /// <para></para>
317    /// </param>
318    /// <param name="second">
319    /// <para>The second.</para>
320    /// <para></para>
321    /// </param>
322    /// <returns>
323    /// <para>The ulong</para>
324    /// <para></para>
325    /// </returns>
326    [MethodImpl(MethodImplOptions.AggressiveInlining)]
327    protected override ulong Add(ulong first, ulong second) => first + second;
328
329    /// <summary>
330    /// <para>
331    /// Subtracts the first.
332    /// </para>
333    /// <para></para>

```

```

334     /// </summary>
335     /// <param name="first">
336     /// <para>The first.</para>
337     /// <para></para>
338     /// </param>
339     /// <param name="second">
340     /// <para>The second.</para>
341     /// <para></para>
342     /// </param>
343     /// <returns>
344     /// <para>The ulong</para>
345     /// <para></para>
346     /// </returns>
347     [MethodImpl(MethodImplOptions.AggressiveInlining)]
348     protected override ulong Subtract(ulong first, ulong second) => first - second;
349
350     /// <summary>
351     /// <para>
352     /// Gets the link data part reference using the specified link.
353     /// </para>
354     /// <para></para>
355     /// </summary>
356     /// <param name="link">
357     /// <para>The link.</para>
358     /// <para></para>
359     /// </param>
360     /// <returns>
361     /// <para>A ref raw link data part of t link</para>
362     /// <para></para>
363     /// </returns>
364     [MethodImpl(MethodImplOptions.AggressiveInlining)]
365     protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
366     ↪ ref LinksDataParts[link];
367
368     /// <summary>
369     /// <para>
370     /// Gets the link index part reference using the specified link.
371     /// </para>
372     /// <para></para>
373     /// </summary>
374     /// <param name="link">
375     /// <para>The link.</para>
376     /// <para></para>
377     /// </param>
378     /// <returns>
379     /// <para>A ref raw link index part of t link</para>
380     /// <para></para>
381     /// </returns>
382     [MethodImpl(MethodImplOptions.AggressiveInlining)]
383     protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
384     ↪ ref LinksIndexParts[link];
385
386     /// <summary>
387     /// <para>
388     /// Determines whether this instance first is to the left of second.
389     /// </para>
390     /// <para></para>
391     /// </summary>
392     /// <param name="first">
393     /// <para>The first.</para>
394     /// <para></para>
395     /// </param>
396     /// <param name="second">
397     /// <para>The second.</para>
398     /// <para></para>
399     /// </param>
400     /// <returns>
401     /// <para>The bool</para>
402     /// <para></para>
403     /// </returns>
404     [MethodImpl(MethodImplOptions.AggressiveInlining)]
405     protected override bool FirstIsToLeftOfSecond(TLink first, TLink second) =>
406     ↪ GetKeyPartValue(first) < GetKeyPartValue(second);
407
408     /// <summary>
409     /// <para>
410     /// Determines whether this instance first is to the right of second.
411     /// </para>

```

```

409     /// <para></para>
410     /// </summary>
411     /// <param name="first">
412     /// <para>The first.</para>
413     /// <para></para>
414     /// </param>
415     /// <param name="second">
416     /// <para>The second.</para>
417     /// <para></para>
418     /// </param>
419     /// <returns>
420     /// <para>The bool</para>
421     /// <para></para>
422     /// </returns>
423     [MethodImpl(MethodImplOptions.AggressiveInlining)]
424     protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second) =>
        ↪ GetKeyPartValue(first) > GetKeyPartValue(second);
425 }
426 }

```

## 1.70 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64InternalLinksSourcesLinkedListMethods.cs

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt64;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Generic
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 64 internal links sources linked list methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="InternalLinksSourcesLinkedListMethods{TLink}"/>
15     public unsafe class UInt64InternalLinksSourcesLinkedListMethods :
        ↪ InternalLinksSourcesLinkedListMethods<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// The links data parts.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         private readonly RawLinkDataPart<TLink>* _linksDataParts;
24         /// <summary>
25         /// <para>
26         /// The links index parts.
27         /// </para>
28         /// <para></para>
29         /// </summary>
30         private readonly RawLinkIndexPart<TLink>* _linksIndexParts;
31
32         /// <summary>
33         /// <para>
34         /// Initializes a new <see cref="UInt64InternalLinksSourcesLinkedListMethods"/> instance.
35         /// </para>
36         /// <para></para>
37         /// </summary>
38         /// <param name="constants">
39         /// <para>A constants.</para>
40         /// <para></para>
41         /// </param>
42         /// <param name="linksDataParts">
43         /// <para>A links data parts.</para>
44         /// <para></para>
45         /// </param>
46         /// <param name="linksIndexParts">
47         /// <para>A links index parts.</para>
48         /// <para></para>
49         /// </param>
50         [MethodImpl(MethodImplOptions.AggressiveInlining)]
51         public UInt64InternalLinksSourcesLinkedListMethods(LinksConstants<TLink> constants,
        ↪ RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>* linksIndexParts)
            : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts)
52         {
53             _linksDataParts = linksDataParts;
54             _linksIndexParts = linksIndexParts;
55         }
56     }
57 }

```

```

56     }
57
58     /// <summary>
59     /// <para>
60     /// Gets the link data part reference using the specified link.
61     /// </para>
62     /// <para></para>
63     /// </summary>
64     /// <param name="link">
65     /// <para>The link.</para>
66     /// <para></para>
67     /// </param>
68     /// <returns>
69     /// <para>A ref raw link data part of t link</para>
70     /// <para></para>
71     /// </returns>
72     [MethodImpl(MethodImplOptions.AggressiveInlining)]
73     protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
74         ↪ ref _linksDataParts[link];
75
76     /// <summary>
77     /// <para>
78     /// Gets the link index part reference using the specified link.
79     /// </para>
80     /// <para></para>
81     /// </summary>
82     /// <param name="link">
83     /// <para>The link.</para>
84     /// <para></para>
85     /// </param>
86     /// <returns>
87     /// <para>A ref raw link index part of t link</para>
88     /// <para></para>
89     /// </returns>
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
92         ↪ ref _linksIndexParts[link];
93 }
94 }

```

## 1.71 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64InternalLinksSourcesRecursionlessSizeBalancedTreeMethodsBase

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt64;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 64 internal links sources recursionless size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt64InternalLinksRecursionlessSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt64InternalLinksSourcesRecursionlessSizeBalancedTreeMethods :
16         ↪ UInt64InternalLinksRecursionlessSizeBalancedTreeMethodsBase
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see
21         ↪ cref="UInt64InternalLinksSourcesRecursionlessSizeBalancedTreeMethods"/> instance.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         /// <param name="constants">
26         /// <para>A constants.</para>
27         /// <para></para>
28         /// </param>
29         /// <param name="linksDataParts">
30         /// <para>A links data parts.</para>
31         /// <para></para>
32         /// </param>
33         /// <param name="linksIndexParts">
34         /// <para>A links index parts.</para>
35         /// <para></para>
36         /// </param>
37         /// <param name="header">

```

```

36    /// <para>A header.</para>
37    /// <para></para>
38    /// </param>
39    [MethodImpl(MethodImplOptions.AggressiveInlining)]
40    public
41    ↪ UInt64InternalLinksSourcesRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
42    ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
43    ↪ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
44    ↪ linksIndexParts, header) { }
45
46    /// <summary>
47    /// <para>
48    /// Gets the left reference using the specified node.
49    /// </para>
50    /// <para></para>
51    /// </summary>
52    /// <param name="node">
53    /// <para>The node.</para>
54    /// <para></para>
55    /// </param>
56    /// <returns>
57    /// <para>The ref link</para>
58    /// <para></para>
59    /// </returns>
60    [MethodImpl(MethodImplOptions.AggressiveInlining)]
61    protected override ref TLink GetLeftReference(TLink node) => ref
62    ↪ LinksIndexParts[node].LeftAsSource;
63
64    /// <summary>
65    /// <para>
66    /// Gets the right reference using the specified node.
67    /// </para>
68    /// <para></para>
69    /// </summary>
70    /// <param name="node">
71    /// <para>The node.</para>
72    /// <para></para>
73    /// </param>
74    /// <returns>
75    /// <para>The ref link</para>
76    /// <para></para>
77    /// </returns>
78    [MethodImpl(MethodImplOptions.AggressiveInlining)]
79    protected override ref TLink GetRightReference(TLink node) => ref
80    ↪ LinksIndexParts[node].RightAsSource;
81
82    /// <summary>
83    /// <para>
84    /// Gets the left using the specified node.
85    /// </para>
86    /// <para></para>
87    /// </summary>
88    /// <param name="node">
89    /// <para>The node.</para>
90    /// <para></para>
91    /// </param>
92    /// <returns>
93    /// <para>The link</para>
94    /// <para></para>
95    /// </returns>
96    [MethodImpl(MethodImplOptions.AggressiveInlining)]
97    protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsSource;
98
99    /// <summary>
100    /// <para>
101    /// Gets the right using the specified node.
102    /// </para>
103    /// <para></para>
104    /// </summary>
105    /// <param name="node">
106    /// <para>The node.</para>
107    /// <para></para>
108    /// </param>
109    /// <returns>
110    /// <para>The link</para>
111    /// <para></para>
112    /// </returns>
113    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

108     protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsSource;
109
110     /// <summary>
111     /// <para>
112     /// Sets the left using the specified node.
113     /// </para>
114     /// <para></para>
115     /// </summary>
116     /// <param name="node">
117     /// <para>The node.</para>
118     /// <para></para>
119     /// </param>
120     /// <param name="left">
121     /// <para>The left.</para>
122     /// <para></para>
123     /// </param>
124     [MethodImpl(MethodImplOptions.AggressiveInlining)]
125     protected override void SetLeft(TLink node, TLink left) =>
126     ↪ LinksIndexParts[node].LeftAsSource = left;
127
128     /// <summary>
129     /// <para>
130     /// Sets the right using the specified node.
131     /// </para>
132     /// <para></para>
133     /// </summary>
134     /// <param name="node">
135     /// <para>The node.</para>
136     /// <para></para>
137     /// </param>
138     /// <param name="right">
139     /// <para>The right.</para>
140     /// <para></para>
141     /// </param>
142     [MethodImpl(MethodImplOptions.AggressiveInlining)]
143     protected override void SetRight(TLink node, TLink right) =>
144     ↪ LinksIndexParts[node].RightAsSource = right;
145
146     /// <summary>
147     /// <para>
148     /// Gets the size using the specified node.
149     /// </para>
150     /// <para></para>
151     /// </summary>
152     /// <param name="node">
153     /// <para>The node.</para>
154     /// <para></para>
155     /// </param>
156     /// <returns>
157     /// <para>The link</para>
158     /// <para></para>
159     /// </returns>
160     [MethodImpl(MethodImplOptions.AggressiveInlining)]
161     protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsSource;
162
163     /// <summary>
164     /// <para>
165     /// Sets the size using the specified node.
166     /// </para>
167     /// <para></para>
168     /// </summary>
169     /// <param name="node">
170     /// <para>The node.</para>
171     /// <para></para>
172     /// </param>
173     /// <param name="size">
174     /// <para>The size.</para>
175     /// <para></para>
176     /// </param>
177     [MethodImpl(MethodImplOptions.AggressiveInlining)]
178     protected override void SetSize(TLink node, TLink size) =>
179     ↪ LinksIndexParts[node].SizeAsSource = size;
180
181     /// <summary>
182     /// <para>
183     /// Gets the tree root using the specified node.
184     /// </para>
185     /// <para></para>

```



```

183     /// </summary>
184     /// <param name="node">
185     /// <para>The node.</para>
186     /// <para></para>
187     /// </param>
188     /// <returns>
189     /// <para>The link</para>
190     /// <para></para>
191     /// </returns>
192     [MethodImpl(MethodImplOptions.AggressiveInlining)]
193     protected override TLink GetTreeRoot(TLink node) => LinksIndexParts[node].RootAsSource;
194
195     /// <summary>
196     /// <para>
197     /// Gets the base part value using the specified node.
198     /// </para>
199     /// <para></para>
200     /// </summary>
201     /// <param name="node">
202     /// <para>The node.</para>
203     /// <para></para>
204     /// </param>
205     /// <returns>
206     /// <para>The link</para>
207     /// <para></para>
208     /// </returns>
209     [MethodImpl(MethodImplOptions.AggressiveInlining)]
210     protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Source;
211
212     /// <summary>
213     /// <para>
214     /// Gets the key part value using the specified node.
215     /// </para>
216     /// <para></para>
217     /// </summary>
218     /// <param name="node">
219     /// <para>The node.</para>
220     /// <para></para>
221     /// </param>
222     /// <returns>
223     /// <para>The link</para>
224     /// <para></para>
225     /// </returns>
226     [MethodImpl(MethodImplOptions.AggressiveInlining)]
227     protected override TLink GetKeyPartValue(TLink node) => LinksDataParts[node].Target;
228
229     /// <summary>
230     /// <para>
231     /// Clears the node using the specified node.
232     /// </para>
233     /// <para></para>
234     /// </summary>
235     /// <param name="node">
236     /// <para>The node.</para>
237     /// <para></para>
238     /// </param>
239     [MethodImpl(MethodImplOptions.AggressiveInlining)]
240     protected override void ClearNode(TLink node)
241     {
242         ref var link = ref LinksIndexParts[node];
243         link.LeftAsSource = Zero;
244         link.RightAsSource = Zero;
245         link.SizeAsSource = Zero;
246     }
247
248     /// <summary>
249     /// <para>
250     /// Searches the source.
251     /// </para>
252     /// <para></para>
253     /// </summary>
254     /// <param name="source">
255     /// <para>The source.</para>
256     /// <para></para>
257     /// </param>
258     /// <param name="target">
259     /// <para>The target.</para>
260     /// <para></para>

```

```

261     /// </param>
262     /// <returns>
263     /// <para>The link</para>
264     /// <para></para>
265     /// </returns>
266     public override TLink Search(TLink source, TLink target) =>
        ↳ SearchCore(GetTreeRoot(source), target);
267 }
268 }

```

## 1.72 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64InternalLinksSourcesSizeBalancedTreeMethod

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt64;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 64 internal links sources size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt64InternalLinksSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt64InternalLinksSourcesSizeBalancedTreeMethods :
        ↳ UInt64InternalLinksSizeBalancedTreeMethodsBase
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="UInt64InternalLinksSourcesSizeBalancedTreeMethods"/>
20         ↳ instance.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         /// <param name="constants">
25         /// <para>A constants.</para>
26         /// <para></para>
27         /// </param>
28         /// <param name="linksDataParts">
29         /// <para>A links data parts.</para>
30         /// <para></para>
31         /// </param>
32         /// <param name="linksIndexParts">
33         /// <para>A links index parts.</para>
34         /// <para></para>
35         /// </param>
36         /// <param name="header">
37         /// <para>A header.</para>
38         /// <para></para>
39         /// </param>
40         [MethodImpl(MethodImplOptions.AggressiveInlining)]
41         public UInt64InternalLinksSourcesSizeBalancedTreeMethods(LinksConstants<TLink>
42         ↳ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
43         ↳ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
44         ↳ linksIndexParts, header) { }
45
46         /// <summary>
47         /// <para>
48         /// Gets the left reference using the specified node.
49         /// </para>
50         /// <para></para>
51         /// </summary>
52         /// <param name="node">
53         /// <para>The node.</para>
54         /// <para></para>
55         /// </param>
56         /// <returns>
57         /// <para>The ref link</para>
58         /// <para></para>
59         /// </returns>
60         [MethodImpl(MethodImplOptions.AggressiveInlining)]
61         protected override ref TLink GetLeftReference(TLink node) => ref
        ↳ LinksIndexParts[node].LeftAsSource;
62
63         /// <summary>
64         /// <para>
65         /// Gets the right reference using the specified node.
66         /// </para>
67         /// <para></para>
68         /// </summary>
69         /// <param name="node">
70         /// <para>The node.</para>
71         /// <para></para>
72         /// </param>
73         /// <returns>
74         /// <para>The ref link</para>
75         /// <para></para>
76         /// </returns>
77         [MethodImpl(MethodImplOptions.AggressiveInlining)]
78         protected override ref TLink GetRightReference(TLink node) => ref
        ↳ LinksIndexParts[node].RightAsSource;
79     }
80 }

```

```

62     /// </para>
63     /// <para></para>
64     /// </summary>
65     /// <param name="node">
66     /// <para>The node.</para>
67     /// <para></para>
68     /// </param>
69     /// <returns>
70     /// <para>The ref link</para>
71     /// <para></para>
72     /// </returns>
73     [MethodImpl(MethodImplOptions.AggressiveInlining)]
74     protected override ref TLink GetRightReference(TLink node) => ref
75     ↪ LinksIndexParts[node].RightAsSource;
76
77     /// <summary>
78     /// <para>
79     /// Gets the left using the specified node.
80     /// </para>
81     /// <para></para>
82     /// </summary>
83     /// <param name="node">
84     /// <para>The node.</para>
85     /// <para></para>
86     /// </param>
87     /// <returns>
88     /// <para>The link</para>
89     /// <para></para>
90     /// </returns>
91     [MethodImpl(MethodImplOptions.AggressiveInlining)]
92     protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsSource;
93
94     /// <summary>
95     /// <para>
96     /// Gets the right using the specified node.
97     /// </para>
98     /// <para></para>
99     /// </summary>
100    /// <param name="node">
101    /// <para>The node.</para>
102    /// <para></para>
103    /// </param>
104    /// <returns>
105    /// <para>The link</para>
106    /// <para></para>
107    /// </returns>
108    [MethodImpl(MethodImplOptions.AggressiveInlining)]
109    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsSource;
110
111    /// <summary>
112    /// <para>
113    /// Sets the left using the specified node.
114    /// </para>
115    /// <para></para>
116    /// </summary>
117    /// <param name="node">
118    /// <para>The node.</para>
119    /// <para></para>
120    /// </param>
121    /// <param name="left">
122    /// <para>The left.</para>
123    /// <para></para>
124    /// </param>
125    [MethodImpl(MethodImplOptions.AggressiveInlining)]
126    protected override void SetLeft(TLink node, TLink left) =>
127    ↪ LinksIndexParts[node].LeftAsSource = left;
128
129    /// <summary>
130    /// <para>
131    /// Sets the right using the specified node.
132    /// </para>
133    /// <para></para>
134    /// </summary>
135    /// <param name="node">
136    /// <para>The node.</para>
137    /// <para></para>
138    /// </param>
139    /// <param name="right">

```

```

138     /// <para>The right.</para>
139     /// <para></para>
140     /// </param>
141     [MethodImpl(MethodImplOptions.AggressiveInlining)]
142     protected override void SetRight(TLink node, TLink right) =>
143         ↳ LinksIndexParts[node].RightAsSource = right;
144
145     /// <summary>
146     /// <para>
147     /// Gets the size using the specified node.
148     /// </para>
149     /// </summary>
150     /// <param name="node">
151     /// <para>The node.</para>
152     /// </param>
153     /// <returns>
154     /// <para>The link</para>
155     /// </returns>
156     [MethodImpl(MethodImplOptions.AggressiveInlining)]
157     protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsSource;
158
159     /// <summary>
160     /// <para>
161     /// Sets the size using the specified node.
162     /// </para>
163     /// </summary>
164     /// <param name="node">
165     /// <para>The node.</para>
166     /// </param>
167     /// <param name="size">
168     /// <para>The size.</para>
169     /// </param>
170     [MethodImpl(MethodImplOptions.AggressiveInlining)]
171     protected override void SetSize(TLink node, TLink size) =>
172         ↳ LinksIndexParts[node].SizeAsSource = size;
173
174     /// <summary>
175     /// <para>
176     /// Gets the tree root using the specified node.
177     /// </para>
178     /// </summary>
179     /// <param name="node">
180     /// <para>The node.</para>
181     /// </param>
182     /// <returns>
183     /// <para>The link</para>
184     /// </returns>
185     [MethodImpl(MethodImplOptions.AggressiveInlining)]
186     protected override TLink GetTreeRoot(TLink node) => LinksIndexParts[node].RootAsSource;
187
188     /// <summary>
189     /// <para>
190     /// Gets the base part value using the specified node.
191     /// </para>
192     /// </summary>
193     /// <param name="node">
194     /// <para>The node.</para>
195     /// </param>
196     /// <returns>
197     /// <para>The link</para>
198     /// </returns>
199     [MethodImpl(MethodImplOptions.AggressiveInlining)]
200     protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Source;
201
202     /// <summary>
203     /// <para>
204

```

```

214     /// Gets the key part value using the specified node.
215     /// </para>
216     /// <para></para>
217     /// </summary>
218     /// <param name="node">
219     /// <para>The node.</para>
220     /// <para></para>
221     /// </param>
222     /// <returns>
223     /// <para>The link</para>
224     /// <para></para>
225     /// </returns>
226     [MethodImpl(MethodImplOptions.AggressiveInlining)]
227     protected override TLink GetKeyPartValue(TLink node) => LinksDataParts[node].Target;
228
229     /// <summary>
230     /// <para>
231     /// Clears the node using the specified node.
232     /// </para>
233     /// <para></para>
234     /// </summary>
235     /// <param name="node">
236     /// <para>The node.</para>
237     /// <para></para>
238     /// </param>
239     [MethodImpl(MethodImplOptions.AggressiveInlining)]
240     protected override void ClearNode(TLink node)
241     {
242         ref var link = ref LinksIndexParts[node];
243         link.LeftAsSource = Zero;
244         link.RightAsSource = Zero;
245         link.SizeAsSource = Zero;
246     }
247
248     /// <summary>
249     /// <para>
250     /// Searches the source.
251     /// </para>
252     /// <para></para>
253     /// </summary>
254     /// <param name="source">
255     /// <para>The source.</para>
256     /// <para></para>
257     /// </param>
258     /// <param name="target">
259     /// <para>The target.</para>
260     /// <para></para>
261     /// </param>
262     /// <returns>
263     /// <para>The link</para>
264     /// <para></para>
265     /// </returns>
266     public override TLink Search(TLink source, TLink target) =>
267         ↪ SearchCore(GetTreeRoot(source), target);
268 }

```

### 1.73 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64InternalLinksTargetsRecursionlessSizeBalancedTreeMethodsBase

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt64;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 64 internal links targets recursionless size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt64InternalLinksRecursionlessSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt64InternalLinksTargetsRecursionlessSizeBalancedTreeMethods :
16         ↪ UInt64InternalLinksRecursionlessSizeBalancedTreeMethodsBase
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see
21         ↪ cref="UInt64InternalLinksTargetsRecursionlessSizeBalancedTreeMethods"/> instance.

```

```

20    /// </para>
21    /// <para></para>
22    /// </summary>
23    /// <param name="constants">
24    /// <para>A constants.</para>
25    /// <para></para>
26    /// </param>
27    /// <param name="linksDataParts">
28    /// <para>A links data parts.</para>
29    /// <para></para>
30    /// </param>
31    /// <param name="linksIndexParts">
32    /// <para>A links index parts.</para>
33    /// <para></para>
34    /// </param>
35    /// <param name="header">
36    /// <para>A header.</para>
37    /// <para></para>
38    /// </param>
39    [MethodImpl(MethodImplOptions.AggressiveInlining)]
40    public
41    ↪ UInt64InternalLinksTargetsRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
42    ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
43    ↪ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
44    ↪ linksIndexParts, header) { }
45
46    /// <summary>
47    /// <para>
48    /// Gets the left reference using the specified node.
49    /// </para>
50    /// <para></para>
51    /// </summary>
52    /// <param name="node">
53    /// <para>The node.</para>
54    /// <para></para>
55    /// </param>
56    /// <returns>
57    /// <para>The ref ulong</para>
58    /// <para></para>
59    /// </returns>
60    [MethodImpl(MethodImplOptions.AggressiveInlining)]
61    protected override ref ulong GetLeftReference(ulong node) => ref
62    ↪ LinksIndexParts[node].LeftAsTarget;
63
64    /// <summary>
65    /// <para>
66    /// Gets the right reference using the specified node.
67    /// </para>
68    /// <para></para>
69    /// </summary>
70    /// <param name="node">
71    /// <para>The node.</para>
72    /// <para></para>
73    /// </param>
74    /// <returns>
75    /// <para>The ref ulong</para>
76    /// <para></para>
77    /// </returns>
78    [MethodImpl(MethodImplOptions.AggressiveInlining)]
79    protected override ref ulong GetRightReference(ulong node) => ref
80    ↪ LinksIndexParts[node].RightAsTarget;
81
82    /// <summary>
83    /// <para>
84    /// Gets the left using the specified node.
85    /// </para>
86    /// <para></para>
87    /// </summary>
88    /// <param name="node">
89    /// <para>The node.</para>
90    /// <para></para>
91    /// </param>
92    /// <returns>
93    /// <para>The link</para>
94    /// <para></para>
95    /// </returns>
96    [MethodImpl(MethodImplOptions.AggressiveInlining)]
97    protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsTarget;

```

```

92     /// <summary>
93     /// <para>
94     /// Gets the right using the specified node.
95     /// </para>
96     /// <para></para>
97     /// </summary>
98     /// <param name="node">
99     /// <para>The node.</para>
100    /// <para></para>
101    /// </param>
102    /// <returns>
103    /// <para>The link</para>
104    /// <para></para>
105    /// </returns>
106    [MethodImpl(MethodImplOptions.AggressiveInlining)]
107    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsTarget;
108
109    /// <summary>
110    /// <para>
111    /// Sets the left using the specified node.
112    /// </para>
113    /// <para></para>
114    /// </summary>
115    /// <param name="node">
116    /// <para>The node.</para>
117    /// <para></para>
118    /// </param>
119    /// <param name="left">
120    /// <para>The left.</para>
121    /// <para></para>
122    /// </param>
123    [MethodImpl(MethodImplOptions.AggressiveInlining)]
124    protected override void SetLeft(TLink node, TLink left) =>
125        ↪ LinksIndexParts[node].LeftAsTarget = left;
126
127    /// <summary>
128    /// <para>
129    /// Sets the right using the specified node.
130    /// </para>
131    /// <para></para>
132    /// </summary>
133    /// <param name="node">
134    /// <para>The node.</para>
135    /// <para></para>
136    /// </param>
137    /// <param name="right">
138    /// <para>The right.</para>
139    /// <para></para>
140    /// </param>
141    [MethodImpl(MethodImplOptions.AggressiveInlining)]
142    protected override void SetRight(TLink node, TLink right) =>
143        ↪ LinksIndexParts[node].RightAsTarget = right;
144
145    /// <summary>
146    /// <para>
147    /// Gets the size using the specified node.
148    /// </para>
149    /// <para></para>
150    /// </summary>
151    /// <param name="node">
152    /// <para>The node.</para>
153    /// <para></para>
154    /// </param>
155    /// <returns>
156    /// <para>The link</para>
157    /// <para></para>
158    /// </returns>
159    [MethodImpl(MethodImplOptions.AggressiveInlining)]
160    protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsTarget;
161
162    /// <summary>
163    /// <para>
164    /// Sets the size using the specified node.
165    /// </para>
166    /// <para></para>
167    /// </summary>
168    /// <param name="node">

```

```

168     /// <para>The node.</para>
169     /// <para></para>
170     /// </param>
171     /// <param name="size">
172     /// <para>The size.</para>
173     /// <para></para>
174     /// </param>
175     [MethodImpl(MethodImplOptions.AggressiveInlining)]
176     protected override void SetSize(TLink node, TLink size) =>
177         ↳ LinksIndexParts[node].SizeAsTarget = size;
178
179     /// <summary>
180     /// <para>
181     /// Gets the tree root using the specified node.
182     /// </para>
183     /// <para></para>
184     /// </summary>
185     /// <param name="node">
186     /// <para>The node.</para>
187     /// <para></para>
188     /// </param>
189     /// <returns>
190     /// <para>The link</para>
191     /// <para></para>
192     /// </returns>
193     [MethodImpl(MethodImplOptions.AggressiveInlining)]
194     protected override TLink GetTreeRoot(TLink node) => LinksIndexParts[node].RootAsTarget;
195
196     /// <summary>
197     /// <para>
198     /// Gets the base part value using the specified node.
199     /// </para>
200     /// <para></para>
201     /// </summary>
202     /// <param name="node">
203     /// <para>The node.</para>
204     /// <para></para>
205     /// </param>
206     /// <returns>
207     /// <para>The link</para>
208     /// <para></para>
209     /// </returns>
210     [MethodImpl(MethodImplOptions.AggressiveInlining)]
211     protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Target;
212
213     /// <summary>
214     /// <para>
215     /// Gets the key part value using the specified node.
216     /// </para>
217     /// <para></para>
218     /// </summary>
219     /// <param name="node">
220     /// <para>The node.</para>
221     /// <para></para>
222     /// </param>
223     /// <returns>
224     /// <para>The link</para>
225     /// <para></para>
226     /// </returns>
227     [MethodImpl(MethodImplOptions.AggressiveInlining)]
228     protected override TLink GetKeyPartValue(TLink node) => LinksDataParts[node].Source;
229
230     /// <summary>
231     /// <para>
232     /// Clears the node using the specified node.
233     /// </para>
234     /// <para></para>
235     /// </summary>
236     /// <param name="node">
237     /// <para>The node.</para>
238     /// <para></para>
239     /// </param>
240     [MethodImpl(MethodImplOptions.AggressiveInlining)]
241     protected override void ClearNode(TLink node)
242     {
243         ref var link = ref LinksIndexParts[node];
244         link.LeftAsTarget = Zero;
245         link.RightAsTarget = Zero;

```



```

245         link.SizeAsTarget = Zero;
246     }
247
248     /// <summary>
249     /// <para>
250     /// Searches the source.
251     /// </para>
252     /// <para></para>
253     /// </summary>
254     /// <param name="source">
255     /// <para>The source.</para>
256     /// <para></para>
257     /// </param>
258     /// <param name="target">
259     /// <para>The target.</para>
260     /// <para></para>
261     /// </param>
262     /// <returns>
263     /// <para>The link</para>
264     /// <para></para>
265     /// </returns>
266     public override TLink Search(TLink source, TLink target) =>
        ↪ SearchCore(GetTreeRoot(target), source);
267 }
268 }

```

#### 1.74 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64InternalLinksTargetsSizeBalancedTreeMethods

```

1  using System.Runtime.CompilerServices;
2  using TLink = System.UInt64;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.Split.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 64 internal links targets size balanced tree methods.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="UInt64InternalLinksSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt64InternalLinksTargetsSizeBalancedTreeMethods :
        ↪ UInt64InternalLinksSizeBalancedTreeMethodsBase
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="UInt64InternalLinksTargetsSizeBalancedTreeMethods"/>
20         ↪ instance.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         /// <param name="constants">
25         /// <para>A constants.</para>
26         /// <para></para>
27         /// </param>
28         /// <param name="linksDataParts">
29         /// <para>A links data parts.</para>
30         /// <para></para>
31         /// </param>
32         /// <param name="linksIndexParts">
33         /// <para>A links index parts.</para>
34         /// <para></para>
35         /// </param>
36         /// <param name="header">
37         /// <para>A header.</para>
38         /// <para></para>
39         /// </param>
40         [MethodImpl(MethodImplOptions.AggressiveInlining)]
41         public UInt64InternalLinksTargetsSizeBalancedTreeMethods(LinksConstants<TLink>
            ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
            ↪ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
            ↪ linksIndexParts, header) { }
41
42         /// <summary>
43         /// <para>
44         /// Gets the left reference using the specified node.
45         /// </para>
46         /// <para></para>

```

```

47     /// </summary>
48     /// <param name="node">
49     /// <para>The node.</para>
50     /// <para></para>
51     /// </param>
52     /// <returns>
53     /// <para>The ref ulong</para>
54     /// <para></para>
55     /// </returns>
56     [MethodImpl(MethodImplOptions.AggressiveInlining)]
57     protected override ref ulong GetLeftReference(ulong node) => ref
    ↪ LinksIndexParts[node].LeftAsTarget;
58
59     /// <summary>
60     /// <para>
61     /// Gets the right reference using the specified node.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     /// <param name="node">
66     /// <para>The node.</para>
67     /// <para></para>
68     /// </param>
69     /// <returns>
70     /// <para>The ref ulong</para>
71     /// <para></para>
72     /// </returns>
73     [MethodImpl(MethodImplOptions.AggressiveInlining)]
74     protected override ref ulong GetRightReference(ulong node) => ref
    ↪ LinksIndexParts[node].RightAsTarget;
75
76     /// <summary>
77     /// <para>
78     /// Gets the left using the specified node.
79     /// </para>
80     /// <para></para>
81     /// </summary>
82     /// <param name="node">
83     /// <para>The node.</para>
84     /// <para></para>
85     /// </param>
86     /// <returns>
87     /// <para>The link</para>
88     /// <para></para>
89     /// </returns>
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsTarget;
92
93     /// <summary>
94     /// <para>
95     /// Gets the right using the specified node.
96     /// </para>
97     /// <para></para>
98     /// </summary>
99     /// <param name="node">
100    /// <para>The node.</para>
101    /// <para></para>
102    /// </param>
103    /// <returns>
104    /// <para>The link</para>
105    /// <para></para>
106    /// </returns>
107    [MethodImpl(MethodImplOptions.AggressiveInlining)]
108    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsTarget;
109
110    /// <summary>
111    /// <para>
112    /// Sets the left using the specified node.
113    /// </para>
114    /// <para></para>
115    /// </summary>
116    /// <param name="node">
117    /// <para>The node.</para>
118    /// <para></para>
119    /// </param>
120    /// <param name="left">
121    /// <para>The left.</para>
122    /// <para></para>

```

```

123     /// </param>
124     [MethodImpl(MethodImplOptions.AggressiveInlining)]
125     protected override void SetLeft(TLink node, TLink left) =>
126         ↳ LinksIndexParts[node].LeftAsTarget = left;
127
128     /// <summary>
129     /// <para>
130     /// Sets the right using the specified node.
131     /// </para>
132     /// </summary>
133     /// <param name="node">
134     /// <para>The node.</para>
135     /// </para>
136     /// </param>
137     /// <param name="right">
138     /// <para>The right.</para>
139     /// </para>
140     /// </param>
141     [MethodImpl(MethodImplOptions.AggressiveInlining)]
142     protected override void SetRight(TLink node, TLink right) =>
143         ↳ LinksIndexParts[node].RightAsTarget = right;
144
145     /// <summary>
146     /// <para>
147     /// Gets the size using the specified node.
148     /// </para>
149     /// </summary>
150     /// <param name="node">
151     /// <para>The node.</para>
152     /// </para>
153     /// </param>
154     /// <returns>
155     /// <para>The link</para>
156     /// </returns>
157     [MethodImpl(MethodImplOptions.AggressiveInlining)]
158     protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsTarget;
159
160     /// <summary>
161     /// <para>
162     /// Sets the size using the specified node.
163     /// </para>
164     /// </summary>
165     /// <param name="node">
166     /// <para>The node.</para>
167     /// </para>
168     /// </param>
169     /// <param name="size">
170     /// <para>The size.</para>
171     /// </para>
172     /// </param>
173     [MethodImpl(MethodImplOptions.AggressiveInlining)]
174     protected override void SetSize(TLink node, TLink size) =>
175         ↳ LinksIndexParts[node].SizeAsTarget = size;
176
177     /// <summary>
178     /// <para>
179     /// Gets the tree root using the specified node.
180     /// </para>
181     /// </summary>
182     /// <param name="node">
183     /// <para>The node.</para>
184     /// </para>
185     /// </param>
186     /// <returns>
187     /// <para>The link</para>
188     /// </returns>
189     [MethodImpl(MethodImplOptions.AggressiveInlining)]
190     protected override TLink GetTreeRoot(TLink node) => LinksIndexParts[node].RootAsTarget;
191
192     /// <summary>
193     /// <para>
194     /// Gets the base part value using the specified node.
195     /// </para>
196     /// </summary>
197

```

```

198     /// </para>
199     /// <para></para>
200     /// </summary>
201     /// <param name="node">
202     /// <para>The node.</para>
203     /// <para></para>
204     /// </param>
205     /// <returns>
206     /// <para>The link</para>
207     /// <para></para>
208     /// </returns>
209     [MethodImpl(MethodImplOptions.AggressiveInlining)]
210     protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Target;
211
212     /// <summary>
213     /// <para>
214     /// Gets the key part value using the specified node.
215     /// </para>
216     /// <para></para>
217     /// </summary>
218     /// <param name="node">
219     /// <para>The node.</para>
220     /// <para></para>
221     /// </param>
222     /// <returns>
223     /// <para>The link</para>
224     /// <para></para>
225     /// </returns>
226     [MethodImpl(MethodImplOptions.AggressiveInlining)]
227     protected override TLink GetKeyPartValue(TLink node) => LinksDataParts[node].Source;
228
229     /// <summary>
230     /// <para>
231     /// Clears the node using the specified node.
232     /// </para>
233     /// <para></para>
234     /// </summary>
235     /// <param name="node">
236     /// <para>The node.</para>
237     /// <para></para>
238     /// </param>
239     [MethodImpl(MethodImplOptions.AggressiveInlining)]
240     protected override void ClearNode(TLink node)
241     {
242         ref var link = ref LinksIndexParts[node];
243         link.LeftAsTarget = Zero;
244         link.RightAsTarget = Zero;
245         link.SizeAsTarget = Zero;
246     }
247
248     /// <summary>
249     /// <para>
250     /// Searches the source.
251     /// </para>
252     /// <para></para>
253     /// </summary>
254     /// <param name="source">
255     /// <para>The source.</para>
256     /// <para></para>
257     /// </param>
258     /// <param name="target">
259     /// <para>The target.</para>
260     /// <para></para>
261     /// </param>
262     /// <returns>
263     /// <para>The link</para>
264     /// <para></para>
265     /// </returns>
266     public override TLink Search(TLink source, TLink target) =>
267         ↪ SearchCore(GetTreeRoot(target), source);
268 }

```

## 1.75 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64SplitMemoryLinks.cs

```

1 using System;
2 using System.Runtime.CompilerServices;
3 using Platform.Singletons;
4 using Platform.Memory;

```

```

5 using Platform.Data.Doublets.Memory.Split.Generic;
6 using TLink = System.UInt64;
7
8 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
9
10 namespace Platform.Data.Doublets.Memory.Split.Specific
11 {
12     /// <summary>
13     /// <para>
14     /// Represents the int 64 split memory links.
15     /// </para>
16     /// <para></para>
17     /// </summary>
18     /// <seealso cref="SplitMemoryLinksBase{TLink}"/>
19     public unsafe class UInt64SplitMemoryLinks : SplitMemoryLinksBase<TLink>
20     {
21         /// <summary>
22         /// <para>
23         /// The create internal source tree methods.
24         /// </para>
25         /// <para></para>
26         /// </summary>
27         private readonly Func<ILinksTreeMethods<TLink>> _createInternalSourceTreeMethods;
28         /// <summary>
29         /// <para>
30         /// The create external source tree methods.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         private readonly Func<ILinksTreeMethods<TLink>> _createExternalSourceTreeMethods;
35         /// <summary>
36         /// <para>
37         /// The create internal target tree methods.
38         /// </para>
39         /// <para></para>
40         /// </summary>
41         private readonly Func<ILinksTreeMethods<TLink>> _createInternalTargetTreeMethods;
42         /// <summary>
43         /// <para>
44         /// The create external target tree methods.
45         /// </para>
46         /// <para></para>
47         /// </summary>
48         private readonly Func<ILinksTreeMethods<TLink>> _createExternalTargetTreeMethods;
49         /// <summary>
50         /// <para>
51         /// The header.
52         /// </para>
53         /// <para></para>
54         /// </summary>
55         private LinksHeader<ulong>* _header;
56         /// <summary>
57         /// <para>
58         /// The links data parts.
59         /// </para>
60         /// <para></para>
61         /// </summary>
62         private RawLinkDataPart<ulong>* _linksDataParts;
63         /// <summary>
64         /// <para>
65         /// The links index parts.
66         /// </para>
67         /// <para></para>
68         /// </summary>
69         private RawLinkIndexPart<ulong>* _linksIndexParts;
70
71         /// <summary>
72         /// <para>
73         /// Initializes a new <see cref="UInt64SplitMemoryLinks"/> instance.
74         /// </para>
75         /// <para></para>
76         /// </summary>
77         /// <param name="dataMemory">
78         /// <para>A data memory.</para>
79         /// <para></para>
80         /// </param>
81         /// <param name="indexMemory">
82         /// <para>A index memory.</para>
83         /// <para></para>

```

```

84     /// </param>
85     [MethodImpl(MethodImplOptions.AggressiveInlining)]
86     public UInt64SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
      ↪ indexMemory) : this(dataMemory, indexMemory, DefaultLinksSizeStep) { }
87
88     /// <summary>
89     /// <para>
90     /// Initializes a new <see cref="UInt64SplitMemoryLinks"/> instance.
91     /// </para>
92     /// <para></para>
93     /// </summary>
94     /// <param name="dataMemory">
95     /// <para>A data memory.</para>
96     /// <para></para>
97     /// </param>
98     /// <param name="indexMemory">
99     /// <para>A index memory.</para>
100    /// <para></para>
101    /// </param>
102    /// <param name="memoryReservationStep">
103    /// <para>A memory reservation step.</para>
104    /// <para></para>
105    /// </param>
106    [MethodImpl(MethodImplOptions.AggressiveInlining)]
107    public UInt64SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
      ↪ indexMemory, long memoryReservationStep) : this(dataMemory, indexMemory,
      ↪ memoryReservationStep, Default<LinksConstants<TLink>>.Instance,
      ↪ IndexTreeType.Default, useLinkedList: true) { }
108
109    /// <summary>
110    /// <para>
111    /// Initializes a new <see cref="UInt64SplitMemoryLinks"/> instance.
112    /// </para>
113    /// <para></para>
114    /// </summary>
115    /// <param name="dataMemory">
116    /// <para>A data memory.</para>
117    /// <para></para>
118    /// </param>
119    /// <param name="indexMemory">
120    /// <para>A index memory.</para>
121    /// <para></para>
122    /// </param>
123    /// <param name="memoryReservationStep">
124    /// <para>A memory reservation step.</para>
125    /// <para></para>
126    /// </param>
127    /// <param name="constants">
128    /// <para>A constants.</para>
129    /// <para></para>
130    /// </param>
131    [MethodImpl(MethodImplOptions.AggressiveInlining)]
132    public UInt64SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
      ↪ indexMemory, long memoryReservationStep, LinksConstants<TLink> constants) :
      ↪ this(dataMemory, indexMemory, memoryReservationStep, constants,
      ↪ IndexTreeType.Default, useLinkedList: true) { }
133
134    /// <summary>
135    /// <para>
136    /// Initializes a new <see cref="UInt64SplitMemoryLinks"/> instance.
137    /// </para>
138    /// <para></para>
139    /// </summary>
140    /// <param name="dataMemory">
141    /// <para>A data memory.</para>
142    /// <para></para>
143    /// </param>
144    /// <param name="indexMemory">
145    /// <para>A index memory.</para>
146    /// <para></para>
147    /// </param>
148    /// <param name="memoryReservationStep">
149    /// <para>A memory reservation step.</para>
150    /// <para></para>
151    /// </param>
152    /// <param name="constants">
153    /// <para>A constants.</para>

```

```

154    /// <para></para>
155    /// </param>
156    /// <param name="indexTreeType">
157    /// <para>A index tree type.</para>
158    /// <para></para>
159    /// </param>
160    /// <param name="useLinkedList">
161    /// <para>A use linked list.</para>
162    /// <para></para>
163    /// </param>
164    [MethodImpl(MethodImplOptions.AggressiveInlining)]
165    public UInt64SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
        ↪ indexMemory, long memoryReservationStep, LinksConstants<TLink> constants,
        ↪ IndexTreeType indexTreeType, bool useLinkedList) : base(dataMemory, indexMemory,
        ↪ memoryReservationStep, constants, useLinkedList)
166    {
167        if (indexTreeType == IndexTreeType.SizeBalancedTree)
168        {
169            _createInternalSourceTreeMethods = () => new
        ↪ UInt64InternalLinksSourcesSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
170            _createExternalSourceTreeMethods = () => new
        ↪ UInt64ExternalLinksSourcesSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
171            _createInternalTargetTreeMethods = () => new
        ↪ UInt64InternalLinksTargetsSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
172            _createExternalTargetTreeMethods = () => new
        ↪ UInt64ExternalLinksTargetsSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
173        }
174        else
175        {
176            _createInternalSourceTreeMethods = () => new
        ↪ UInt64InternalLinksSourcesRecursionlessSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
177            _createExternalSourceTreeMethods = () => new
        ↪ UInt64ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
178            _createInternalTargetTreeMethods = () => new
        ↪ UInt64InternalLinksTargetsRecursionlessSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
179            _createExternalTargetTreeMethods = () => new
        ↪ UInt64ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
180        }
181        Init(dataMemory, indexMemory);
182    }
183
184    /// <summary>
185    /// <para>
186    /// Sets the pointers using the specified data memory.
187    /// </para>
188    /// <para></para>
189    /// </summary>
190    /// <param name="dataMemory">
191    /// <para>The data memory.</para>
192    /// <para></para>
193    /// </param>
194    /// <param name="indexMemory">
195    /// <para>The index memory.</para>
196    /// <para></para>
197    /// </param>
198    [MethodImpl(MethodImplOptions.AggressiveInlining)]
199    protected override void SetPointers(IResizableDirectMemory dataMemory,
        ↪ IResizableDirectMemory indexMemory)
200    {
201        _linksDataParts = (RawLinkDataPart<TLink>*)dataMemory.Pointer;
202        _linksIndexParts = (RawLinkIndexPart<TLink>*)indexMemory.Pointer;
203        _header = (LinksHeader<TLink>*)indexMemory.Pointer;
204        if (_useLinkedList)
205        {
206            InternalSourcesListMethods = new
        ↪ UInt64InternalLinksSourcesLinkedListMethods(Constants, _linksDataParts,
        ↪ _linksIndexParts);
207        }
208        else

```

```

209     {
210         InternalSourcesTreeMethods = _createInternalSourceTreeMethods();
211     }
212     ExternalSourcesTreeMethods = _createExternalSourceTreeMethods();
213     InternalTargetsTreeMethods = _createInternalTargetTreeMethods();
214     ExternalTargetsTreeMethods = _createExternalTargetTreeMethods();
215     UnusedLinksListMethods = new UInt64UnusedLinksListMethods(_linksDataParts, _header);
216 }
217
218 /// <summary>
219 /// <para>
220 /// Resets the pointers.
221 /// </para>
222 /// <para></para>
223 /// </summary>
224 [MethodImpl(MethodImplOptions.AggressiveInlining)]
225 protected override void ResetPointers()
226 {
227     base.ResetPointers();
228     _linksDataParts = null;
229     _linksIndexParts = null;
230     _header = null;
231 }
232
233 /// <summary>
234 /// <para>
235 /// Gets the header reference.
236 /// </para>
237 /// <para></para>
238 /// </summary>
239 /// <returns>
240 /// <para>A ref links header of t link</para>
241 /// <para></para>
242 /// </returns>
243 [MethodImpl(MethodImplOptions.AggressiveInlining)]
244 protected override ref LinksHeader<TLink> GetHeaderReference() => ref *_header;
245
246 /// <summary>
247 /// <para>
248 /// Gets the link data part reference using the specified link index.
249 /// </para>
250 /// <para></para>
251 /// </summary>
252 /// <param name="linkIndex">
253 /// <para>The link index.</para>
254 /// <para></para>
255 /// </param>
256 /// <returns>
257 /// <para>A ref raw link data part of t link</para>
258 /// <para></para>
259 /// </returns>
260 [MethodImpl(MethodImplOptions.AggressiveInlining)]
261 protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink linkIndex)
262     => ref _linksDataParts[linkIndex];
263
264 /// <summary>
265 /// <para>
266 /// Gets the link index part reference using the specified link index.
267 /// </para>
268 /// <para></para>
269 /// </summary>
270 /// <param name="linkIndex">
271 /// <para>The link index.</para>
272 /// <para></para>
273 /// </param>
274 /// <returns>
275 /// <para>A ref raw link index part of t link</para>
276 /// <para></para>
277 /// </returns>
278 [MethodImpl(MethodImplOptions.AggressiveInlining)]
279 protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink
280     linkIndex) => ref _linksIndexParts[linkIndex];
281
282 /// <summary>
283 /// <para>
284 /// Determines whether this instance are equal.
285 /// </para>
286 /// <para></para>

```



```

285     /// </summary>
286     /// <param name="first">
287     /// <para>The first.</para>
288     /// <para></para>
289     /// </param>
290     /// <param name="second">
291     /// <para>The second.</para>
292     /// <para></para>
293     /// </param>
294     /// <returns>
295     /// <para>The bool</para>
296     /// <para></para>
297     /// </returns>
298     [MethodImpl(MethodImplOptions.AggressiveInlining)]
299     protected override bool AreEqual(ulong first, ulong second) => first == second;
300
301     /// <summary>
302     /// <para>
303     /// Determines whether this instance less than.
304     /// </para>
305     /// <para></para>
306     /// </summary>
307     /// <param name="first">
308     /// <para>The first.</para>
309     /// <para></para>
310     /// </param>
311     /// <param name="second">
312     /// <para>The second.</para>
313     /// <para></para>
314     /// </param>
315     /// <returns>
316     /// <para>The bool</para>
317     /// <para></para>
318     /// </returns>
319     [MethodImpl(MethodImplOptions.AggressiveInlining)]
320     protected override bool LessThan(ulong first, ulong second) => first < second;
321
322     /// <summary>
323     /// <para>
324     /// Determines whether this instance less or equal than.
325     /// </para>
326     /// <para></para>
327     /// </summary>
328     /// <param name="first">
329     /// <para>The first.</para>
330     /// <para></para>
331     /// </param>
332     /// <param name="second">
333     /// <para>The second.</para>
334     /// <para></para>
335     /// </param>
336     /// <returns>
337     /// <para>The bool</para>
338     /// <para></para>
339     /// </returns>
340     [MethodImpl(MethodImplOptions.AggressiveInlining)]
341     protected override bool LessOrEqualThan(ulong first, ulong second) => first <= second;
342
343     /// <summary>
344     /// <para>
345     /// Determines whether this instance greater than.
346     /// </para>
347     /// <para></para>
348     /// </summary>
349     /// <param name="first">
350     /// <para>The first.</para>
351     /// <para></para>
352     /// </param>
353     /// <param name="second">
354     /// <para>The second.</para>
355     /// <para></para>
356     /// </param>
357     /// <returns>
358     /// <para>The bool</para>
359     /// <para></para>
360     /// </returns>
361     [MethodImpl(MethodImplOptions.AggressiveInlining)]
362     protected override bool GreaterThan(ulong first, ulong second) => first > second;

```

```

363     /// <summary>
364     /// <para>
365     /// Determines whether this instance greater or equal than.
366     /// </para>
367     /// <para></para>
368     /// </summary>
369     /// <param name="first">
370     /// <para>The first.</para>
371     /// <para></para>
372     /// </param>
373     /// <param name="second">
374     /// <para>The second.</para>
375     /// <para></para>
376     /// </param>
377     /// <returns>
378     /// <para>The bool</para>
379     /// <para></para>
380     /// </returns>
381     [MethodImpl(MethodImplOptions.AggressiveInlining)]
382     protected override bool GreaterOrEqualThan(ulong first, ulong second) => first >= second;
383
384     /// <summary>
385     /// <para>
386     /// Gets the zero.
387     /// </para>
388     /// <para></para>
389     /// </summary>
390     /// <returns>
391     /// <para>The ulong</para>
392     /// <para></para>
393     /// </returns>
394     [MethodImpl(MethodImplOptions.AggressiveInlining)]
395     protected override ulong GetZero() => 0UL;
396
397     /// <summary>
398     /// <para>
399     /// Gets the one.
400     /// </para>
401     /// <para></para>
402     /// </summary>
403     /// <returns>
404     /// <para>The ulong</para>
405     /// <para></para>
406     /// </returns>
407     [MethodImpl(MethodImplOptions.AggressiveInlining)]
408     protected override ulong GetOne() => 1UL;
409
410     /// <summary>
411     /// <para>
412     /// Converts the to int 64 using the specified value.
413     /// </para>
414     /// <para></para>
415     /// </summary>
416     /// <param name="value">
417     /// <para>The value.</para>
418     /// <para></para>
419     /// </param>
420     /// <returns>
421     /// <para>The long</para>
422     /// <para></para>
423     /// </returns>
424     [MethodImpl(MethodImplOptions.AggressiveInlining)]
425     protected override long ConvertToInt64(ulong value) => (long)value;
426
427     /// <summary>
428     /// <para>
429     /// Converts the to address using the specified value.
430     /// </para>
431     /// <para></para>
432     /// </summary>
433     /// <param name="value">
434     /// <para>The value.</para>
435     /// <para></para>
436     /// </param>
437     /// <returns>
438     /// <para>The ulong</para>
439     /// <para></para>
440     /// </returns>

```

```

441     /// </returns>
442     [MethodImpl(MethodImplOptions.AggressiveInlining)]
443     protected override ulong ConvertToAddress(long value) => (ulong)value;
444
445     /// <summary>
446     /// <para>
447     /// Adds the first.
448     /// </para>
449     /// <para></para>
450     /// </summary>
451     /// <param name="first">
452     /// <para>The first.</para>
453     /// <para></para>
454     /// </param>
455     /// <param name="second">
456     /// <para>The second.</para>
457     /// <para></para>
458     /// </param>
459     /// <returns>
460     /// <para>The ulong</para>
461     /// <para></para>
462     /// </returns>
463     [MethodImpl(MethodImplOptions.AggressiveInlining)]
464     protected override ulong Add(ulong first, ulong second) => first + second;
465
466     /// <summary>
467     /// <para>
468     /// Subtracts the first.
469     /// </para>
470     /// <para></para>
471     /// </summary>
472     /// <param name="first">
473     /// <para>The first.</para>
474     /// <para></para>
475     /// </param>
476     /// <param name="second">
477     /// <para>The second.</para>
478     /// <para></para>
479     /// </param>
480     /// <returns>
481     /// <para>The ulong</para>
482     /// <para></para>
483     /// </returns>
484     [MethodImpl(MethodImplOptions.AggressiveInlining)]
485     protected override ulong Subtract(ulong first, ulong second) => first - second;
486
487     /// <summary>
488     /// <para>
489     /// Increments the link.
490     /// </para>
491     /// <para></para>
492     /// </summary>
493     /// <param name="link">
494     /// <para>The link.</para>
495     /// <para></para>
496     /// </param>
497     /// <returns>
498     /// <para>The ulong</para>
499     /// <para></para>
500     /// </returns>
501     [MethodImpl(MethodImplOptions.AggressiveInlining)]
502     protected override ulong Increment(ulong link) => ++link;
503
504     /// <summary>
505     /// <para>
506     /// Decrements the link.
507     /// </para>
508     /// <para></para>
509     /// </summary>
510     /// <param name="link">
511     /// <para>The link.</para>
512     /// <para></para>
513     /// </param>
514     /// <returns>
515     /// <para>The ulong</para>
516     /// <para></para>
517     /// </returns>
518     [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

519         protected override ulong Decrement(ulong link) => --link;
520     }
521 }

```

## 1.76 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64UnusedLinksListMethods.cs

```

1  using System.Runtime.CompilerServices;
2  using Platform.Data.Doublets.Memory.Split.Generic;
3  using TLink = System.UInt64;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Doublets.Memory.Split.Specific
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the int 64 unused links list methods.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     /// <seealso cref="UnusedLinksListMethods{TLink}"/>
16     public unsafe class UInt64UnusedLinksListMethods : UnusedLinksListMethods<TLink>
17     {
18         /// <summary>
19         /// <para>
20         /// The links.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         private readonly RawLinkDataPart<ulong>* _links;
25         /// <summary>
26         /// <para>
27         /// The header.
28         /// </para>
29         /// <para></para>
30         /// </summary>
31         private readonly LinksHeader<ulong>* _header;
32
33         /// <summary>
34         /// <para>
35         /// Initializes a new <see cref="UInt64UnusedLinksListMethods"/> instance.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         /// <param name="links">
40         /// <para>A links.</para>
41         /// <para></para>
42         /// </param>
43         /// <param name="header">
44         /// <para>A header.</para>
45         /// <para></para>
46         /// </param>
47         [MethodImpl(MethodImplOptions.AggressiveInlining)]
48         public UInt64UnusedLinksListMethods(RawLinkDataPart<ulong>* links, LinksHeader<ulong>*
49             ↪ header)
50             : base((byte*)links, (byte*)header)
51         {
52             _links = links;
53             _header = header;
54         }
55
56         /// <summary>
57         /// <para>
58         /// Gets the link data part reference using the specified link.
59         /// </para>
60         /// <para></para>
61         /// </summary>
62         /// <param name="link">
63         /// <para>The link.</para>
64         /// <para></para>
65         /// </param>
66         /// <returns>
67         /// <para>A ref raw link data part of t link</para>
68         /// <para></para>
69         /// </returns>
70         [MethodImpl(MethodImplOptions.AggressiveInlining)]
71         protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
72             ↪ ref _links[link];
73
74         /// <summary>

```

```

73     /// <para>
74     /// Gets the header reference.
75     /// </para>
76     /// <para></para>
77     /// </summary>
78     /// <returns>
79     /// <para>A ref links header of t link</para>
80     /// <para></para>
81     /// </returns>
82     [MethodImpl(MethodImplOptions.AggressiveInlining)]
83     protected override ref LinksHeader<TLink> GetHeaderReference() => ref *_header;
84 }
85 }

```

## 1.77 ./csharp/Platform.Data.Doublets/Memory/United/Generic/LinksAvlBalancedTreeMethodsBase.cs

```

1  using System;
2  using System.Text;
3  using System.Collections.Generic;
4  using System.Runtime.CompilerServices;
5  using Platform.Collections.Methods.Trees;
6  using Platform.Converters;
7  using Platform.Numbers;
8  using static System.Runtime.CompilerServices.Unsafe;
9
10 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
11
12 namespace Platform.Data.Doublets.Memory.United.Generic
13 {
14     /// <summary>
15     /// <para>
16     /// Represents the links avl balanced tree methods base.
17     /// </para>
18     /// <para></para>
19     /// </summary>
20     /// <seealso cref="SizedAndThreadedAVLBalancedTreeMethods{TLink}" />
21     /// <seealso cref="ILinksTreeMethods{TLink}" />
22     public unsafe abstract class LinksAvlBalancedTreeMethodsBase<TLink> :
23     ↪ SizedAndThreadedAVLBalancedTreeMethods<TLink>, ILinksTreeMethods<TLink>
24     {
25         /// <summary>
26         /// <para>
27         /// The default.
28         /// </para>
29         /// <para></para>
30         /// </summary>
31         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
32         ↪ UncheckedConverter<TLink, long>.Default;
33         /// <summary>
34         /// <para>
35         /// The default.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         private static readonly UncheckedConverter<TLink, int> _addressToInt32Converter =
40         ↪ UncheckedConverter<TLink, int>.Default;
41         /// <summary>
42         /// <para>
43         /// The default.
44         /// </para>
45         /// <para></para>
46         /// </summary>
47         private static readonly UncheckedConverter<bool, TLink> _boolToAddressConverter =
48         ↪ UncheckedConverter<bool, TLink>.Default;
49         /// <summary>
50         /// <para>
51         /// The default.
52         /// </para>
53         /// <para></para>
54         /// </summary>
55         private static readonly UncheckedConverter<TLink, bool> _addressToBoolConverter =
56         ↪ UncheckedConverter<TLink, bool>.Default;
57         /// <summary>
58         /// <para>
59         /// The default.
60         /// </para>
61         /// <para></para>
62         /// </summary>
63         private static readonly UncheckedConverter<int, TLink> _int32ToAddressConverter =
64         ↪ UncheckedConverter<int, TLink>.Default;

```

```

59
60     /// <summary>
61     /// <para>
62     /// The break.
63     /// </para>
64     /// <para></para>
65     /// </summary>
66     protected readonly TLink Break;
67     /// <summary>
68     /// <para>
69     /// The continue.
70     /// </para>
71     /// <para></para>
72     /// </summary>
73     protected readonly TLink Continue;
74     /// <summary>
75     /// <para>
76     /// The links.
77     /// </para>
78     /// <para></para>
79     /// </summary>
80     protected readonly byte* Links;
81     /// <summary>
82     /// <para>
83     /// The header.
84     /// </para>
85     /// <para></para>
86     /// </summary>
87     protected readonly byte* Header;
88
89     /// <summary>
90     /// <para>
91     /// Initializes a new <see cref="LinksAvlBalancedTreeMethodsBase"/> instance.
92     /// </para>
93     /// <para></para>
94     /// </summary>
95     /// <param name="constants">
96     /// <para>A constants.</para>
97     /// <para></para>
98     /// </param>
99     /// <param name="links">
100    /// <para>A links.</para>
101    /// <para></para>
102    /// </param>
103    /// <param name="header">
104    /// <para>A header.</para>
105    /// <para></para>
106    /// </param>
107    [MethodImpl(MethodImplOptions.AggressiveInlining)]
108    protected LinksAvlBalancedTreeMethodsBase(LinksConstants<TLink> constants, byte* links,
109        ↪ byte* header)
110    {
111        Links = links;
112        Header = header;
113        Break = constants.Break;
114        Continue = constants.Continue;
115    }
116
117    /// <summary>
118    /// <para>
119    /// Gets the tree root.
120    /// </para>
121    /// <para></para>
122    /// </summary>
123    /// <returns>
124    /// <para>The link</para>
125    /// <para></para>
126    /// </returns>
127    [MethodImpl(MethodImplOptions.AggressiveInlining)]
128    protected abstract TLink GetTreeRoot();
129
130    /// <summary>
131    /// <para>
132    /// Gets the base part value using the specified link.
133    /// </para>
134    /// <para></para>
135    /// </summary>
136    /// <param name="link">

```

```

136    /// <para>The link.</para>
137    /// <para></para>
138    /// </param>
139    /// <returns>
140    /// <para>The link</para>
141    /// <para></para>
142    /// </returns>
143    [MethodImpl(MethodImplOptions.AggressiveInlining)]
144    protected abstract TLink GetBasePartValue(TLink link);
145
146    /// <summary>
147    /// <para>
148    /// Determines whether this instance first is to the right of second.
149    /// </para>
150    /// <para></para>
151    /// </summary>
152    /// <param name="source">
153    /// <para>The source.</para>
154    /// <para></para>
155    /// </param>
156    /// <param name="target">
157    /// <para>The target.</para>
158    /// <para></para>
159    /// </param>
160    /// <param name="rootSource">
161    /// <para>The root source.</para>
162    /// <para></para>
163    /// </param>
164    /// <param name="rootTarget">
165    /// <para>The root target.</para>
166    /// <para></para>
167    /// </param>
168    /// <returns>
169    /// <para>The bool</para>
170    /// <para></para>
171    /// </returns>
172    [MethodImpl(MethodImplOptions.AggressiveInlining)]
173    protected abstract bool FirstIsToTheRightOfSecond(TLink source, TLink target, TLink
        ↪ rootSource, TLink rootTarget);
174
175    /// <summary>
176    /// <para>
177    /// Determines whether this instance first is to the left of second.
178    /// </para>
179    /// <para></para>
180    /// </summary>
181    /// <param name="source">
182    /// <para>The source.</para>
183    /// <para></para>
184    /// </param>
185    /// <param name="target">
186    /// <para>The target.</para>
187    /// <para></para>
188    /// </param>
189    /// <param name="rootSource">
190    /// <para>The root source.</para>
191    /// <para></para>
192    /// </param>
193    /// <param name="rootTarget">
194    /// <para>The root target.</para>
195    /// <para></para>
196    /// </param>
197    /// <returns>
198    /// <para>The bool</para>
199    /// <para></para>
200    /// </returns>
201    [MethodImpl(MethodImplOptions.AggressiveInlining)]
202    protected abstract bool FirstIsToTheLeftOfSecond(TLink source, TLink target, TLink
        ↪ rootSource, TLink rootTarget);
203
204    /// <summary>
205    /// <para>
206    /// Gets the header reference.
207    /// </para>
208    /// <para></para>
209    /// </summary>
210    /// <returns>
211    /// <para>A ref links header of t link</para>

```

```

212 /// <para></para>
213 /// </returns>
214 [MethodImpl(MethodImplOptions.AggressiveInlining)]
215 protected virtual ref LinksHeader<TLink> GetHeaderReference() => ref
    ↳ AsRef<LinksHeader<TLink>>(Header);
216
217 /// <summary>
218 /// <para>
219 /// Gets the link reference using the specified link.
220 /// </para>
221 /// <para></para>
222 /// </summary>
223 /// <param name="link">
224 /// <para>The link.</para>
225 /// <para></para>
226 /// </param>
227 /// <returns>
228 /// <para>A ref raw link of t link</para>
229 /// <para></para>
230 /// </returns>
231 [MethodImpl(MethodImplOptions.AggressiveInlining)]
232 protected virtual ref RawLink<TLink> GetLinkReference(TLink link) => ref
    ↳ AsRef<RawLink<TLink>>(Links + (RawLink<TLink>.SizeInBytes *
    ↳ _addressToInt64Converter.Convert(link)));
233
234 /// <summary>
235 /// <para>
236 /// Gets the link values using the specified link index.
237 /// </para>
238 /// <para></para>
239 /// </summary>
240 /// <param name="linkIndex">
241 /// <para>The link index.</para>
242 /// <para></para>
243 /// </param>
244 /// <returns>
245 /// <para>A list of t link</para>
246 /// <para></para>
247 /// </returns>
248 [MethodImpl(MethodImplOptions.AggressiveInlining)]
249 protected virtual IList<TLink> GetLinkValues(TLink linkIndex)
250 {
251     ref var link = ref GetLinkReference(linkIndex);
252     return new Link<TLink>(linkIndex, link.Source, link.Target);
253 }
254
255 /// <summary>
256 /// <para>
257 /// Determines whether this instance first is to the left of second.
258 /// </para>
259 /// <para></para>
260 /// </summary>
261 /// <param name="first">
262 /// <para>The first.</para>
263 /// <para></para>
264 /// </param>
265 /// <param name="second">
266 /// <para>The second.</para>
267 /// <para></para>
268 /// </param>
269 /// <returns>
270 /// <para>The bool</para>
271 /// <para></para>
272 /// </returns>
273 [MethodImpl(MethodImplOptions.AggressiveInlining)]
274 protected override bool FirstIsToTheLeftOfSecond(TLink first, TLink second)
275 {
276     ref var firstLink = ref GetLinkReference(first);
277     ref var secondLink = ref GetLinkReference(second);
278     return FirstIsToTheLeftOfSecond(firstLink.Source, firstLink.Target,
    ↳ secondLink.Source, secondLink.Target);
279 }
280
281 /// <summary>
282 /// <para>
283 /// Determines whether this instance first is to the right of second.
284 /// </para>
285 /// <para></para>

```



```

286    /// </summary>
287    /// <param name="first">
288    /// <para>The first.</para>
289    /// <para></para>
290    /// </param>
291    /// <param name="second">
292    /// <para>The second.</para>
293    /// <para></para>
294    /// </param>
295    /// <returns>
296    /// <para>The bool</para>
297    /// <para></para>
298    /// </returns>
299    [MethodImpl(MethodImplOptions.AggressiveInlining)]
300    protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second)
301    {
302        ref var firstLink = ref GetLinkReference(first);
303        ref var secondLink = ref GetLinkReference(second);
304        return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
305            ↪ secondLink.Source, secondLink.Target);
306    }
307    /// <summary>
308    /// <para>
309    /// Gets the size value using the specified value.
310    /// </para>
311    /// <para></para>
312    /// </summary>
313    /// <param name="value">
314    /// <para>The value.</para>
315    /// <para></para>
316    /// </param>
317    /// <returns>
318    /// <para>The link</para>
319    /// <para></para>
320    /// </returns>
321    [MethodImpl(MethodImplOptions.AggressiveInlining)]
322    protected virtual TLink GetSizeValue(TLink value) => Bit<TLink>.PartialRead(value, 5,
323        ↪ -5);
324    /// <summary>
325    /// <para>
326    /// Sets the size value using the specified stored value.
327    /// </para>
328    /// <para></para>
329    /// </summary>
330    /// <param name="storedValue">
331    /// <para>The stored value.</para>
332    /// <para></para>
333    /// </param>
334    /// <param name="size">
335    /// <para>The size.</para>
336    /// <para></para>
337    /// </param>
338    [MethodImpl(MethodImplOptions.AggressiveInlining)]
339    protected virtual void SetSizeValue(ref TLink storedValue, TLink size) => storedValue =
340        ↪ Bit<TLink>.PartialWrite(storedValue, size, 5, -5);
341    /// <summary>
342    /// <para>
343    /// Determines whether this instance get left is child value.
344    /// </para>
345    /// <para></para>
346    /// </summary>
347    /// <param name="value">
348    /// <para>The value.</para>
349    /// <para></para>
350    /// </param>
351    /// <returns>
352    /// <para>The bool</para>
353    /// <para></para>
354    /// </returns>
355    [MethodImpl(MethodImplOptions.AggressiveInlining)]
356    protected virtual bool GetLeftIsChildValue(TLink value)
357    {
358        unchecked
359        {
360            return _addressToBoolConverter.Convert(Bit<TLink>.PartialRead(value, 4, 1));

```

```

361         //return !EqualityComparer.Equals(Bit<TLink>.PartialRead(value, 4, 1), default);
362     }
363 }
364
365 /// <summary>
366 /// <para>
367 /// Sets the left is child value using the specified stored value.
368 /// </para>
369 /// <para></para>
370 /// </summary>
371 /// <param name="storedValue">
372 /// <para>The stored value.</para>
373 /// <para></para>
374 /// </param>
375 /// <param name="value">
376 /// <para>The value.</para>
377 /// <para></para>
378 /// </param>
379 [MethodImpl(MethodImplOptions.AggressiveInlining)]
380 protected virtual void SetLeftIsChildValue(ref TLink storedValue, bool value)
381 {
382     unchecked
383     {
384         var previousValue = storedValue;
385         var modified = Bit<TLink>.PartialWrite(previousValue,
386             ↪ _boolToAddressConverter.Convert(value), 4, 1);
387         storedValue = modified;
388     }
389
390 /// <summary>
391 /// <para>
392 /// Determines whether this instance get right is child value.
393 /// </para>
394 /// <para></para>
395 /// </summary>
396 /// <param name="value">
397 /// <para>The value.</para>
398 /// <para></para>
399 /// </param>
400 /// <returns>
401 /// <para>The bool</para>
402 /// <para></para>
403 /// </returns>
404 [MethodImpl(MethodImplOptions.AggressiveInlining)]
405 protected virtual bool GetRightIsChildValue(TLink value)
406 {
407     unchecked
408     {
409         return _addressToBoolConverter.Convert(Bit<TLink>.PartialRead(value, 3, 1));
410         //return !EqualityComparer.Equals(Bit<TLink>.PartialRead(value, 3, 1), default);
411     }
412 }
413
414 /// <summary>
415 /// <para>
416 /// Sets the right is child value using the specified stored value.
417 /// </para>
418 /// <para></para>
419 /// </summary>
420 /// <param name="storedValue">
421 /// <para>The stored value.</para>
422 /// <para></para>
423 /// </param>
424 /// <param name="value">
425 /// <para>The value.</para>
426 /// <para></para>
427 /// </param>
428 [MethodImpl(MethodImplOptions.AggressiveInlining)]
429 protected virtual void SetRightIsChildValue(ref TLink storedValue, bool value)
430 {
431     unchecked
432     {
433         var previousValue = storedValue;
434         var modified = Bit<TLink>.PartialWrite(previousValue,
435             ↪ _boolToAddressConverter.Convert(value), 3, 1);
436         storedValue = modified;
437     }
438 }

```

```

437     }
438
439     /// <summary>
440     /// <para>
441     /// Determines whether this instance is child.
442     /// </para>
443     /// <para></para>
444     /// </summary>
445     /// <param name="parent">
446     /// <para>The parent.</para>
447     /// <para></para>
448     /// </param>
449     /// <param name="possibleChild">
450     /// <para>The possible child.</para>
451     /// <para></para>
452     /// </param>
453     /// <returns>
454     /// <para>The bool</para>
455     /// <para></para>
456     /// </returns>
457     [MethodImpl(MethodImplOptions.AggressiveInlining)]
458     protected bool IsChild(TLink parent, TLink possibleChild)
459     {
460         var parentSize = GetSize(parent);
461         var childSize = GetSizeOrZero(possibleChild);
462         return GreaterThanZero(childSize) && LessOrEqualThan(childSize, parentSize);
463     }
464
465     /// <summary>
466     /// <para>
467     /// Gets the balance value using the specified stored value.
468     /// </para>
469     /// <para></para>
470     /// </summary>
471     /// <param name="storedValue">
472     /// <para>The stored value.</para>
473     /// <para></para>
474     /// </param>
475     /// <returns>
476     /// <para>The sbyte</para>
477     /// <para></para>
478     /// </returns>
479     [MethodImpl(MethodImplOptions.AggressiveInlining)]
480     protected virtual sbyte GetBalanceValue(TLink storedValue)
481     {
482         unchecked
483         {
484             var value = _addressToInt32Converter.Convert(Bit<TLink>.PartialRead(storedValue,
485                 ↪ 0, 3));
486             value |= 0xF8 * ((value & 4) >> 2); // if negative, then continue ones to the
487                 ↪ end of sbyte
488             return (sbyte)value;
489         }
490     }
491
492     /// <summary>
493     /// <para>
494     /// Sets the balance value using the specified stored value.
495     /// </para>
496     /// <para></para>
497     /// </summary>
498     /// <param name="storedValue">
499     /// <para>The stored value.</para>
500     /// <para></para>
501     /// </param>
502     /// <param name="value">
503     /// <para>The value.</para>
504     /// <para></para>
505     /// </param>
506     [MethodImpl(MethodImplOptions.AggressiveInlining)]
507     protected virtual void SetBalanceValue(ref TLink storedValue, sbyte value)
508     {
509         unchecked
510         {
511             var packagedValue = _int32ToAddressConverter.Convert((byte)value >> 5 & 4 |

```

```

512     }
513 }
514
515 /// <summary>
516 /// <para>
517 /// The zero.
518 /// </para>
519 /// <para></para>
520 /// </summary>
521 public TLink this[TLink index]
522 {
523     [MethodImpl(MethodImplOptions.AggressiveInlining)]
524     get
525     {
526         var root = GetTreeRoot();
527         if (GreaterOrEqualThan(index, GetSize(root)))
528         {
529             return Zero;
530         }
531         while (!EqualToZero(root))
532         {
533             var left = GetLeftOrDefault(root);
534             var leftSize = GetSizeOrZero(left);
535             if (LessThan(index, leftSize))
536             {
537                 root = left;
538                 continue;
539             }
540             if (AreEqual(index, leftSize))
541             {
542                 return root;
543             }
544             root = GetRightOrDefault(root);
545             index = Subtract(index, Increment(leftSize));
546         }
547         return Zero; // TODO: Impossible situation exception (only if tree structure
548                     ↪ broken)
549     }
550 }
551
552 /// <summary>
553 /// Выполняет поиск и возвращает индекс связи с указанными Source (началом) и Target
554 ↪ (концом).
555 /// </summary>
556 /// <param name="source">Индекс связи, которая является началом на искомой связи.</param>
557 /// <param name="target">Индекс связи, которая является концом на искомой связи.</param>
558 /// <returns>Индекс искомой связи.</returns>
559 [MethodImpl(MethodImplOptions.AggressiveInlining)]
560 public TLink Search(TLink source, TLink target)
561 {
562     var root = GetTreeRoot();
563     while (!EqualToZero(root))
564     {
565         ref var rootLink = ref GetLinkReference(root);
566         var rootSource = rootLink.Source;
567         var rootTarget = rootLink.Target;
568         if (FirstIsToTheLeftOfSecond(source, target, rootSource, rootTarget)) //
569             ↪ node.Key < root.Key
570         {
571             root = GetLeftOrDefault(root);
572         }
573         else if (FirstIsToTheRightOfSecond(source, target, rootSource, rootTarget)) //
574             ↪ node.Key > root.Key
575         {
576             root = GetRightOrDefault(root);
577         }
578         else // node.Key == root.Key
579         {
580             return root;
581         }
582     }
583     return Zero;
584 }
585
586 // TODO: Return indices range instead of references count
587 /// <summary>
588 /// <para>
589 /// Counts the usages using the specified link.

```

```

586 /// </para>
587 /// <para></para>
588 /// </summary>
589 /// <param name="link">
590 /// <para>The link.</para>
591 /// <para></para>
592 /// </param>
593 /// <returns>
594 /// <para>The link</para>
595 /// <para></para>
596 /// </returns>
597 [MethodImpl(MethodImplOptions.AggressiveInlining)]
598 public TLink CountUsages(TLink link)
599 {
600     var root = GetTreeRoot();
601     var total = GetSize(root);
602     var totalRightIgnore = Zero;
603     while (!EqualToZero(root))
604     {
605         var @base = GetBasePartValue(root);
606         if (LessOrEqualThan(@base, link))
607         {
608             root = GetRightOrDefault(root);
609         }
610         else
611         {
612             totalRightIgnore = Add(totalRightIgnore, Increment(GetRightSize(root)));
613             root = GetLeftOrDefault(root);
614         }
615     }
616     root = GetTreeRoot();
617     var totalLeftIgnore = Zero;
618     while (!EqualToZero(root))
619     {
620         var @base = GetBasePartValue(root);
621         if (GreaterOrEqualThan(@base, link))
622         {
623             root = GetLeftOrDefault(root);
624         }
625         else
626         {
627             totalLeftIgnore = Add(totalLeftIgnore, Increment(GetLeftSize(root)));
628             root = GetRightOrDefault(root);
629         }
630     }
631     return Subtract(Subtract(total, totalRightIgnore), totalLeftIgnore);
632 }
633
634 /// <summary>
635 /// <para>
636 /// Eaches the usage using the specified link.
637 /// </para>
638 /// <para></para>
639 /// </summary>
640 /// <param name="link">
641 /// <para>The link.</para>
642 /// <para></para>
643 /// </param>
644 /// <param name="handler">
645 /// <para>The handler.</para>
646 /// <para></para>
647 /// </param>
648 /// <returns>
649 /// <para>The continue.</para>
650 /// <para></para>
651 /// </returns>
652 [MethodImpl(MethodImplOptions.AggressiveInlining)]
653 public TLink EachUsage(TLink link, Func<IList<TLink>, TLink> handler)
654 {
655     var root = GetTreeRoot();
656     if (EqualToZero(root))
657     {
658         return Continue;
659     }
660     TLink first = Zero, current = root;
661     while (!EqualToZero(current))
662     {

```

```

664         var @base = GetBasePartValue(current);
665         if (GreaterOrEqualThan(@base, link))
666         {
667             if (AreEqual(@base, link))
668             {
669                 first = current;
670             }
671             current = GetLeftOrDefault(current);
672         }
673         else
674         {
675             current = GetRightOrDefault(current);
676         }
677     }
678     if (!EqualToZero(first))
679     {
680         current = first;
681         while (true)
682         {
683             if (AreEqual(handler(GetLinkValues(current)), Break))
684             {
685                 return Break;
686             }
687             current = GetNext(current);
688             if (EqualToZero(current) || !AreEqual(GetBasePartValue(current), link))
689             {
690                 break;
691             }
692         }
693     }
694     return Continue;
695 }
696
697 /// <summary>
698 /// <para>
699 /// Prints the node value using the specified node.
700 /// </para>
701 /// <para></para>
702 /// </summary>
703 /// <param name="node">
704 /// <para>The node.</para>
705 /// <para></para>
706 /// </param>
707 /// <param name="sb">
708 /// <para>The sb.</para>
709 /// <para></para>
710 /// </param>
711 [MethodImpl(MethodImplOptions.AggressiveInlining)]
712 protected override void PrintNodeValue(TLink node, StringBuilder sb)
713 {
714     ref var link = ref GetLinkReference(node);
715     sb.Append(' ');
716     sb.Append(link.Source);
717     sb.Append('-');
718     sb.Append('>');
719     sb.Append(link.Target);
720 }
721 }
722 }

```

## 1.78 ./csharp/Platform.Data.Doublets/Memory/United/Generic/LinksRecursionlessSizeBalancedTreeMethodsBase

```

1  using System;
2  using System.Text;
3  using System.Collections.Generic;
4  using System.Runtime.CompilerServices;
5  using Platform.Collections.Methods.Trees;
6  using Platform.Converters;
7  using static System.Runtime.CompilerServices.Unsafe;
8
9  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
10
11 namespace Platform.Data.Doublets.Memory.United.Generic
12 {
13     /// <summary>
14     /// <para>
15     /// Represents the links recursionless size balanced tree methods base.
16     /// </para>
17     /// <para></para>
18     /// </summary>

```

```

19  /// <seealso cref="RecursionlessSizeBalancedTreeMethods{TLink}"/>
20  /// <seealso cref="ILinksTreeMethods{TLink}"/>
21  public unsafe abstract class LinksRecursionlessSizeBalancedTreeMethodsBase<TLink> :
    ↳ RecursionlessSizeBalancedTreeMethods<TLink>, ILinksTreeMethods<TLink>
22  {
23      /// <summary>
24      /// <para>
25      /// The default.
26      /// </para>
27      /// <para></para>
28      /// </summary>
29      private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
    ↳ UncheckedConverter<TLink, long>.Default;
30
31      /// <summary>
32      /// <para>
33      /// The break.
34      /// </para>
35      /// <para></para>
36      /// </summary>
37      protected readonly TLink Break;
38      /// <summary>
39      /// <para>
40      /// The continue.
41      /// </para>
42      /// <para></para>
43      /// </summary>
44      protected readonly TLink Continue;
45      /// <summary>
46      /// <para>
47      /// The links.
48      /// </para>
49      /// <para></para>
50      /// </summary>
51      protected readonly byte* Links;
52      /// <summary>
53      /// <para>
54      /// The header.
55      /// </para>
56      /// <para></para>
57      /// </summary>
58      protected readonly byte* Header;
59
60      /// <summary>
61      /// <para>
62      /// Initializes a new <see cref="LinksRecursionlessSizeBalancedTreeMethodsBase"/>
    ↳ instance.
63      /// </para>
64      /// <para></para>
65      /// </summary>
66      /// <param name="constants">
67      /// <para>A constants.</para>
68      /// <para></para>
69      /// </param>
70      /// <param name="links">
71      /// <para>A links.</para>
72      /// <para></para>
73      /// </param>
74      /// <param name="header">
75      /// <para>A header.</para>
76      /// <para></para>
77      /// </param>
78      [MethodImpl(MethodImplOptions.AggressiveInlining)]
79      protected LinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<TLink> constants,
    ↳ byte* links, byte* header)
80      {
81          Links = links;
82          Header = header;
83          Break = constants.Break;
84          Continue = constants.Continue;
85      }
86
87      /// <summary>
88      /// <para>
89      /// Gets the tree root.
90      /// </para>
91      /// <para></para>
92      /// </summary>
93      /// <returns>

```

```

94     /// <para>The link</para>
95     /// <para></para>
96     /// </returns>
97     [MethodImpl(MethodImplOptions.AggressiveInlining)]
98     protected abstract TLink GetTreeRoot();
99
100    /// <summary>
101    /// <para>
102    /// Gets the base part value using the specified link.
103    /// </para>
104    /// <para></para>
105    /// </summary>
106    /// <param name="link">
107    /// <para>The link.</para>
108    /// <para></para>
109    /// </param>
110    /// <returns>
111    /// <para>The link</para>
112    /// <para></para>
113    /// </returns>
114    [MethodImpl(MethodImplOptions.AggressiveInlining)]
115    protected abstract TLink GetBasePartValue(TLink link);
116
117    /// <summary>
118    /// <para>
119    /// Determines whether this instance first is to the right of second.
120    /// </para>
121    /// <para></para>
122    /// </summary>
123    /// <param name="source">
124    /// <para>The source.</para>
125    /// <para></para>
126    /// </param>
127    /// <param name="target">
128    /// <para>The target.</para>
129    /// <para></para>
130    /// </param>
131    /// <param name="rootSource">
132    /// <para>The root source.</para>
133    /// <para></para>
134    /// </param>
135    /// <param name="rootTarget">
136    /// <para>The root target.</para>
137    /// <para></para>
138    /// </param>
139    /// <returns>
140    /// <para>The bool</para>
141    /// <para></para>
142    /// </returns>
143    [MethodImpl(MethodImplOptions.AggressiveInlining)]
144    protected abstract bool FirstIsToTheRightOfSecond(TLink source, TLink target, TLink
        ↪ rootSource, TLink rootTarget);
145
146    /// <summary>
147    /// <para>
148    /// Determines whether this instance first is to the left of second.
149    /// </para>
150    /// <para></para>
151    /// </summary>
152    /// <param name="source">
153    /// <para>The source.</para>
154    /// <para></para>
155    /// </param>
156    /// <param name="target">
157    /// <para>The target.</para>
158    /// <para></para>
159    /// </param>
160    /// <param name="rootSource">
161    /// <para>The root source.</para>
162    /// <para></para>
163    /// </param>
164    /// <param name="rootTarget">
165    /// <para>The root target.</para>
166    /// <para></para>
167    /// </param>
168    /// <returns>
169    /// <para>The bool</para>
170    /// <para></para>

```



```

171     /// </returns>
172     [MethodImpl(MethodImplOptions.AggressiveInlining)]
173     protected abstract bool FirstIsToTheLeftOfSecond(TLink source, TLink target, TLink
        ↳ rootSource, TLink rootTarget);
174
175     /// <summary>
176     /// <para>
177     /// Gets the header reference.
178     /// </para>
179     /// <para></para>
180     /// </summary>
181     /// <returns>
182     /// <para>A ref links header of t link</para>
183     /// <para></para>
184     /// </returns>
185     [MethodImpl(MethodImplOptions.AggressiveInlining)]
186     protected virtual ref LinksHeader<TLink> GetHeaderReference() => ref
        ↳ AsRef<LinksHeader<TLink>>(Header);
187
188     /// <summary>
189     /// <para>
190     /// Gets the link reference using the specified link.
191     /// </para>
192     /// <para></para>
193     /// </summary>
194     /// <param name="link">
195     /// <para>The link.</para>
196     /// <para></para>
197     /// </param>
198     /// <returns>
199     /// <para>A ref raw link of t link</para>
200     /// <para></para>
201     /// </returns>
202     [MethodImpl(MethodImplOptions.AggressiveInlining)]
203     protected virtual ref RawLink<TLink> GetLinkReference(TLink link) => ref
        ↳ AsRef<RawLink<TLink>>(Links + (RawLink<TLink>.SizeInBytes *
        ↳ _addressToInt64Converter.Convert(link)));
204
205     /// <summary>
206     /// <para>
207     /// Gets the link values using the specified link index.
208     /// </para>
209     /// <para></para>
210     /// </summary>
211     /// <param name="linkIndex">
212     /// <para>The link index.</para>
213     /// <para></para>
214     /// </param>
215     /// <returns>
216     /// <para>A list of t link</para>
217     /// <para></para>
218     /// </returns>
219     [MethodImpl(MethodImplOptions.AggressiveInlining)]
220     protected virtual IList<TLink> GetLinkValues(TLink linkIndex)
221     {
222         ref var link = ref GetLinkReference(linkIndex);
223         return new Link<TLink>(linkIndex, link.Source, link.Target);
224     }
225
226     /// <summary>
227     /// <para>
228     /// Determines whether this instance first is to the left of second.
229     /// </para>
230     /// <para></para>
231     /// </summary>
232     /// <param name="first">
233     /// <para>The first.</para>
234     /// <para></para>
235     /// </param>
236     /// <param name="second">
237     /// <para>The second.</para>
238     /// <para></para>
239     /// </param>
240     /// <returns>
241     /// <para>The bool</para>
242     /// <para></para>
243     /// </returns>
244     [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

245 protected override bool FirstIsToTheLeftOfSecond(TLink first, TLink second)
246 {
247     ref var firstLink = ref GetLinkReference(first);
248     ref var secondLink = ref GetLinkReference(second);
249     return FirstIsToTheLeftOfSecond(firstLink.Source, firstLink.Target,
        ↪ secondLink.Source, secondLink.Target);
250 }
251
252 /// <summary>
253 /// <para>
254 /// Determines whether this instance first is to the right of second.
255 /// </para>
256 /// <para></para>
257 /// </summary>
258 /// <param name="first">
259 /// <para>The first.</para>
260 /// <para></para>
261 /// </param>
262 /// <param name="second">
263 /// <para>The second.</para>
264 /// <para></para>
265 /// </param>
266 /// <returns>
267 /// <para>The bool</para>
268 /// <para></para>
269 /// </returns>
270 [MethodImpl(MethodImplOptions.AggressiveInlining)]
271 protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second)
272 {
273     ref var firstLink = ref GetLinkReference(first);
274     ref var secondLink = ref GetLinkReference(second);
275     return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
        ↪ secondLink.Source, secondLink.Target);
276 }
277
278 /// <summary>
279 /// <para>
280 /// The zero.
281 /// </para>
282 /// <para></para>
283 /// </summary>
284 public TLink this[TLink index]
285 {
286     [MethodImpl(MethodImplOptions.AggressiveInlining)]
287     get
288     {
289         var root = GetTreeRoot();
290         if (GreaterOrEqualThan(index, GetSize(root)))
291         {
292             return Zero;
293         }
294         while (!EqualToZero(root))
295         {
296             var left = GetLeftOrDefault(root);
297             var leftSize = GetSizeOrZero(left);
298             if (LessThan(index, leftSize))
299             {
300                 root = left;
301                 continue;
302             }
303             if (AreEqual(index, leftSize))
304             {
305                 return root;
306             }
307             root = GetRightOrDefault(root);
308             index = Subtract(index, Increment(leftSize));
309         }
310         return Zero; // TODO: Impossible situation exception (only if tree structure
            ↪ broken)
311     }
312 }
313
314 /// <summary>
315 /// Выполняет поиск и возвращает индекс связи с указанными Source (началом) и Target
    ↪ (концом).
316 /// </summary>
317 /// <param name="source">Индекс связи, которая является началом на искомой связи.</param>
318 /// <param name="target">Индекс связи, которая является концом на искомой связи.</param>

```

```

319 /// <returns>Индекс искомой связи.</returns>
320 [MethodImpl(MethodImplOptions.AggressiveInlining)]
321 public TLink Search(TLink source, TLink target)
322 {
323     var root = GetTreeRoot();
324     while (!EqualToZero(root))
325     {
326         ref var rootLink = ref GetLinkReference(root);
327         var rootSource = rootLink.Source;
328         var rootTarget = rootLink.Target;
329         if (FirstIsToTheLeftOfSecond(source, target, rootSource, rootTarget)) //
330             ↪ node.Key < root.Key
331         {
332             root = GetLeftOrDefault(root);
333         }
334         else if (FirstIsToTheRightOfSecond(source, target, rootSource, rootTarget)) //
335             ↪ node.Key > root.Key
336         {
337             root = GetRightOrDefault(root);
338         }
339         else // node.Key == root.Key
340         {
341             return root;
342         }
343     }
344     return Zero;
345 }
346
347 /// TODO: Return indices range instead of references count
348 /// <summary>
349 /// <para>
350 /// Counts the usages using the specified link.
351 /// </para>
352 /// <para></para>
353 /// </summary>
354 /// <param name="link">
355 /// <para>The link.</para>
356 /// <para></para>
357 /// </param>
358 /// <returns>
359 /// <para>The link</para>
360 /// <para></para>
361 /// </returns>
362 [MethodImpl(MethodImplOptions.AggressiveInlining)]
363 public TLink CountUsages(TLink link)
364 {
365     var root = GetTreeRoot();
366     var total = GetSize(root);
367     var totalRightIgnore = Zero;
368     while (!EqualToZero(root))
369     {
370         var @base = GetBasePartValue(root);
371         if (LessOrEqualThan(@base, link))
372         {
373             root = GetRightOrDefault(root);
374         }
375         else
376         {
377             totalRightIgnore = Add(totalRightIgnore, Increment(GetRightSize(root)));
378             root = GetLeftOrDefault(root);
379         }
380     }
381     root = GetTreeRoot();
382     var totalLeftIgnore = Zero;
383     while (!EqualToZero(root))
384     {
385         var @base = GetBasePartValue(root);
386         if (GreaterOrEqualThan(@base, link))
387         {
388             root = GetLeftOrDefault(root);
389         }
390         else
391         {
392             totalLeftIgnore = Add(totalLeftIgnore, Increment(GetLeftSize(root)));
393             root = GetRightOrDefault(root);
394         }
395     }
396     return Subtract(Subtract(total, totalRightIgnore), totalLeftIgnore);
397 }

```

```

395 }
396
397 /// <summary>
398 /// <para>
399 /// Eaches the usage using the specified base.
400 /// </para>
401 /// <para></para>
402 /// </summary>
403 /// <param name="@base">
404 /// <para>The base.</para>
405 /// <para></para>
406 /// </param>
407 /// <param name="handler">
408 /// <para>The handler.</para>
409 /// <para></para>
410 /// </param>
411 /// <returns>
412 /// <para>The link</para>
413 /// <para></para>
414 /// </returns>
415 [MethodImpl(MethodImplOptions.AggressiveInlining)]
416 public TLink EachUsage(TLink @base, Func<IList<TLink>, TLink> handler) =>
417     ↳ EachUsageCore(@base, GetTreeRoot(), handler);
418
419 // TODO: 1. Move target, handler to separate object. 2. Use stack or walker 3. Use
420 ↳ low-level MSIL stack.
421 /// <summary>
422 /// <para>
423 /// Eaches the usage core using the specified base.
424 /// </para>
425 /// <para></para>
426 /// </summary>
427 /// <param name="@base">
428 /// <para>The base.</para>
429 /// <para></para>
430 /// </param>
431 /// <param name="link">
432 /// <para>The link.</para>
433 /// <para></para>
434 /// </param>
435 /// <param name="handler">
436 /// <para>The handler.</para>
437 /// <para></para>
438 /// </param>
439 /// <returns>
440 /// <para>The continue.</para>
441 /// <para></para>
442 /// </returns>
443 [MethodImpl(MethodImplOptions.AggressiveInlining)]
444 private TLink EachUsageCore(TLink @base, TLink link, Func<IList<TLink>, TLink> handler)
445 {
446     var @continue = Continue;
447     if (EqualToZero(link))
448     {
449         return @continue;
450     }
451     var linkBasePart = GetBasePartValue(link);
452     var @break = Break;
453     if (GreaterThan(linkBasePart, @base))
454     {
455         if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
456         {
457             return @break;
458         }
459     }
460     else if (LessThan(linkBasePart, @base))
461     {
462         if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
463         {
464             return @break;
465         }
466     }
467     else //if (linkBasePart == @base)
468     {
469         if (AreEqual(handler(GetLinkValues(link)), @break))
470         {
471             return @break;
472         }
473     }
474 }

```

```

471         if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
472         {
473             return @break;
474         }
475         if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
476         {
477             return @break;
478         }
479     }
480     return @continue;
481 }
482
483 /// <summary>
484 /// <para>
485 /// Prints the node value using the specified node.
486 /// </para>
487 /// <para></para>
488 /// </summary>
489 /// <param name="node">
490 /// <para>The node.</para>
491 /// <para></para>
492 /// </param>
493 /// <param name="sb">
494 /// <para>The sb.</para>
495 /// <para></para>
496 /// </param>
497 [MethodImpl(MethodImplOptions.AggressiveInlining)]
498 protected override void PrintNodeValue(TLink node, StringBuilder sb)
499 {
500     ref var link = ref GetLinkReference(node);
501     sb.Append(' ');
502     sb.Append(link.Source);
503     sb.Append('-');
504     sb.Append('>');
505     sb.Append(link.Target);
506 }
507 }
508 }

```

## 1.79 ./csharp/Platform.Data.Doublets/Memory/United/Generic/LinksSizeBalancedTreeMethodsBase.cs

```

1  using System;
2  using System.Text;
3  using System.Collections.Generic;
4  using System.Runtime.CompilerServices;
5  using Platform.Collections.Methods.Trees;
6  using Platform.Converters;
7  using static System.Runtime.CompilerServices.Unsafe;
8
9  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
10
11 namespace Platform.Data.Doublets.Memory.United.Generic
12 {
13     /// <summary>
14     /// <para>
15     /// Represents the links size balanced tree methods base.
16     /// </para>
17     /// <para></para>
18     /// </summary>
19     /// <seealso cref="SizeBalancedTreeMethods{TLink}"/>
20     /// <seealso cref="ILinksTreeMethods{TLink}"/>
21     public unsafe abstract class LinksSizeBalancedTreeMethodsBase<TLink> :
22     ↪ SizeBalancedTreeMethods<TLink>, ILinksTreeMethods<TLink>
23     {
24         /// <summary>
25         /// <para>
26         /// The default.
27         /// </para>
28         /// <para></para>
29         /// </summary>
30         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
31         ↪ UncheckedConverter<TLink, long>.Default;
32
33         /// <summary>
34         /// <para>
35         /// The break.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         protected readonly TLink Break;

```

```

38     /// <summary>
39     /// <para>
40     /// The continue.
41     /// </para>
42     /// <para></para>
43     /// </summary>
44     protected readonly TLink Continue;
45     /// <summary>
46     /// <para>
47     /// The links.
48     /// </para>
49     /// <para></para>
50     /// </summary>
51     protected readonly byte* Links;
52     /// <summary>
53     /// <para>
54     /// The header.
55     /// </para>
56     /// <para></para>
57     /// </summary>
58     protected readonly byte* Header;
59
60     /// <summary>
61     /// <para>
62     /// Initializes a new <see cref="LinksSizeBalancedTreeMethodsBase"/> instance.
63     /// </para>
64     /// <para></para>
65     /// </summary>
66     /// <param name="constants">
67     /// <para>A constants.</para>
68     /// <para></para>
69     /// </param>
70     /// <param name="links">
71     /// <para>A links.</para>
72     /// <para></para>
73     /// </param>
74     /// <param name="header">
75     /// <para>A header.</para>
76     /// <para></para>
77     /// </param>
78     [MethodImpl(MethodImplOptions.AggressiveInlining)]
79     protected LinksSizeBalancedTreeMethodsBase(LinksConstants<TLink> constants, byte* links,
80     ↪ byte* header)
81     {
82         Links = links;
83         Header = header;
84         Break = constants.Break;
85         Continue = constants.Continue;
86     }
87
88     /// <summary>
89     /// <para>
90     /// Gets the tree root.
91     /// </para>
92     /// <para></para>
93     /// </summary>
94     /// <returns>
95     /// <para>The link</para>
96     /// <para></para>
97     /// </returns>
98     [MethodImpl(MethodImplOptions.AggressiveInlining)]
99     protected abstract TLink GetTreeRoot();
100
101     /// <summary>
102     /// <para>
103     /// Gets the base part value using the specified link.
104     /// </para>
105     /// <para></para>
106     /// </summary>
107     /// <param name="link">
108     /// <para>The link.</para>
109     /// <para></para>
110     /// </param>
111     /// <returns>
112     /// <para>The link</para>
113     /// <para></para>
114     /// </returns>
115     [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

115     protected abstract TLink GetBasePartValue(TLink link);
116
117     /// <summary>
118     /// <para>
119     /// Determines whether this instance first is to the right of second.
120     /// </para>
121     /// <para></para>
122     /// </summary>
123     /// <param name="source">
124     /// <para>The source.</para>
125     /// <para></para>
126     /// </param>
127     /// <param name="target">
128     /// <para>The target.</para>
129     /// <para></para>
130     /// </param>
131     /// <param name="rootSource">
132     /// <para>The root source.</para>
133     /// <para></para>
134     /// </param>
135     /// <param name="rootTarget">
136     /// <para>The root target.</para>
137     /// <para></para>
138     /// </param>
139     /// <returns>
140     /// <para>The bool</para>
141     /// <para></para>
142     /// </returns>
143     [MethodImpl(MethodImplOptions.AggressiveInlining)]
144     protected abstract bool FirstIsToTheRightOfSecond(TLink source, TLink target, TLink
        ↪ rootSource, TLink rootTarget);
145
146     /// <summary>
147     /// <para>
148     /// Determines whether this instance first is to the left of second.
149     /// </para>
150     /// <para></para>
151     /// </summary>
152     /// <param name="source">
153     /// <para>The source.</para>
154     /// <para></para>
155     /// </param>
156     /// <param name="target">
157     /// <para>The target.</para>
158     /// <para></para>
159     /// </param>
160     /// <param name="rootSource">
161     /// <para>The root source.</para>
162     /// <para></para>
163     /// </param>
164     /// <param name="rootTarget">
165     /// <para>The root target.</para>
166     /// <para></para>
167     /// </param>
168     /// <returns>
169     /// <para>The bool</para>
170     /// <para></para>
171     /// </returns>
172     [MethodImpl(MethodImplOptions.AggressiveInlining)]
173     protected abstract bool FirstIsToTheLeftOfSecond(TLink source, TLink target, TLink
        ↪ rootSource, TLink rootTarget);
174
175     /// <summary>
176     /// <para>
177     /// Gets the header reference.
178     /// </para>
179     /// <para></para>
180     /// </summary>
181     /// <returns>
182     /// <para>A ref links header of t link</para>
183     /// <para></para>
184     /// </returns>
185     [MethodImpl(MethodImplOptions.AggressiveInlining)]
186     protected virtual ref LinksHeader<TLink> GetHeaderReference() => ref
        ↪ AsRef<LinksHeader<TLink>>(Header);
187
188     /// <summary>
189     /// <para>

```

```

190    /// Gets the link reference using the specified link.
191    /// </para>
192    /// <para></para>
193    /// </summary>
194    /// <param name="link">
195    /// <para>The link.</para>
196    /// <para></para>
197    /// </param>
198    /// <returns>
199    /// <para>A ref raw link of t link</para>
200    /// <para></para>
201    /// </returns>
202    [MethodImpl(MethodImplOptions.AggressiveInlining)]
203    protected virtual ref RawLink<TLink> GetLinkReference(TLink link) => ref
    ↪ AsRef<RawLink<TLink>>(Links + (RawLink<TLink>.SizeInBytes *
    ↪ _addressToInt64Converter.Convert(link)));

204
205    /// <summary>
206    /// <para>
207    /// Gets the link values using the specified link index.
208    /// </para>
209    /// <para></para>
210    /// </summary>
211    /// <param name="linkIndex">
212    /// <para>The link index.</para>
213    /// <para></para>
214    /// </param>
215    /// <returns>
216    /// <para>A list of t link</para>
217    /// <para></para>
218    /// </returns>
219    [MethodImpl(MethodImplOptions.AggressiveInlining)]
220    protected virtual IList<TLink> GetLinkValues(TLink linkIndex)
221    {
222        ref var link = ref GetLinkReference(linkIndex);
223        return new Link<TLink>(linkIndex, link.Source, link.Target);
224    }

225
226    /// <summary>
227    /// <para>
228    /// Determines whether this instance first is to the left of second.
229    /// </para>
230    /// <para></para>
231    /// </summary>
232    /// <param name="first">
233    /// <para>The first.</para>
234    /// <para></para>
235    /// </param>
236    /// <param name="second">
237    /// <para>The second.</para>
238    /// <para></para>
239    /// </param>
240    /// <returns>
241    /// <para>The bool</para>
242    /// <para></para>
243    /// </returns>
244    [MethodImpl(MethodImplOptions.AggressiveInlining)]
245    protected override bool FirstIsToTheLeftOfSecond(TLink first, TLink second)
246    {
247        ref var firstLink = ref GetLinkReference(first);
248        ref var secondLink = ref GetLinkReference(second);
249        return FirstIsToTheLeftOfSecond(firstLink.Source, firstLink.Target,
    ↪ secondLink.Source, secondLink.Target);
250    }

251
252    /// <summary>
253    /// <para>
254    /// Determines whether this instance first is to the right of second.
255    /// </para>
256    /// <para></para>
257    /// </summary>
258    /// <param name="first">
259    /// <para>The first.</para>
260    /// <para></para>
261    /// </param>
262    /// <param name="second">
263    /// <para>The second.</para>
264    /// <para></para>

```



```

265 /// </param>
266 /// <returns>
267 /// <para>The bool</para>
268 /// <para></para>
269 /// </returns>
270 [MethodImpl(MethodImplOptions.AggressiveInlining)]
271 protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second)
272 {
273     ref var firstLink = ref GetLinkReference(first);
274     ref var secondLink = ref GetLinkReference(second);
275     return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
276         ↪ secondLink.Source, secondLink.Target);
277 }
278
279 /// <summary>
280 /// <para>
281 /// The zero.
282 /// </para>
283 /// <para></para>
284 /// </summary>
285 public TLink this[TLink index]
286 {
287     [MethodImpl(MethodImplOptions.AggressiveInlining)]
288     get
289     {
290         var root = GetTreeRoot();
291         if (GreaterOrEqualThan(index, GetSize(root)))
292         {
293             return Zero;
294         }
295         while (!EqualToZero(root))
296         {
297             var left = GetLeftOrDefault(root);
298             var leftSize = GetSizeOrZero(left);
299             if (LessThan(index, leftSize))
300             {
301                 root = left;
302                 continue;
303             }
304             if (AreEqual(index, leftSize))
305             {
306                 return root;
307             }
308             root = GetRightOrDefault(root);
309             index = Subtract(index, Increment(leftSize));
310         }
311         return Zero; // TODO: Impossible situation exception (only if tree structure
312             ↪ broken)
313     }
314 }
315
316 /// <summary>
317 /// Выполняет поиск и возвращает индекс связи с указанными Source (началом) и Target
318 ↪ (концом).
319 /// </summary>
320 /// <param name="source">Индекс связи, которая является началом на искомой связи.</param>
321 /// <param name="target">Индекс связи, которая является концом на искомой связи.</param>
322 /// <returns>Индекс искомой связи.</returns>
323 [MethodImpl(MethodImplOptions.AggressiveInlining)]
324 public TLink Search(TLink source, TLink target)
325 {
326     var root = GetTreeRoot();
327     while (!EqualToZero(root))
328     {
329         ref var rootLink = ref GetLinkReference(root);
330         var rootSource = rootLink.Source;
331         var rootTarget = rootLink.Target;
332         if (FirstIsToTheLeftOfSecond(source, target, rootSource, rootTarget)) //
333             ↪ node.Key < root.Key
334         {
335             root = GetLeftOrDefault(root);
336         }
337         else if (FirstIsToTheRightOfSecond(source, target, rootSource, rootTarget)) //
338             ↪ node.Key > root.Key
339         {
340             root = GetRightOrDefault(root);
341         }
342         else // node.Key == root.Key

```

```

338         {
339             return root;
340         }
341     }
342     return Zero;
343 }
344
345 // TODO: Return indices range instead of references count
346 /// <summary>
347 /// <para>
348 /// Counts the usages using the specified link.
349 /// </para>
350 /// <para></para>
351 /// </summary>
352 /// <param name="link">
353 /// <para>The link.</para>
354 /// <para></para>
355 /// </param>
356 /// <returns>
357 /// <para>The link</para>
358 /// <para></para>
359 /// </returns>
360 [MethodImpl(MethodImplOptions.AggressiveInlining)]
361 public TLink CountUsages(TLink link)
362 {
363     var root = GetTreeRoot();
364     var total = GetSize(root);
365     var totalRightIgnore = Zero;
366     while (!EqualToZero(root))
367     {
368         var @base = GetBasePartValue(root);
369         if (LessOrEqualThan(@base, link))
370         {
371             root = GetRightOrDefault(root);
372         }
373         else
374         {
375             totalRightIgnore = Add(totalRightIgnore, Increment(GetRightSize(root)));
376             root = GetLeftOrDefault(root);
377         }
378     }
379     root = GetTreeRoot();
380     var totalLeftIgnore = Zero;
381     while (!EqualToZero(root))
382     {
383         var @base = GetBasePartValue(root);
384         if (GreaterOrEqualThan(@base, link))
385         {
386             root = GetLeftOrDefault(root);
387         }
388         else
389         {
390             totalLeftIgnore = Add(totalLeftIgnore, Increment(GetLeftSize(root)));
391             root = GetRightOrDefault(root);
392         }
393     }
394     return Subtract(Subtract(total, totalRightIgnore), totalLeftIgnore);
395 }
396
397 /// <summary>
398 /// <para>
399 /// Eaches the usage using the specified base.
400 /// </para>
401 /// <para></para>
402 /// </summary>
403 /// <param name="@base">
404 /// <para>The base.</para>
405 /// <para></para>
406 /// </param>
407 /// <param name="handler">
408 /// <para>The handler.</para>
409 /// <para></para>
410 /// </param>
411 /// <returns>
412 /// <para>The link</para>
413 /// <para></para>
414 /// </returns>
415 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

416 public TLink EachUsage(TLink @base, Func<IList<TLink>, TLink> handler) =>
417     ↳ EachUsageCore(@base, GetTreeRoot(), handler);
418 // TODO: 1. Move target, handler to separate object. 2. Use stack or walker 3. Use
419 ↳ low-level MSIL stack.
420 /// <summary>
421 /// <para>
422 /// Eaches the usage core using the specified base.
423 /// </para>
424 /// <para></para>
425 /// </summary>
426 /// <param name="@base">
427 /// <para>The base.</para>
428 /// </param>
429 /// <param name="link">
430 /// <para>The link.</para>
431 /// <para></para>
432 /// </param>
433 /// <param name="handler">
434 /// <para>The handler.</para>
435 /// <para></para>
436 /// </param>
437 /// <returns>
438 /// <para>The continue.</para>
439 /// <para></para>
440 /// </returns>
441 [MethodImpl(MethodImplOptions.AggressiveInlining)]
442 private TLink EachUsageCore(TLink @base, TLink link, Func<IList<TLink>, TLink> handler)
443 {
444     var @continue = Continue;
445     if (EqualToZero(link))
446     {
447         return @continue;
448     }
449     var linkBasePart = GetBasePartValue(link);
450     var @break = Break;
451     if (GreaterThan(linkBasePart, @base))
452     {
453         if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
454         {
455             return @break;
456         }
457     }
458     else if (LessThan(linkBasePart, @base))
459     {
460         if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
461         {
462             return @break;
463         }
464     }
465     else //if (linkBasePart == @base)
466     {
467         if (AreEqual(handler(GetLinkValues(link)), @break))
468         {
469             return @break;
470         }
471         if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
472         {
473             return @break;
474         }
475         if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
476         {
477             return @break;
478         }
479     }
480     return @continue;
481 }
482
483 /// <summary>
484 /// <para>
485 /// Prints the node value using the specified node.
486 /// </para>
487 /// <para></para>
488 /// </summary>
489 /// <param name="node">
490 /// <para>The node.</para>
491 /// <para></para>

```

```

492     /// </param>
493     /// <param name="sb">
494     /// <para>The sb.</para>
495     /// <para></para>
496     /// </param>
497     [MethodImpl(MethodImplOptions.AggressiveInlining)]
498     protected override void PrintNodeValue(TLink node, StringBuilder sb)
499     {
500         ref var link = ref GetLinkReference(node);
501         sb.Append(' ');
502         sb.Append(link.Source);
503         sb.Append('-');
504         sb.Append('>');
505         sb.Append(link.Target);
506     }
507 }
508 }

```

## 1.80 ./csharp/Platform.Data.Doublets/Memory/United/Generic/LinksSourcesAvlBalancedTreeMethods.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.Data.Doublets.Memory.United.Generic
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the links sources avl balanced tree methods.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="LinksAvlBalancedTreeMethodsBase{TLink}" />
14     public unsafe class LinksSourcesAvlBalancedTreeMethods<TLink> :
15         ↳ LinksAvlBalancedTreeMethodsBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="LinksSourcesAvlBalancedTreeMethods" /> instance.
20         /// <para></para>
21         /// </summary>
22         /// <param name="constants">
23         /// <para>A constants.</para>
24         /// <para></para>
25         /// </param>
26         /// <param name="links">
27         /// <para>A links.</para>
28         /// <para></para>
29         /// </param>
30         /// <param name="header">
31         /// <para>A header.</para>
32         /// <para></para>
33         /// </param>
34         [MethodImpl(MethodImplOptions.AggressiveInlining)]
35         public LinksSourcesAvlBalancedTreeMethods(LinksConstants<TLink> constants, byte* links,
36             ↳ byte* header) : base(constants, links, header) { }
37
38         /// <summary>
39         /// <para>
40         /// Gets the left reference using the specified node.
41         /// </para>
42         /// <para></para>
43         /// </summary>
44         /// <param name="node">
45         /// <para>The node.</para>
46         /// <para></para>
47         /// </param>
48         /// <returns>
49         /// <para>The ref link</para>
50         /// <para></para>
51         /// </returns>
52         [MethodImpl(MethodImplOptions.AggressiveInlining)]
53         protected override ref TLink GetLeftReference(TLink node) => ref
54             ↳ GetLinkReference(node).LeftAsSource;
55
56         /// <summary>
57         /// <para>
58         /// Gets the right reference using the specified node.

```

```

57     /// </para>
58     /// <para></para>
59     /// </summary>
60     /// <param name="node">
61     /// <para>The node.</para>
62     /// <para></para>
63     /// </param>
64     /// <returns>
65     /// <para>The ref link</para>
66     /// <para></para>
67     /// </returns>
68     [MethodImpl(MethodImplOptions.AggressiveInlining)]
69     protected override ref TLink GetRightReference(TLink node) => ref
    ↪ GetLinkReference(node).RightAsSource;
70
71     /// <summary>
72     /// <para>
73     /// Gets the left using the specified node.
74     /// </para>
75     /// <para></para>
76     /// </summary>
77     /// <param name="node">
78     /// <para>The node.</para>
79     /// <para></para>
80     /// </param>
81     /// <returns>
82     /// <para>The link</para>
83     /// <para></para>
84     /// </returns>
85     [MethodImpl(MethodImplOptions.AggressiveInlining)]
86     protected override TLink GetLeft(TLink node) => GetLinkReference(node).LeftAsSource;
87
88     /// <summary>
89     /// <para>
90     /// Gets the right using the specified node.
91     /// </para>
92     /// <para></para>
93     /// </summary>
94     /// <param name="node">
95     /// <para>The node.</para>
96     /// <para></para>
97     /// </param>
98     /// <returns>
99     /// <para>The link</para>
100    /// <para></para>
101    /// </returns>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    protected override TLink GetRight(TLink node) => GetLinkReference(node).RightAsSource;
104
105    /// <summary>
106    /// <para>
107    /// Sets the left using the specified node.
108    /// </para>
109    /// <para></para>
110    /// </summary>
111    /// <param name="node">
112    /// <para>The node.</para>
113    /// <para></para>
114    /// </param>
115    /// <param name="left">
116    /// <para>The left.</para>
117    /// <para></para>
118    /// </param>
119    [MethodImpl(MethodImplOptions.AggressiveInlining)]
120    protected override void SetLeft(TLink node, TLink left) =>
    ↪ GetLinkReference(node).LeftAsSource = left;
121
122    /// <summary>
123    /// <para>
124    /// Sets the right using the specified node.
125    /// </para>
126    /// <para></para>
127    /// </summary>
128    /// <param name="node">
129    /// <para>The node.</para>
130    /// <para></para>
131    /// </param>
132    /// <param name="right">

```

```

133     /// <para>The right.</para>
134     /// <para></para>
135     /// </param>
136     [MethodImpl(MethodImplOptions.AggressiveInlining)]
137     protected override void SetRight(TLink node, TLink right) =>
138         ↪ GetLinkReference(node).RightAsSource = right;
139
140     /// <summary>
141     /// <para>
142     /// Gets the size using the specified node.
143     /// </para>
144     /// </summary>
145     /// <param name="node">
146     /// <para>The node.</para>
147     /// </param>
148     /// <returns>
149     /// <para>The link</para>
150     /// </returns>
151     [MethodImpl(MethodImplOptions.AggressiveInlining)]
152     protected override TLink GetSize(TLink node) =>
153         ↪ GetSizeValue(GetLinkReference(node).SizeAsSource);
154
155     /// <summary>
156     /// <para>
157     /// Sets the size using the specified node.
158     /// </para>
159     /// </summary>
160     /// <param name="node">
161     /// <para>The node.</para>
162     /// </param>
163     /// <param name="size">
164     /// <para>The size.</para>
165     /// </param>
166     [MethodImpl(MethodImplOptions.AggressiveInlining)]
167     protected override void SetSize(TLink node, TLink size) => SetSizeValue(ref
168         ↪ GetLinkReference(node).SizeAsSource, size);
169
170     /// <summary>
171     /// <para>
172     /// Determines whether this instance get left is child.
173     /// </para>
174     /// </summary>
175     /// <param name="node">
176     /// <para>The node.</para>
177     /// </param>
178     /// <returns>
179     /// <para>The bool</para>
180     /// </returns>
181     [MethodImpl(MethodImplOptions.AggressiveInlining)]
182     protected override bool GetLeftIsChild(TLink node) =>
183         ↪ GetLeftIsChildValue(GetLinkReference(node).SizeAsSource);
184
185     /// <summary>
186     /// <para>
187     /// Sets the left is child using the specified node.
188     /// </para>
189     /// </summary>
190     /// <param name="node">
191     /// <para>The node.</para>
192     /// </param>
193     /// <param name="value">
194     /// <para>The value.</para>
195     /// </param>
196     [MethodImpl(MethodImplOptions.AggressiveInlining)]
197     protected override void SetLeftIsChild(TLink node, bool value) =>
198         ↪ SetLeftIsChildValue(ref GetLinkReference(node).SizeAsSource, value);

```

```

206
207     /// <summary>
208     /// <para>
209     /// Determines whether this instance get right is child.
210     /// </para>
211     /// <para></para>
212     /// </summary>
213     /// <param name="node">
214     /// <para>The node.</para>
215     /// <para></para>
216     /// </param>
217     /// <returns>
218     /// <para>The bool</para>
219     /// <para></para>
220     /// </returns>
221     [MethodImpl(MethodImplOptions.AggressiveInlining)]
222     protected override bool GetRightIsChild(TLink node) =>
223         ↪ GetRightIsChildValue(GetLinkReference(node).SizeAsSource);
224
225     /// <summary>
226     /// <para>
227     /// Sets the right is child using the specified node.
228     /// </para>
229     /// <para></para>
230     /// </summary>
231     /// <param name="node">
232     /// <para>The node.</para>
233     /// <para></para>
234     /// </param>
235     /// <param name="value">
236     /// <para>The value.</para>
237     /// <para></para>
238     /// </param>
239     [MethodImpl(MethodImplOptions.AggressiveInlining)]
240     protected override void SetRightIsChild(TLink node, bool value) =>
241         ↪ SetRightIsChildValue(ref GetLinkReference(node).SizeAsSource, value);
242
243     /// <summary>
244     /// <para>
245     /// Gets the balance using the specified node.
246     /// </para>
247     /// <para></para>
248     /// </summary>
249     /// <param name="node">
250     /// <para>The node.</para>
251     /// <para></para>
252     /// </param>
253     /// <returns>
254     /// <para>The sbyte</para>
255     /// <para></para>
256     /// </returns>
257     [MethodImpl(MethodImplOptions.AggressiveInlining)]
258     protected override sbyte GetBalance(TLink node) =>
259         ↪ GetBalanceValue(GetLinkReference(node).SizeAsSource);
260
261     /// <summary>
262     /// <para>
263     /// Sets the balance using the specified node.
264     /// </para>
265     /// <para></para>
266     /// </summary>
267     /// <param name="node">
268     /// <para>The node.</para>
269     /// <para></para>
270     /// </param>
271     /// <param name="value">
272     /// <para>The value.</para>
273     /// <para></para>
274     /// </param>
275     [MethodImpl(MethodImplOptions.AggressiveInlining)]
276     protected override void SetBalance(TLink node, sbyte value) => SetBalanceValue(ref
277         ↪ GetLinkReference(node).SizeAsSource, value);
278
279     /// <summary>
280     /// <para>
281     /// Gets the tree root.
282     /// </para>
283     /// <para></para>

```

```

280    /// </summary>
281    /// <returns>
282    /// <para>The link</para>
283    /// <para></para>
284    /// </returns>
285    [MethodImpl(MethodImplOptions.AggressiveInlining)]
286    protected override TLink GetTreeRoot() => GetHeaderReference().RootAsSource;
287
288    /// <summary>
289    /// <para>
290    /// Gets the base part value using the specified link.
291    /// </para>
292    /// <para></para>
293    /// </summary>
294    /// <param name="link">
295    /// <para>The link.</para>
296    /// <para></para>
297    /// </param>
298    /// <returns>
299    /// <para>The link</para>
300    /// <para></para>
301    /// </returns>
302    [MethodImpl(MethodImplOptions.AggressiveInlining)]
303    protected override TLink GetBasePartValue(TLink link) => GetLinkReference(link).Source;
304
305    /// <summary>
306    /// <para>
307    /// Determines whether this instance first is to the left of second.
308    /// </para>
309    /// <para></para>
310    /// </summary>
311    /// <param name="firstSource">
312    /// <para>The first source.</para>
313    /// <para></para>
314    /// </param>
315    /// <param name="firstTarget">
316    /// <para>The first target.</para>
317    /// <para></para>
318    /// </param>
319    /// <param name="secondSource">
320    /// <para>The second source.</para>
321    /// <para></para>
322    /// </param>
323    /// <param name="secondTarget">
324    /// <para>The second target.</para>
325    /// <para></para>
326    /// </param>
327    /// <returns>
328    /// <para>The bool</para>
329    /// <para></para>
330    /// </returns>
331    [MethodImpl(MethodImplOptions.AggressiveInlining)]
332    protected override bool FirstIsToLeftOfSecond(TLink firstSource, TLink firstTarget,
333    ↪ TLink secondSource, TLink secondTarget) => LessThan(firstSource, secondSource) ||
334    ↪ (AreEqual(firstSource, secondSource) && LessThan(firstTarget, secondTarget));
335
336    /// <summary>
337    /// <para>
338    /// Determines whether this instance first is to the right of second.
339    /// </para>
340    /// <para></para>
341    /// </summary>
342    /// <param name="firstSource">
343    /// <para>The first source.</para>
344    /// <para></para>
345    /// </param>
346    /// <param name="firstTarget">
347    /// <para>The first target.</para>
348    /// <para></para>
349    /// </param>
350    /// <param name="secondSource">
351    /// <para>The second source.</para>
352    /// <para></para>
353    /// </param>
354    /// <param name="secondTarget">
355    /// <para>The second target.</para>
356    /// <para></para>
357    /// </param>

```



```

356     /// <returns>
357     /// <para>The bool</para>
358     /// <para></para>
359     /// </returns>
360     [MethodImpl(MethodImplOptions.AggressiveInlining)]
361     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
        ↪ TLink secondSource, TLink secondTarget) => GreaterThan(firstSource, secondSource) ||
        ↪ (AreEqual(firstSource, secondSource) && GreaterThan(firstTarget, secondTarget));
362
363     /// <summary>
364     /// <para>
365     /// Clears the node using the specified node.
366     /// </para>
367     /// <para></para>
368     /// </summary>
369     /// <param name="node">
370     /// <para>The node.</para>
371     /// <para></para>
372     /// </param>
373     [MethodImpl(MethodImplOptions.AggressiveInlining)]
374     protected override void ClearNode(TLink node)
375     {
376         ref var link = ref GetLinkReference(node);
377         link.LeftAsSource = Zero;
378         link.RightAsSource = Zero;
379         link.SizeAsSource = Zero;
380     }
381 }
382 }

```

## 1.81 ./csharp/Platform.Data.Doublets/Memory/United/Generic/LinksSourcesRecursionlessSizeBalancedTreeMethods

```

1  using System.Runtime.CompilerServices;
2
3  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5  namespace Platform.Data.Doublets.Memory.United.Generic
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the links sources recursionless size balanced tree methods.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="LinksRecursionlessSizeBalancedTreeMethodsBase{TLink}"/>
14     public unsafe class LinksSourcesRecursionlessSizeBalancedTreeMethods<TLink> :
        ↪ LinksRecursionlessSizeBalancedTreeMethodsBase<TLink>
15     {
16         /// <summary>
17         /// <para>
18         /// Initializes a new <see cref="LinksSourcesRecursionlessSizeBalancedTreeMethods"/>
19         ↪ instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="constants">
24         /// <para>A constants.</para>
25         /// <para></para>
26         /// </param>
27         /// <param name="links">
28         /// <para>A links.</para>
29         /// <para></para>
30         /// </param>
31         /// <param name="header">
32         /// <para>A header.</para>
33         /// <para></para>
34         /// </param>
35         [MethodImpl(MethodImplOptions.AggressiveInlining)]
36         public LinksSourcesRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink> constants,
            ↪ byte* links, byte* header) : base(constants, links, header) { }
37
38         /// <summary>
39         /// <para>
40         /// Gets the left reference using the specified node.
41         /// </para>
42         /// <para></para>
43         /// </summary>
44         /// <param name="node">
45         /// <para>The node.</para>

```

```

45    /// <para></para>
46    /// </param>
47    /// <returns>
48    /// <para>The ref link</para>
49    /// <para></para>
50    /// </returns>
51    [MethodImpl(MethodImplOptions.AggressiveInlining)]
52    protected override ref TLink GetLeftReference(TLink node) => ref
    ↪ GetLinkReference(node).LeftAsSource;
53
54    /// <summary>
55    /// <para>
56    /// Gets the right reference using the specified node.
57    /// </para>
58    /// <para></para>
59    /// </summary>
60    /// <param name="node">
61    /// <para>The node.</para>
62    /// <para></para>
63    /// </param>
64    /// <returns>
65    /// <para>The ref link</para>
66    /// <para></para>
67    /// </returns>
68    [MethodImpl(MethodImplOptions.AggressiveInlining)]
69    protected override ref TLink GetRightReference(TLink node) => ref
    ↪ GetLinkReference(node).RightAsSource;
70
71    /// <summary>
72    /// <para>
73    /// Gets the left using the specified node.
74    /// </para>
75    /// <para></para>
76    /// </summary>
77    /// <param name="node">
78    /// <para>The node.</para>
79    /// <para></para>
80    /// </param>
81    /// <returns>
82    /// <para>The link</para>
83    /// <para></para>
84    /// </returns>
85    [MethodImpl(MethodImplOptions.AggressiveInlining)]
86    protected override TLink GetLeft(TLink node) => GetLinkReference(node).LeftAsSource;
87
88    /// <summary>
89    /// <para>
90    /// Gets the right using the specified node.
91    /// </para>
92    /// <para></para>
93    /// </summary>
94    /// <param name="node">
95    /// <para>The node.</para>
96    /// <para></para>
97    /// </param>
98    /// <returns>
99    /// <para>The link</para>
100    /// <para></para>
101    /// </returns>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    protected override TLink GetRight(TLink node) => GetLinkReference(node).RightAsSource;
104
105    /// <summary>
106    /// <para>
107    /// Sets the left using the specified node.
108    /// </para>
109    /// <para></para>
110    /// </summary>
111    /// <param name="node">
112    /// <para>The node.</para>
113    /// <para></para>
114    /// </param>
115    /// <param name="left">
116    /// <para>The left.</para>
117    /// <para></para>
118    /// </param>
119    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

120     protected override void SetLeft(TLink node, TLink left) =>
121         ↪ GetLinkReference(node).LeftAsSource = left;
122
123     /// <summary>
124     /// <para>
125     /// Sets the right using the specified node.
126     /// </para>
127     /// </summary>
128     /// <param name="node">
129     /// <para>The node.</para>
130     /// </param>
131     /// <param name="right">
132     /// <para>The right.</para>
133     /// </param>
134     [MethodImpl(MethodImplOptions.AggressiveInlining)]
135     protected override void SetRight(TLink node, TLink right) =>
136         ↪ GetLinkReference(node).RightAsSource = right;
137
138     /// <summary>
139     /// <para>
140     /// Gets the size using the specified node.
141     /// </para>
142     /// </summary>
143     /// <param name="node">
144     /// <para>The node.</para>
145     /// </param>
146     /// <returns>
147     /// <para>The link</para>
148     /// </returns>
149     [MethodImpl(MethodImplOptions.AggressiveInlining)]
150     protected override TLink GetSize(TLink node) => GetLinkReference(node).SizeAsSource;
151
152     /// <summary>
153     /// <para>
154     /// Sets the size using the specified node.
155     /// </para>
156     /// </summary>
157     /// <param name="node">
158     /// <para>The node.</para>
159     /// </param>
160     /// <param name="size">
161     /// <para>The size.</para>
162     /// </param>
163     [MethodImpl(MethodImplOptions.AggressiveInlining)]
164     protected override void SetSize(TLink node, TLink size) =>
165         ↪ GetLinkReference(node).SizeAsSource = size;
166
167     /// <summary>
168     /// <para>
169     /// Gets the tree root.
170     /// </para>
171     /// </summary>
172     /// <returns>
173     /// <para>The link</para>
174     /// </returns>
175     [MethodImpl(MethodImplOptions.AggressiveInlining)]
176     protected override TLink GetTreeRoot() => GetHeaderReference().RootAsSource;
177
178     /// <summary>
179     /// <para>
180     /// Gets the base part value using the specified link.
181     /// </para>
182     /// </summary>
183     /// <param name="link">
184     /// <para>The link.</para>
185     /// </param>

```

```

195     /// </param>
196     /// <returns>
197     /// <para>The link</para>
198     /// <para></para>
199     /// </returns>
200     [MethodImpl(MethodImplOptions.AggressiveInlining)]
201     protected override TLink GetBasePartValue(TLink link) => GetLinkReference(link).Source;
202
203     /// <summary>
204     /// <para>
205     /// Determines whether this instance first is to the left of second.
206     /// </para>
207     /// <para></para>
208     /// </summary>
209     /// <param name="firstSource">
210     /// <para>The first source.</para>
211     /// <para></para>
212     /// </param>
213     /// <param name="firstTarget">
214     /// <para>The first target.</para>
215     /// <para></para>
216     /// </param>
217     /// <param name="secondSource">
218     /// <para>The second source.</para>
219     /// <para></para>
220     /// </param>
221     /// <param name="secondTarget">
222     /// <para>The second target.</para>
223     /// <para></para>
224     /// </param>
225     /// <returns>
226     /// <para>The bool</para>
227     /// <para></para>
228     /// </returns>
229     [MethodImpl(MethodImplOptions.AggressiveInlining)]
230     protected override bool FirstIsToTheLeftOfSecond(TLink firstSource, TLink firstTarget,
231     ↪ TLink secondSource, TLink secondTarget) => LessThan(firstSource, secondSource) ||
232     ↪ (AreEqual(firstSource, secondSource) && LessThan(firstTarget, secondTarget));
233
234     /// <summary>
235     /// <para>
236     /// Determines whether this instance first is to the right of second.
237     /// </para>
238     /// <para></para>
239     /// </summary>
240     /// <param name="firstSource">
241     /// <para>The first source.</para>
242     /// <para></para>
243     /// </param>
244     /// <param name="firstTarget">
245     /// <para>The first target.</para>
246     /// <para></para>
247     /// </param>
248     /// <param name="secondSource">
249     /// <para>The second source.</para>
250     /// <para></para>
251     /// </param>
252     /// <param name="secondTarget">
253     /// <para>The second target.</para>
254     /// <para></para>
255     /// </param>
256     /// <returns>
257     /// <para>The bool</para>
258     /// <para></para>
259     /// </returns>
260     [MethodImpl(MethodImplOptions.AggressiveInlining)]
261     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
262     ↪ TLink secondSource, TLink secondTarget) => GreaterThan(firstSource, secondSource) ||
263     ↪ (AreEqual(firstSource, secondSource) && GreaterThan(firstTarget, secondTarget));
264
265     /// <summary>
266     /// <para>
267     /// Clears the node using the specified node.
268     /// </para>
269     /// <para></para>
270     /// </summary>
271     /// <param name="node">

```

```

268     /// <para>The node.</para>
269     /// <para></para>
270     /// </param>
271     [MethodImpl(MethodImplOptions.AggressiveInlining)]
272     protected override void ClearNode(TLink node)
273     {
274         ref var link = ref GetLinkReference(node);
275         link.LeftAsSource = Zero;
276         link.RightAsSource = Zero;
277         link.SizeAsSource = Zero;
278     }
279 }
280 }

```

## 1.82 ./csharp/Platform.Data.Doublets/Memory/United/Generic/LinksSourcesSizeBalancedTreeMethods.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.Data.Doublets.Memory.United.Generic
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the links sources size balanced tree methods.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="LinksSizeBalancedTreeMethodsBase{TLink}"/>
14     public unsafe class LinksSourcesSizeBalancedTreeMethods<TLink> :
15         ↳ LinksSizeBalancedTreeMethodsBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="LinksSourcesSizeBalancedTreeMethods"/> instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="constants">
24         /// <para>A constants.</para>
25         /// <para></para>
26         /// </param>
27         /// <param name="links">
28         /// <para>A links.</para>
29         /// <para></para>
30         /// </param>
31         /// <param name="header">
32         /// <para>A header.</para>
33         /// <para></para>
34         /// </param>
35         [MethodImpl(MethodImplOptions.AggressiveInlining)]
36         public LinksSourcesSizeBalancedTreeMethods(LinksConstants<TLink> constants, byte* links,
37             ↳ byte* header) : base(constants, links, header) { }
38
39         /// <summary>
40         /// <para>
41         /// Gets the left reference using the specified node.
42         /// </para>
43         /// <para></para>
44         /// </summary>
45         /// <param name="node">
46         /// <para>The node.</para>
47         /// <para></para>
48         /// </param>
49         /// <returns>
50         /// <para>The ref link</para>
51         /// <para></para>
52         /// </returns>
53         [MethodImpl(MethodImplOptions.AggressiveInlining)]
54         protected override ref TLink GetLeftReference(TLink node) => ref
55             ↳ GetLinkReference(node).LeftAsSource;
56
57         /// <summary>
58         /// <para>
59         /// Gets the right reference using the specified node.
60         /// </para>
61         /// <para></para>
62         /// </summary>
63         /// <param name="node">

```

```

61     /// <para>The node.</para>
62     /// <para></para>
63     /// </param>
64     /// <returns>
65     /// <para>The ref link</para>
66     /// <para></para>
67     /// </returns>
68     [MethodImpl(MethodImplOptions.AggressiveInlining)]
69     protected override ref TLink GetRightReference(TLink node) => ref
    ↪ GetLinkReference(node).RightAsSource;
70
71     /// <summary>
72     /// <para>
73     /// Gets the left using the specified node.
74     /// </para>
75     /// <para></para>
76     /// </summary>
77     /// <param name="node">
78     /// <para>The node.</para>
79     /// <para></para>
80     /// </param>
81     /// <returns>
82     /// <para>The link</para>
83     /// <para></para>
84     /// </returns>
85     [MethodImpl(MethodImplOptions.AggressiveInlining)]
86     protected override TLink GetLeft(TLink node) => GetLinkReference(node).LeftAsSource;
87
88     /// <summary>
89     /// <para>
90     /// Gets the right using the specified node.
91     /// </para>
92     /// <para></para>
93     /// </summary>
94     /// <param name="node">
95     /// <para>The node.</para>
96     /// <para></para>
97     /// </param>
98     /// <returns>
99     /// <para>The link</para>
100    /// <para></para>
101    /// </returns>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    protected override TLink GetRight(TLink node) => GetLinkReference(node).RightAsSource;
104
105    /// <summary>
106    /// <para>
107    /// Sets the left using the specified node.
108    /// </para>
109    /// <para></para>
110    /// </summary>
111    /// <param name="node">
112    /// <para>The node.</para>
113    /// <para></para>
114    /// </param>
115    /// <param name="left">
116    /// <para>The left.</para>
117    /// <para></para>
118    /// </param>
119    [MethodImpl(MethodImplOptions.AggressiveInlining)]
120    protected override void SetLeft(TLink node, TLink left) =>
    ↪ GetLinkReference(node).LeftAsSource = left;
121
122    /// <summary>
123    /// <para>
124    /// Sets the right using the specified node.
125    /// </para>
126    /// <para></para>
127    /// </summary>
128    /// <param name="node">
129    /// <para>The node.</para>
130    /// <para></para>
131    /// </param>
132    /// <param name="right">
133    /// <para>The right.</para>
134    /// <para></para>
135    /// </param>
136    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

137     protected override void SetRight(TLink node, TLink right) =>
138         ↪ GetLinkReference(node).RightAsSource = right;
139
140     /// <summary>
141     /// <para>
142     /// Gets the size using the specified node.
143     /// </para>
144     /// </summary>
145     /// <param name="node">
146     /// <para>The node.</para>
147     /// </para>
148     /// </param>
149     /// <returns>
150     /// <para>The link</para>
151     /// </para>
152     /// </returns>
153     [MethodImpl(MethodImplOptions.AggressiveInlining)]
154     protected override TLink GetSize(TLink node) => GetLinkReference(node).SizeAsSource;
155
156     /// <summary>
157     /// <para>
158     /// Sets the size using the specified node.
159     /// </para>
160     /// </summary>
161     /// <param name="node">
162     /// <para>The node.</para>
163     /// </para>
164     /// </param>
165     /// <param name="size">
166     /// <para>The size.</para>
167     /// </para>
168     /// </param>
169     [MethodImpl(MethodImplOptions.AggressiveInlining)]
170     protected override void SetSize(TLink node, TLink size) =>
171         ↪ GetLinkReference(node).SizeAsSource = size;
172
173     /// <summary>
174     /// <para>
175     /// Gets the tree root.
176     /// </para>
177     /// </summary>
178     /// <returns>
179     /// <para>The link</para>
180     /// </para>
181     /// </returns>
182     [MethodImpl(MethodImplOptions.AggressiveInlining)]
183     protected override TLink GetTreeRoot() => GetHeaderReference().RootAsSource;
184
185     /// <summary>
186     /// <para>
187     /// Gets the base part value using the specified link.
188     /// </para>
189     /// </summary>
190     /// <param name="link">
191     /// <para>The link.</para>
192     /// </para>
193     /// </param>
194     /// <returns>
195     /// <para>The link</para>
196     /// </para>
197     /// </returns>
198     [MethodImpl(MethodImplOptions.AggressiveInlining)]
199     protected override TLink GetBasePartValue(TLink link) => GetLinkReference(link).Source;
200
201     /// <summary>
202     /// <para>
203     /// Determines whether this instance first is to the left of second.
204     /// </para>
205     /// </summary>
206     /// <param name="firstSource">
207     /// <para>The first source.</para>
208     /// </para>
209     /// </param>
210
211
212

```

```

213     /// <param name="firstTarget">
214     /// <para>The first target.</para>
215     /// <para></para>
216     /// </param>
217     /// <param name="secondSource">
218     /// <para>The second source.</para>
219     /// <para></para>
220     /// </param>
221     /// <param name="secondTarget">
222     /// <para>The second target.</para>
223     /// <para></para>
224     /// </param>
225     /// <returns>
226     /// <para>The bool</para>
227     /// <para></para>
228     /// </returns>
229     [MethodImpl(MethodImplOptions.AggressiveInlining)]
230     protected override bool FirstIsToTheLeftOfSecond(TLink firstSource, TLink firstTarget,
    ↪ TLink secondSource, TLink secondTarget) => LessThan(firstSource, secondSource) ||
    ↪ (AreEqual(firstSource, secondSource) && LessThan(firstTarget, secondTarget));

231     /// <summary>
232     /// <para>
233     /// Determines whether this instance first is to the right of second.
234     /// </para>
235     /// <para></para>
236     /// </summary>
237     /// <param name="firstSource">
238     /// <para>The first source.</para>
239     /// <para></para>
240     /// </param>
241     /// <param name="firstTarget">
242     /// <para>The first target.</para>
243     /// <para></para>
244     /// </param>
245     /// <param name="secondSource">
246     /// <para>The second source.</para>
247     /// <para></para>
248     /// </param>
249     /// <param name="secondTarget">
250     /// <para>The second target.</para>
251     /// <para></para>
252     /// </param>
253     /// <returns>
254     /// <para>The bool</para>
255     /// <para></para>
256     /// </returns>
257     [MethodImpl(MethodImplOptions.AggressiveInlining)]
258     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
    ↪ TLink secondSource, TLink secondTarget) => GreaterThan(firstSource, secondSource) ||
    ↪ (AreEqual(firstSource, secondSource) && GreaterThan(firstTarget, secondTarget));

260     /// <summary>
261     /// <para>
262     /// Clears the node using the specified node.
263     /// </para>
264     /// <para></para>
265     /// </summary>
266     /// <param name="node">
267     /// <para>The node.</para>
268     /// <para></para>
269     /// </param>
270     [MethodImpl(MethodImplOptions.AggressiveInlining)]
271     protected override void ClearNode(TLink node)
272     {
273         ref var link = ref GetLinkReference(node);
274         link.LeftAsSource = Zero;
275         link.RightAsSource = Zero;
276         link.SizeAsSource = Zero;
277     }
278 }
279 }
280 }

```

1.83 ./csharp/Platform.Data.Doublets/Memory/United/Generic/LinksTargetsAvlBalancedTreeMethods.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.Data.Doublets.Memory.United.Generic
6 {
7     /// <summary>
8     /// <para>
9     /// Represents the links targets avl balanced tree methods.
10    /// </para>
11    /// <para></para>
12    /// </summary>
13    /// <seealso cref="LinksAvlBalancedTreeMethodsBase{TLink}"/>
14    public unsafe class LinksTargetsAvlBalancedTreeMethods<TLink> :
15        ↳ LinksAvlBalancedTreeMethodsBase<TLink>
16    {
17        /// <summary>
18        /// <para>
19        /// Initializes a new <see cref="LinksTargetsAvlBalancedTreeMethods"/> instance.
20        /// </para>
21        /// <para></para>
22        /// </summary>
23        /// <param name="constants">
24        /// <para>A constants.</para>
25        /// <para></para>
26        /// </param>
27        /// <param name="links">
28        /// <para>A links.</para>
29        /// <para></para>
30        /// </param>
31        /// <param name="header">
32        /// <para>A header.</para>
33        /// <para></para>
34        /// </param>
35        [MethodImpl(MethodImplOptions.AggressiveInlining)]
36        public LinksTargetsAvlBalancedTreeMethods(LinksConstants<TLink> constants, byte* links,
37            ↳ byte* header) : base(constants, links, header) { }
38
39        /// <summary>
40        /// <para>
41        /// Gets the left reference using the specified node.
42        /// </para>
43        /// <para></para>
44        /// </summary>
45        /// <param name="node">
46        /// <para>The node.</para>
47        /// <para></para>
48        /// </param>
49        /// <returns>
50        /// <para>The ref link</para>
51        /// <para></para>
52        /// </returns>
53        [MethodImpl(MethodImplOptions.AggressiveInlining)]
54        protected override ref TLink GetLeftReference(TLink node) => ref
55            ↳ GetLinkReference(node).LeftAsTarget;
56
57        /// <summary>
58        /// <para>
59        /// Gets the right reference using the specified node.
60        /// </para>
61        /// <para></para>
62        /// </summary>
63        /// <param name="node">
64        /// <para>The node.</para>
65        /// <para></para>
66        /// </param>
67        /// <returns>
68        /// <para>The ref link</para>
69        /// <para></para>
70        /// </returns>
71        [MethodImpl(MethodImplOptions.AggressiveInlining)]
72        protected override ref TLink GetRightReference(TLink node) => ref
73            ↳ GetLinkReference(node).RightAsTarget;
74
75        /// <summary>
76        /// <para>
77        /// Gets the left using the specified node.
78        /// </para>
79        /// <para></para>
80        /// </summary>
81        /// <param name="node">
82        /// <para>The node.</para>
83        /// <para></para>
84        /// </param>
85        /// <returns>
86        /// <para>The ref link</para>
87        /// <para></para>
88        /// </returns>
89        [MethodImpl(MethodImplOptions.AggressiveInlining)]
90        protected override ref TLink GetLeftReferenceUsingNode(TLink node) => ref
91            ↳ GetLinkReferenceUsingNode(node).LeftAsTarget;
92
93        /// <summary>
94        /// <para>
95        /// Gets the right using the specified node.
96        /// </para>
97        /// <para></para>
98        /// </summary>
99        /// <param name="node">
100       /// <para>The node.</para>
101       /// <para></para>
102       /// </param>
103       /// <returns>
104       /// <para>The ref link</para>
105       /// <para></para>
106       /// </returns>
107       [MethodImpl(MethodImplOptions.AggressiveInlining)]
108       protected override ref TLink GetRightReferenceUsingNode(TLink node) => ref
109           ↳ GetLinkReferenceUsingNode(node).RightAsTarget;
110    }
111 }

```

```

79     /// <para></para>
80     /// </param>
81     /// <returns>
82     /// <para>The link</para>
83     /// <para></para>
84     /// </returns>
85     [MethodImpl(MethodImplOptions.AggressiveInlining)]
86     protected override TLink GetLeft(TLink node) => GetLinkReference(node).LeftAsTarget;
87
88     /// <summary>
89     /// <para>
90     /// Gets the right using the specified node.
91     /// </para>
92     /// <para></para>
93     /// </summary>
94     /// <param name="node">
95     /// <para>The node.</para>
96     /// <para></para>
97     /// </param>
98     /// <returns>
99     /// <para>The link</para>
100    /// <para></para>
101    /// </returns>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    protected override TLink GetRight(TLink node) => GetLinkReference(node).RightAsTarget;
104
105    /// <summary>
106    /// <para>
107    /// Sets the left using the specified node.
108    /// </para>
109    /// <para></para>
110    /// </summary>
111    /// <param name="node">
112    /// <para>The node.</para>
113    /// <para></para>
114    /// </param>
115    /// <param name="left">
116    /// <para>The left.</para>
117    /// <para></para>
118    /// </param>
119    [MethodImpl(MethodImplOptions.AggressiveInlining)]
120    protected override void SetLeft(TLink node, TLink left) =>
121        ↪ GetLinkReference(node).LeftAsTarget = left;
122
123    /// <summary>
124    /// <para>
125    /// Sets the right using the specified node.
126    /// </para>
127    /// <para></para>
128    /// </summary>
129    /// <param name="node">
130    /// <para>The node.</para>
131    /// <para></para>
132    /// </param>
133    /// <param name="right">
134    /// <para>The right.</para>
135    /// <para></para>
136    /// </param>
137    [MethodImpl(MethodImplOptions.AggressiveInlining)]
138    protected override void SetRight(TLink node, TLink right) =>
139        ↪ GetLinkReference(node).RightAsTarget = right;
140
141    /// <summary>
142    /// <para>
143    /// Gets the size using the specified node.
144    /// </para>
145    /// <para></para>
146    /// </summary>
147    /// <param name="node">
148    /// <para>The node.</para>
149    /// <para></para>
150    /// </param>
151    /// <returns>
152    /// <para>The link</para>
153    /// <para></para>
154    /// </returns>
155    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

154     protected override TLink GetSize(TLink node) =>
155         ↪ GetSizeValue(GetLinkReference(node).SizeAsTarget);
156
157     /// <summary>
158     /// <para>
159     /// Sets the size using the specified node.
160     /// </para>
161     /// </summary>
162     /// <param name="node">
163     /// <para>The node.</para>
164     /// </param>
165     /// <param name="size">
166     /// <para>The size.</para>
167     /// </param>
168     [MethodImpl(MethodImplOptions.AggressiveInlining)]
169     protected override void SetSize(TLink node, TLink size) => SetSizeValue(ref
170         ↪ GetLinkReference(node).SizeAsTarget, size);
171
172     /// <summary>
173     /// <para>
174     /// Determines whether this instance get left is child.
175     /// </para>
176     /// </summary>
177     /// <param name="node">
178     /// <para>The node.</para>
179     /// </param>
180     /// <returns>
181     /// <para>The bool</para>
182     /// </returns>
183     [MethodImpl(MethodImplOptions.AggressiveInlining)]
184     protected override bool GetLeftIsChild(TLink node) =>
185         ↪ GetLeftIsChildValue(GetLinkReference(node).SizeAsTarget);
186
187     /// <summary>
188     /// <para>
189     /// Sets the left is child using the specified node.
190     /// </para>
191     /// </summary>
192     /// <param name="node">
193     /// <para>The node.</para>
194     /// </param>
195     /// <param name="value">
196     /// <para>The value.</para>
197     /// </param>
198     [MethodImpl(MethodImplOptions.AggressiveInlining)]
199     protected override void SetLeftIsChild(TLink node, bool value) =>
200         ↪ SetLeftIsChildValue(ref GetLinkReference(node).SizeAsTarget, value);
201
202     /// <summary>
203     /// <para>
204     /// Determines whether this instance get right is child.
205     /// </para>
206     /// </summary>
207     /// <param name="node">
208     /// <para>The node.</para>
209     /// </param>
210     /// <returns>
211     /// <para>The bool</para>
212     /// </returns>
213     [MethodImpl(MethodImplOptions.AggressiveInlining)]
214     protected override bool GetRightIsChild(TLink node) =>
215         ↪ GetRightIsChildValue(GetLinkReference(node).SizeAsTarget);
216
217     /// <summary>
218     /// <para>
219

```

```

226     /// Sets the right is child using the specified node.
227     /// </para>
228     /// <para></para>
229     /// </summary>
230     /// <param name="node">
231     /// <para>The node.</para>
232     /// <para></para>
233     /// </param>
234     /// <param name="value">
235     /// <para>The value.</para>
236     /// <para></para>
237     /// </param>
238     [MethodImpl(MethodImplOptions.AggressiveInlining)]
239     protected override void SetRightIsChild(TLink node, bool value) =>
240         ↪ SetRightIsChildValue(ref GetLinkReference(node).SizeAsTarget, value);
241
242     /// <summary>
243     /// <para>
244     /// Gets the balance using the specified node.
245     /// </para>
246     /// <para></para>
247     /// </summary>
248     /// <param name="node">
249     /// <para>The node.</para>
250     /// <para></para>
251     /// </param>
252     /// <returns>
253     /// <para>The sbyte</para>
254     /// <para></para>
255     /// </returns>
256     [MethodImpl(MethodImplOptions.AggressiveInlining)]
257     protected override sbyte GetBalance(TLink node) =>
258         ↪ GetBalanceValue(GetLinkReference(node).SizeAsTarget);
259
260     /// <summary>
261     /// <para>
262     /// Sets the balance using the specified node.
263     /// </para>
264     /// <para></para>
265     /// </summary>
266     /// <param name="node">
267     /// <para>The node.</para>
268     /// <para></para>
269     /// </param>
270     /// <param name="value">
271     /// <para>The value.</para>
272     /// <para></para>
273     /// </param>
274     [MethodImpl(MethodImplOptions.AggressiveInlining)]
275     protected override void SetBalance(TLink node, sbyte value) => SetBalanceValue(ref
276         ↪ GetLinkReference(node).SizeAsTarget, value);
277
278     /// <summary>
279     /// <para>
280     /// Gets the tree root.
281     /// </para>
282     /// <para></para>
283     /// </summary>
284     /// <returns>
285     /// <para>The link</para>
286     /// <para></para>
287     /// </returns>
288     [MethodImpl(MethodImplOptions.AggressiveInlining)]
289     protected override TLink GetTreeRoot() => GetHeaderReference().RootAsTarget;
290
291     /// <summary>
292     /// <para>
293     /// Gets the base part value using the specified link.
294     /// </para>
295     /// <para></para>
296     /// </summary>
297     /// <param name="link">
298     /// <para>The link.</para>
299     /// <para></para>
300     /// </param>
301     /// <returns>
302     /// <para>The link</para>
303     /// <para></para>
304     /// </returns>

```

```

301     /// </returns>
302     [MethodImpl(MethodImplOptions.AggressiveInlining)]
303     protected override TLink GetBasePartValue(TLink link) => GetLinkReference(link).Target;
304
305     /// <summary>
306     /// <para>
307     /// Determines whether this instance first is to the left of second.
308     /// </para>
309     /// <para></para>
310     /// </summary>
311     /// <param name="firstSource">
312     /// <para>The first source.</para>
313     /// <para></para>
314     /// </param>
315     /// <param name="firstTarget">
316     /// <para>The first target.</para>
317     /// <para></para>
318     /// </param>
319     /// <param name="secondSource">
320     /// <para>The second source.</para>
321     /// <para></para>
322     /// </param>
323     /// <param name="secondTarget">
324     /// <para>The second target.</para>
325     /// <para></para>
326     /// </param>
327     /// <returns>
328     /// <para>The bool</para>
329     /// <para></para>
330     /// </returns>
331     [MethodImpl(MethodImplOptions.AggressiveInlining)]
332     protected override bool FirstIsToLeftOfSecond(TLink firstSource, TLink firstTarget,
333     ↪ TLink secondSource, TLink secondTarget) => LessThan(firstTarget, secondTarget) ||
334     ↪ (AreEqual(firstTarget, secondTarget) && LessThan(firstSource, secondSource));
335
336     /// <summary>
337     /// <para>
338     /// Determines whether this instance first is to the right of second.
339     /// </para>
340     /// <para></para>
341     /// </summary>
342     /// <param name="firstSource">
343     /// <para>The first source.</para>
344     /// <para></para>
345     /// </param>
346     /// <param name="firstTarget">
347     /// <para>The first target.</para>
348     /// <para></para>
349     /// </param>
350     /// <param name="secondSource">
351     /// <para>The second source.</para>
352     /// <para></para>
353     /// </param>
354     /// <param name="secondTarget">
355     /// <para>The second target.</para>
356     /// <para></para>
357     /// </param>
358     /// <returns>
359     /// <para>The bool</para>
360     /// <para></para>
361     /// </returns>
362     [MethodImpl(MethodImplOptions.AggressiveInlining)]
363     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
364     ↪ TLink secondSource, TLink secondTarget) => GreaterThan(firstTarget, secondTarget) ||
365     ↪ (AreEqual(firstTarget, secondTarget) && GreaterThan(firstSource, secondSource));
366
367     /// <summary>
368     /// <para>
369     /// Clears the node using the specified node.
370     /// </para>
371     /// <para></para>
372     /// </summary>
373     /// <param name="node">
374     /// <para>The node.</para>
375     /// <para></para>
376     /// </param>
377     [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

374     protected override void ClearNode(TLink node)
375     {
376         ref var link = ref GetLinkReference(node);
377         link.LeftAsTarget = Zero;
378         link.RightAsTarget = Zero;
379         link.SizeAsTarget = Zero;
380     }
381 }
382 }

```

## 1.84 ./csharp/Platform.Data.Doublets/Memory/United/Generic/LinksTargetsRecursionlessSizeBalancedTreeMethods

```

1  using System.Runtime.CompilerServices;
2
3  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5  namespace Platform.Data.Doublets.Memory.United.Generic
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the links targets recursionless size balanced tree methods.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="LinksRecursionlessSizeBalancedTreeMethodsBase{TLink}"/>
14     public unsafe class LinksTargetsRecursionlessSizeBalancedTreeMethods<TLink> :
15         ↳ LinksRecursionlessSizeBalancedTreeMethodsBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="LinksTargetsRecursionlessSizeBalancedTreeMethods"/>
20         ↳ instance.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         /// <param name="constants">
25         /// <para>A constants.</para>
26         /// <para></para>
27         /// </param>
28         /// <param name="links">
29         /// <para>A links.</para>
30         /// <para></para>
31         /// </param>
32         /// <param name="header">
33         /// <para>A header.</para>
34         /// <para></para>
35         /// </param>
36         [MethodImpl(MethodImplOptions.AggressiveInlining)]
37         public LinksTargetsRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink> constants,
38             ↳ byte* links, byte* header) : base(constants, links, header) { }
39
40         /// <summary>
41         /// <para>
42         /// Gets the left reference using the specified node.
43         /// </para>
44         /// <para></para>
45         /// </summary>
46         /// <param name="node">
47         /// <para>The node.</para>
48         /// <para></para>
49         /// </param>
50         /// <returns>
51         /// <para>The ref link</para>
52         /// <para></para>
53         /// </returns>
54         [MethodImpl(MethodImplOptions.AggressiveInlining)]
55         protected override ref TLink GetLeftReference(TLink node) => ref
56             ↳ GetLinkReference(node).LeftAsTarget;
57
58         /// <summary>
59         /// <para>
60         /// Gets the right reference using the specified node.
61         /// </para>
62         /// <para></para>
63         /// </summary>
64         /// <param name="node">
65         /// <para>The node.</para>
66         /// <para></para>
67         /// </param>

```

```

64    /// <returns>
65    /// <para>The ref link</para>
66    /// <para></para>
67    /// </returns>
68    [MethodImpl(MethodImplOptions.AggressiveInlining)]
69    protected override ref TLink GetRightReference(TLink node) => ref
    ↪ GetLinkReference(node).RightAsTarget;

70
71    /// <summary>
72    /// <para>
73    /// Gets the left using the specified node.
74    /// </para>
75    /// <para></para>
76    /// </summary>
77    /// <param name="node">
78    /// <para>The node.</para>
79    /// <para></para>
80    /// </param>
81    /// <returns>
82    /// <para>The link</para>
83    /// <para></para>
84    /// </returns>
85    [MethodImpl(MethodImplOptions.AggressiveInlining)]
86    protected override TLink GetLeft(TLink node) => GetLinkReference(node).LeftAsTarget;
87
88    /// <summary>
89    /// <para>
90    /// Gets the right using the specified node.
91    /// </para>
92    /// <para></para>
93    /// </summary>
94    /// <param name="node">
95    /// <para>The node.</para>
96    /// <para></para>
97    /// </param>
98    /// <returns>
99    /// <para>The link</para>
100    /// <para></para>
101    /// </returns>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    protected override TLink GetRight(TLink node) => GetLinkReference(node).RightAsTarget;
104
105    /// <summary>
106    /// <para>
107    /// Sets the left using the specified node.
108    /// </para>
109    /// <para></para>
110    /// </summary>
111    /// <param name="node">
112    /// <para>The node.</para>
113    /// <para></para>
114    /// </param>
115    /// <param name="left">
116    /// <para>The left.</para>
117    /// <para></para>
118    /// </param>
119    [MethodImpl(MethodImplOptions.AggressiveInlining)]
120    protected override void SetLeft(TLink node, TLink left) =>
    ↪ GetLinkReference(node).LeftAsTarget = left;

121
122    /// <summary>
123    /// <para>
124    /// Sets the right using the specified node.
125    /// </para>
126    /// <para></para>
127    /// </summary>
128    /// <param name="node">
129    /// <para>The node.</para>
130    /// <para></para>
131    /// </param>
132    /// <param name="right">
133    /// <para>The right.</para>
134    /// <para></para>
135    /// </param>
136    [MethodImpl(MethodImplOptions.AggressiveInlining)]
137    protected override void SetRight(TLink node, TLink right) =>
    ↪ GetLinkReference(node).RightAsTarget = right;

```

```

139    /// <summary>
140    /// <para>
141    /// Gets the size using the specified node.
142    /// </para>
143    /// <para></para>
144    /// </summary>
145    /// <param name="node">
146    /// <para>The node.</para>
147    /// <para></para>
148    /// </param>
149    /// <returns>
150    /// <para>The link</para>
151    /// <para></para>
152    /// </returns>
153    [MethodImpl(MethodImplOptions.AggressiveInlining)]
154    protected override TLink GetSize(TLink node) => GetLinkReference(node).SizeAsTarget;
155
156    /// <summary>
157    /// <para>
158    /// Sets the size using the specified node.
159    /// </para>
160    /// <para></para>
161    /// </summary>
162    /// <param name="node">
163    /// <para>The node.</para>
164    /// <para></para>
165    /// </param>
166    /// <param name="size">
167    /// <para>The size.</para>
168    /// <para></para>
169    /// </param>
170    [MethodImpl(MethodImplOptions.AggressiveInlining)]
171    protected override void SetSize(TLink node, TLink size) =>
172        ↪ GetLinkReference(node).SizeAsTarget = size;
173
174    /// <summary>
175    /// <para>
176    /// Gets the tree root.
177    /// </para>
178    /// <para></para>
179    /// </summary>
180    /// <returns>
181    /// <para>The link</para>
182    /// <para></para>
183    /// </returns>
184    [MethodImpl(MethodImplOptions.AggressiveInlining)]
185    protected override TLink GetTreeRoot() => GetHeaderReference().RootAsTarget;
186
187    /// <summary>
188    /// <para>
189    /// Gets the base part value using the specified link.
190    /// </para>
191    /// <para></para>
192    /// </summary>
193    /// <param name="link">
194    /// <para>The link.</para>
195    /// <para></para>
196    /// </param>
197    /// <returns>
198    /// <para>The link</para>
199    /// <para></para>
200    /// </returns>
201    [MethodImpl(MethodImplOptions.AggressiveInlining)]
202    protected override TLink GetBasePartValue(TLink link) => GetLinkReference(link).Target;
203
204    /// <summary>
205    /// <para>
206    /// Determines whether this instance first is to the left of second.
207    /// </para>
208    /// <para></para>
209    /// </summary>
210    /// <param name="firstSource">
211    /// <para>The first source.</para>
212    /// <para></para>
213    /// </param>
214    /// <param name="firstTarget">
215    /// <para>The first target.</para>
216    /// <para></para>

```



```

216     /// </param>
217     /// <param name="secondSource">
218     /// <para>The second source.</para>
219     /// <para></para>
220     /// </param>
221     /// <param name="secondTarget">
222     /// <para>The second target.</para>
223     /// <para></para>
224     /// </param>
225     /// <returns>
226     /// <para>The bool</para>
227     /// <para></para>
228     /// </returns>
229     [MethodImpl(MethodImplOptions.AggressiveInlining)]
230     protected override bool FirstIsToLeftOfSecond(TLink firstSource, TLink firstTarget,
231     ↪ TLink secondSource, TLink secondTarget) => LessThan(firstTarget, secondTarget) ||
232     ↪ (AreEqual(firstTarget, secondTarget) && LessThan(firstSource, secondSource));
233
234     /// <summary>
235     /// <para>
236     /// Determines whether this instance first is to the right of second.
237     /// </para>
238     /// <para></para>
239     /// </summary>
240     /// <param name="firstSource">
241     /// <para>The first source.</para>
242     /// <para></para>
243     /// </param>
244     /// <param name="firstTarget">
245     /// <para>The first target.</para>
246     /// <para></para>
247     /// </param>
248     /// <param name="secondSource">
249     /// <para>The second source.</para>
250     /// <para></para>
251     /// </param>
252     /// <param name="secondTarget">
253     /// <para>The second target.</para>
254     /// <para></para>
255     /// </param>
256     /// <returns>
257     /// <para>The bool</para>
258     /// <para></para>
259     /// </returns>
260     [MethodImpl(MethodImplOptions.AggressiveInlining)]
261     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
262     ↪ TLink secondSource, TLink secondTarget) => GreaterThan(firstTarget, secondTarget) ||
263     ↪ (AreEqual(firstTarget, secondTarget) && GreaterThan(firstSource, secondSource));
264
265     /// <summary>
266     /// <para>
267     /// Clears the node using the specified node.
268     /// </para>
269     /// <para></para>
270     /// </summary>
271     /// <param name="node">
272     /// <para>The node.</para>
273     /// <para></para>
274     /// </param>
275     [MethodImpl(MethodImplOptions.AggressiveInlining)]
276     protected override void ClearNode(TLink node)
277     {
278         ref var link = ref GetLinkReference(node);
279         link.LeftAsTarget = Zero;
280         link.RightAsTarget = Zero;
281         link.SizeAsTarget = Zero;
282     }
283 }

```

## 1.85 ./csharp/Platform.Data.Doublets/Memory/United/Generic/LinksTargetsSizeBalancedTreeMethods.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.Data.Doublets.Memory.United.Generic
6 {
7     /// <summary>

```

```

8  /// <para>
9  /// Represents the links targets size balanced tree methods.
10 /// </para>
11 /// <para></para>
12 /// </summary>
13 /// <seealso cref="LinksSizeBalancedTreeMethodsBase{TLink}"/>
14 public unsafe class LinksTargetsSizeBalancedTreeMethods<TLink> :
    ↳ LinksSizeBalancedTreeMethodsBase<TLink>
15 {
16     /// <summary>
17     /// <para>
18     /// Initializes a new <see cref="LinksTargetsSizeBalancedTreeMethods"/> instance.
19     /// </para>
20     /// <para></para>
21     /// </summary>
22     /// <param name="constants">
23     /// <para>A constants.</para>
24     /// <para></para>
25     /// </param>
26     /// <param name="links">
27     /// <para>A links.</para>
28     /// <para></para>
29     /// </param>
30     /// <param name="header">
31     /// <para>A header.</para>
32     /// <para></para>
33     /// </param>
34     [MethodImpl(MethodImplOptions.AggressiveInlining)]
35     public LinksTargetsSizeBalancedTreeMethods(LinksConstants<TLink> constants, byte* links,
        ↳ byte* header) : base(constants, links, header) { }
36
37     /// <summary>
38     /// <para>
39     /// Gets the left reference using the specified node.
40     /// </para>
41     /// <para></para>
42     /// </summary>
43     /// <param name="node">
44     /// <para>The node.</para>
45     /// <para></para>
46     /// </param>
47     /// <returns>
48     /// <para>The ref link</para>
49     /// <para></para>
50     /// </returns>
51     [MethodImpl(MethodImplOptions.AggressiveInlining)]
52     protected override ref TLink GetLeftReference(TLink node) => ref
        ↳ GetLinkReference(node).LeftAsTarget;
53
54     /// <summary>
55     /// <para>
56     /// Gets the right reference using the specified node.
57     /// </para>
58     /// <para></para>
59     /// </summary>
60     /// <param name="node">
61     /// <para>The node.</para>
62     /// <para></para>
63     /// </param>
64     /// <returns>
65     /// <para>The ref link</para>
66     /// <para></para>
67     /// </returns>
68     [MethodImpl(MethodImplOptions.AggressiveInlining)]
69     protected override ref TLink GetRightReference(TLink node) => ref
        ↳ GetLinkReference(node).RightAsTarget;
70
71     /// <summary>
72     /// <para>
73     /// Gets the left using the specified node.
74     /// </para>
75     /// <para></para>
76     /// </summary>
77     /// <param name="node">
78     /// <para>The node.</para>
79     /// <para></para>
80     /// </param>
81     /// <returns>

```

```

82    /// <para>The link</para>
83    /// <para></para>
84    /// </returns>
85    [MethodImpl(MethodImplOptions.AggressiveInlining)]
86    protected override TLink GetLeft(TLink node) => GetLinkReference(node).LeftAsTarget;
87
88    /// <summary>
89    /// <para>
90    /// Gets the right using the specified node.
91    /// </para>
92    /// <para></para>
93    /// </summary>
94    /// <param name="node">
95    /// <para>The node.</para>
96    /// <para></para>
97    /// </param>
98    /// <returns>
99    /// <para>The link</para>
100    /// <para></para>
101    /// </returns>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    protected override TLink GetRight(TLink node) => GetLinkReference(node).RightAsTarget;
104
105    /// <summary>
106    /// <para>
107    /// Sets the left using the specified node.
108    /// </para>
109    /// <para></para>
110    /// </summary>
111    /// <param name="node">
112    /// <para>The node.</para>
113    /// <para></para>
114    /// </param>
115    /// <param name="left">
116    /// <para>The left.</para>
117    /// <para></para>
118    /// </param>
119    [MethodImpl(MethodImplOptions.AggressiveInlining)]
120    protected override void SetLeft(TLink node, TLink left) =>
121        ↪ GetLinkReference(node).LeftAsTarget = left;
122
123    /// <summary>
124    /// <para>
125    /// Sets the right using the specified node.
126    /// </para>
127    /// <para></para>
128    /// </summary>
129    /// <param name="node">
130    /// <para>The node.</para>
131    /// <para></para>
132    /// </param>
133    /// <param name="right">
134    /// <para>The right.</para>
135    /// <para></para>
136    /// </param>
137    [MethodImpl(MethodImplOptions.AggressiveInlining)]
138    protected override void SetRight(TLink node, TLink right) =>
139        ↪ GetLinkReference(node).RightAsTarget = right;
140
141    /// <summary>
142    /// <para>
143    /// Gets the size using the specified node.
144    /// </para>
145    /// <para></para>
146    /// </summary>
147    /// <param name="node">
148    /// <para>The node.</para>
149    /// <para></para>
150    /// </param>
151    /// <returns>
152    /// <para>The link</para>
153    /// <para></para>
154    /// </returns>
155    [MethodImpl(MethodImplOptions.AggressiveInlining)]
156    protected override TLink GetSize(TLink node) => GetLinkReference(node).SizeAsTarget;
157    /// <summary>
158    /// <para>

```

```

158     /// Sets the size using the specified node.
159     /// </para>
160     /// <para></para>
161     /// </summary>
162     /// <param name="node">
163     /// <para>The node.</para>
164     /// <para></para>
165     /// </param>
166     /// <param name="size">
167     /// <para>The size.</para>
168     /// <para></para>
169     /// </param>
170     [MethodImpl(MethodImplOptions.AggressiveInlining)]
171     protected override void SetSize(TLink node, TLink size) =>
172         ↪ GetLinkReference(node).SizeAsTarget = size;
173
174     /// <summary>
175     /// <para>
176     /// Gets the tree root.
177     /// </para>
178     /// <para></para>
179     /// </summary>
180     /// <returns>
181     /// <para>The link</para>
182     /// <para></para>
183     /// </returns>
184     [MethodImpl(MethodImplOptions.AggressiveInlining)]
185     protected override TLink GetTreeRoot() => GetHeaderReference().RootAsTarget;
186
187     /// <summary>
188     /// <para>
189     /// Gets the base part value using the specified link.
190     /// </para>
191     /// <para></para>
192     /// </summary>
193     /// <param name="link">
194     /// <para>The link.</para>
195     /// <para></para>
196     /// </param>
197     /// <returns>
198     /// <para>The link</para>
199     /// <para></para>
200     /// </returns>
201     [MethodImpl(MethodImplOptions.AggressiveInlining)]
202     protected override TLink GetBasePartValue(TLink link) => GetLinkReference(link).Target;
203
204     /// <summary>
205     /// <para>
206     /// Determines whether this instance first is to the left of second.
207     /// </para>
208     /// <para></para>
209     /// </summary>
210     /// <param name="firstSource">
211     /// <para>The first source.</para>
212     /// <para></para>
213     /// </param>
214     /// <param name="firstTarget">
215     /// <para>The first target.</para>
216     /// <para></para>
217     /// </param>
218     /// <param name="secondSource">
219     /// <para>The second source.</para>
220     /// <para></para>
221     /// </param>
222     /// <param name="secondTarget">
223     /// <para>The second target.</para>
224     /// <para></para>
225     /// </param>
226     /// <returns>
227     /// <para>The bool</para>
228     /// <para></para>
229     /// </returns>
230     [MethodImpl(MethodImplOptions.AggressiveInlining)]
231     protected override bool FirstIsToTheLeftOfSecond(TLink firstSource, TLink firstTarget,
232         ↪ TLink secondSource, TLink secondTarget) => LessThan(firstTarget, secondTarget) ||
        ↪ (AreEqual(firstTarget, secondTarget) && LessThan(firstSource, secondSource));

```

```

233     /// <para>
234     /// Determines whether this instance first is to the right of second.
235     /// </para>
236     /// <para></para>
237     /// </summary>
238     /// <param name="firstSource">
239     /// <para>The first source.</para>
240     /// <para></para>
241     /// </param>
242     /// <param name="firstTarget">
243     /// <para>The first target.</para>
244     /// <para></para>
245     /// </param>
246     /// <param name="secondSource">
247     /// <para>The second source.</para>
248     /// <para></para>
249     /// </param>
250     /// <param name="secondTarget">
251     /// <para>The second target.</para>
252     /// <para></para>
253     /// </param>
254     /// <returns>
255     /// <para>The bool</para>
256     /// <para></para>
257     /// </returns>
258     [MethodImpl(MethodImplOptions.AggressiveInlining)]
259     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
        ↪ TLink secondSource, TLink secondTarget) => GreaterThan(firstTarget, secondTarget) ||
        ↪ (AreEqual(firstTarget, secondTarget) && GreaterThan(firstSource, secondSource));

260     /// <summary>
261     /// <para>
262     /// Clears the node using the specified node.
263     /// </para>
264     /// <para></para>
265     /// </summary>
266     /// <param name="node">
267     /// <para>The node.</para>
268     /// <para></para>
269     /// </param>
270     [MethodImpl(MethodImplOptions.AggressiveInlining)]
271     protected override void ClearNode(TLink node)
272     {
273         ref var link = ref GetLinkReference(node);
274         link.LeftAsTarget = Zero;
275         link.RightAsTarget = Zero;
276         link.SizeAsTarget = Zero;
277     }
278 }
279 }
280 }

```

## 1.86 ./csharp/Platform.Data.Doublets/Memory/United/Generic/UnitedMemoryLinks.cs

```

1  using System;
2  using System.Runtime.CompilerServices;
3  using Platform.Singletons;
4  using Platform.Memory;
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.Data.Doublets.Memory.United.Generic
10 {
11     /// <summary>
12     /// <para>
13     /// Represents the united memory links.
14     /// </para>
15     /// <para></para>
16     /// </summary>
17     /// <seealso cref="UnitedMemoryLinksBase{TLink}"/>
18     public unsafe class UnitedMemoryLinks<TLink> : UnitedMemoryLinksBase<TLink>
19     {
20         /// <summary>
21         /// <para>
22         /// The create source tree methods.
23         /// </para>
24         /// <para></para>
25         /// </summary>
26         private readonly Func<ILinksTreeMethods<TLink>> _createSourceTreeMethods;
27         /// <summary>

```

```

28     /// <para>
29     /// The create target tree methods.
30     /// </para>
31     /// <para></para>
32     /// </summary>
33     private readonly Func<ILinksTreeMethods<TLink>> _createTargetTreeMethods;
34     /// <summary>
35     /// <para>
36     /// The header.
37     /// </para>
38     /// <para></para>
39     /// </summary>
40     private byte* _header;
41     /// <summary>
42     /// <para>
43     /// The links.
44     /// </para>
45     /// <para></para>
46     /// </summary>
47     private byte* _links;
48
49     /// <summary>
50     /// <para>
51     /// Initializes a new <see cref="UnitedMemoryLinks"/> instance.
52     /// </para>
53     /// <para></para>
54     /// </summary>
55     /// <param name="address">
56     /// <para>A address.</para>
57     /// <para></para>
58     /// </param>
59     [MethodImpl(MethodImplOptions.AggressiveInlining)]
60     public UnitedMemoryLinks(string address) : this(address, DefaultLinksSizeStep) { }
61
62     /// <summary>
63     /// Создаёт экземпляр базы данных Links в файле по указанному адресу, с указанным
64     /// → минимальным шагом расширения базы данных.
65     /// </summary>
66     /// <param name="address">Полный путь к файлу базы данных.</param>
67     /// <param name="memoryReservationStep">Минимальный шаг расширения базы данных в
68     /// → байтах.</param>
69     [MethodImpl(MethodImplOptions.AggressiveInlining)]
70     public UnitedMemoryLinks(string address, long memoryReservationStep) : this(new
71     /// → FileMappedResizableDirectMemory(address, memoryReservationStep),
72     /// → memoryReservationStep) { }
73
74     /// <summary>
75     /// <para>
76     /// Initializes a new <see cref="UnitedMemoryLinks"/> instance.
77     /// </para>
78     /// <para></para>
79     /// </summary>
80     /// <param name="memory">
81     /// <para>A memory.</para>
82     /// <para></para>
83     /// </param>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     public UnitedMemoryLinks(IResizableDirectMemory memory) : this(memory,
86     /// → DefaultLinksSizeStep) { }
87
88     /// <summary>
89     /// <para>
90     /// Initializes a new <see cref="UnitedMemoryLinks"/> instance.
91     /// </para>
92     /// <para></para>
93     /// </summary>
94     /// <param name="memory">
95     /// <para>A memory.</para>
96     /// <para></para>
97     /// </param>
98     /// <param name="memoryReservationStep">
99     /// <para>A memory reservation step.</para>
100    /// <para></para>
101    /// </param>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    public UnitedMemoryLinks(IResizableDirectMemory memory, long memoryReservationStep) :
104    /// → this(memory, memoryReservationStep, Default<LinksConstants<TLink>>.Instance,
105    /// → IndexTreeType.Default) { }

```

```

99
100 /// <summary>
101 /// <para>
102 /// Initializes a new <see cref="UnitedMemoryLinks"/> instance.
103 /// </para>
104 /// <para></para>
105 /// </summary>
106 /// <param name="memory">
107 /// <para>A memory.</para>
108 /// <para></para>
109 /// </param>
110 /// <param name="memoryReservationStep">
111 /// <para>A memory reservation step.</para>
112 /// <para></para>
113 /// </param>
114 /// <param name="constants">
115 /// <para>A constants.</para>
116 /// <para></para>
117 /// </param>
118 /// <param name="indexTreeType">
119 /// <para>A index tree type.</para>
120 /// <para></para>
121 /// </param>
122 [MethodImpl(MethodImplOptions.AggressiveInlining)]
123 public UnitedMemoryLinks(IResizableDirectMemory memory, long memoryReservationStep,
124     ↳ LinksConstants<TLink> constants, IndexTreeType indexTreeType) : base(memory,
125     ↳ memoryReservationStep, constants)
126 {
127     if (indexTreeType == IndexTreeType.SizedAndThreadedAVLBalancedTree)
128     {
129         _createSourceTreeMethods = () => new
130             ↳ LinksSourcesAvlBalancedTreeMethods<TLink>(Constants, _links, _header);
131         _createTargetTreeMethods = () => new
132             ↳ LinksTargetsAvlBalancedTreeMethods<TLink>(Constants, _links, _header);
133     }
134     else
135     {
136         _createSourceTreeMethods = () => new
137             ↳ LinksSourcesSizeBalancedTreeMethods<TLink>(Constants, _links, _header);
138         _createTargetTreeMethods = () => new
139             ↳ LinksTargetsSizeBalancedTreeMethods<TLink>(Constants, _links, _header);
140     }
141     Init(memory, memoryReservationStep);
142 }
143
144 /// <summary>
145 /// <para>
146 /// Sets the pointers using the specified memory.
147 /// </para>
148 /// <para></para>
149 /// </summary>
150 /// <param name="memory">
151 /// <para>The memory.</para>
152 /// <para></para>
153 /// </param>
154 [MethodImpl(MethodImplOptions.AggressiveInlining)]
155 protected override void SetPointers(IResizableDirectMemory memory)
156 {
157     _links = (byte*)memory.Pointer;
158     _header = _links;
159     SourcesTreeMethods = _createSourceTreeMethods();
160     TargetsTreeMethods = _createTargetTreeMethods();
161     UnusedLinksListMethods = new UnusedLinksListMethods<TLink>(_links, _header);
162 }
163
164 /// <summary>
165 /// <para>
166 /// Resets the pointers.
167 /// </para>
168 /// <para></para>
169 /// </summary>
170 [MethodImpl(MethodImplOptions.AggressiveInlining)]
171 protected override void ResetPointers()
172 {
173     base.ResetPointers();
174     _links = null;
175     _header = null;
176 }

```

```

171
172     /// <summary>
173     /// <para>
174     /// Gets the header reference.
175     /// </para>
176     /// <para></para>
177     /// </summary>
178     /// <returns>
179     /// <para>A ref links header of t link</para>
180     /// <para></para>
181     /// </returns>
182     [MethodImpl(MethodImplOptions.AggressiveInlining)]
183     protected override ref LinksHeader<TLink> GetHeaderReference() => ref
        ↪ AsRef<LinksHeader<TLink>>(_header);
184
185     /// <summary>
186     /// <para>
187     /// Gets the link reference using the specified link index.
188     /// </para>
189     /// <para></para>
190     /// </summary>
191     /// <param name="linkIndex">
192     /// <para>The link index.</para>
193     /// <para></para>
194     /// </param>
195     /// <returns>
196     /// <para>A ref raw link of t link</para>
197     /// <para></para>
198     /// </returns>
199     [MethodImpl(MethodImplOptions.AggressiveInlining)]
200     protected override ref RawLink<TLink> GetLinkReference(TLink linkIndex) => ref
        ↪ AsRef<RawLink<TLink>>(_links + (LinkSizeInBytes * ConvertToInt64(linkIndex)));
201 }
202 }

```

## 1.87 ./csharp/Platform.Data.Doublets/Memory/United/Generic/UnitedMemoryLinksBase.cs

```

1 using System;
2 using System.Collections.Generic;
3 using System.Runtime.CompilerServices;
4 using Platform.Disposables;
5 using Platform.Singletons;
6 using Platform.Converters;
7 using Platform.Numbers;
8 using Platform.Memory;
9 using Platform.Data.Exceptions;
10
11 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
12
13 namespace Platform.Data.Doublets.Memory.United.Generic
14 {
15     /// <summary>
16     /// <para>
17     /// Represents the united memory links base.
18     /// </para>
19     /// <para></para>
20     /// </summary>
21     /// <seealso cref="DisposableBase"/>
22     /// <seealso cref="ILinks{TLink}"/>
23     public abstract class UnitedMemoryLinksBase<TLink> : DisposableBase, ILinks<TLink>
24     {
25         /// <summary>
26         /// <para>
27         /// The default.
28         /// </para>
29         /// <para></para>
30         /// </summary>
31         private static readonly EqualityComparer<TLink> _equalityComparer =
            ↪ EqualityComparer<TLink>.Default;
32
33         /// <summary>
34         /// <para>
35         /// The default.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         private static readonly Comparer<TLink> _comparer = Comparer<TLink>.Default;
40
41         /// <summary>
42         /// <para>
43         /// The default.
44         /// </para>
45         /// </summary>

```



```

43     /// <para></para>
44     /// </summary>
45     private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
46         ↪ UncheckedConverter<TLink, long>.Default;
47     /// <summary>
48     /// <para>
49     /// The default.
50     /// </para>
51     /// <para></para>
52     /// </summary>
53     private static readonly UncheckedConverter<long, TLink> _int64ToAddressConverter =
54         ↪ UncheckedConverter<long, TLink>.Default;
55     /// <summary>
56     /// <para>
57     /// The zero.
58     /// </para>
59     /// <para></para>
60     /// </summary>
61     private static readonly TLink _zero = default;
62     /// <summary>
63     /// <para>
64     /// The zero.
65     /// </para>
66     /// <para></para>
67     /// </summary>
68     private static readonly TLink _one = Arithmetic.Increment(_zero);
69     /// <summary>Возвращает размер одной связи в байтах.</summary>
70     /// <remarks>
71     /// Используется только во вне класса, не рекомендуется использовать внутри.
72     /// Так как во вне не обязательно будет доступен unsafe C#.
73     /// </remarks>
74     public static readonly long LinkSizeInBytes = RawLink<TLink>.SizeInBytes;
75     /// <summary>
76     /// <para>
77     /// The size in bytes.
78     /// </para>
79     /// <para></para>
80     /// </summary>
81     public static readonly long LinkHeaderSizeInBytes = LinksHeader<TLink>.SizeInBytes;
82     /// <summary>
83     /// <para>
84     /// The link size in bytes.
85     /// </para>
86     /// <para></para>
87     /// </summary>
88     public static readonly long DefaultLinksSizeStep = LinkSizeInBytes * 1024 * 1024;
89     /// <summary>
90     /// <para>
91     /// The memory.
92     /// </para>
93     /// <para></para>
94     /// </summary>
95     protected readonly IResizableDirectMemory _memory;
96     /// <summary>
97     /// <para>
98     /// The memory reservation step.
99     /// </para>
100    /// <para></para>
101    /// </summary>
102    protected readonly long _memoryReservationStep;
103    /// <summary>
104    /// <para>
105    /// The targets tree methods.
106    /// </para>
107    /// <para></para>
108    /// </summary>
109    protected ILinksTreeMethods<TLink> TargetsTreeMethods;
110    /// <summary>
111    /// <para>
112    /// The sources tree methods.
113    /// </para>
114    /// <para></para>
115    /// </summary>
116    protected ILinksTreeMethods<TLink> SourcesTreeMethods;
117    /// <summary>
118    /// <para>
119    /// The targets tree methods.
120    /// </para>
121    /// <para></para>
122    /// </summary>

```

```

120 protected ILinksTreeMethods<TLink> SourcesTreeMethods;
121 // TODO: Возможно чтобы гарантированно проверять на то, является ли связь удалённой,
    ↳ нужно использовать не список а дерево, так как так можно быстрее проверить на
    ↳ наличие связи внутри
122 /// <summary>
123 /// <para>
124 /// The unused links list methods.
125 /// </para>
126 /// <para></para>
127 /// </summary>
128 protected ILinksListMethods<TLink> UnusedLinksListMethods;
129
130 /// <summary>
131 /// Возвращает общее число связей находящихся в хранилище.
132 /// </summary>
133 protected virtual TLink Total
134 {
135     [MethodImpl(MethodImplOptions.AggressiveInlining)]
136     get
137     {
138         ref var header = ref GetHeaderReference();
139         return Subtract(header.AllocatedLinks, header.FreeLinks);
140     }
141 }
142
143 /// <summary>
144 /// <para>
145 /// Gets the constants value.
146 /// </para>
147 /// <para></para>
148 /// </summary>
149 public virtual LinksConstants<TLink> Constants
150 {
151     [MethodImpl(MethodImplOptions.AggressiveInlining)]
152     get;
153 }
154
155 /// <summary>
156 /// <para>
157 /// Initializes a new <see cref="UnitedMemoryLinksBase"/> instance.
158 /// </para>
159 /// <para></para>
160 /// </summary>
161 /// <param name="memory">
162 /// <para>A memory.</para>
163 /// <para></para>
164 /// </param>
165 /// <param name="memoryReservationStep">
166 /// <para>A memory reservation step.</para>
167 /// <para></para>
168 /// </param>
169 /// <param name="constants">
170 /// <para>A constants.</para>
171 /// <para></para>
172 /// </param>
173 [MethodImpl(MethodImplOptions.AggressiveInlining)]
174 protected UnitedMemoryLinksBase(IResizableDirectMemory memory, long
    ↳ memoryReservationStep, LinksConstants<TLink> constants)
175 {
176     _memory = memory;
177     _memoryReservationStep = memoryReservationStep;
178     Constants = constants;
179 }
180
181 /// <summary>
182 /// <para>
183 /// Initializes a new <see cref="UnitedMemoryLinksBase"/> instance.
184 /// </para>
185 /// <para></para>
186 /// </summary>
187 /// <param name="memory">
188 /// <para>A memory.</para>
189 /// <para></para>
190 /// </param>
191 /// <param name="memoryReservationStep">
192 /// <para>A memory reservation step.</para>
193 /// <para></para>
194 /// </param>
195 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

196 protected UnitedMemoryLinksBase(IResizableDirectMemory memory, long
    ↳ memoryReservationStep) : this(memory, memoryReservationStep,
    ↳ Default<LinksConstants<TLink>>.Instance) { }
197
198 /// <summary>
199 /// <para>
200 /// Inits the memory.
201 /// </para>
202 /// <para></para>
203 /// </summary>
204 /// <param name="memory">
205 /// <para>The memory.</para>
206 /// <para></para>
207 /// </param>
208 /// <param name="memoryReservationStep">
209 /// <para>The memory reservation step.</para>
210 /// <para></para>
211 /// </param>
212 [MethodImpl(MethodImplOptions.AggressiveInlining)]
213 protected virtual void Init(IResizableDirectMemory memory, long memoryReservationStep)
214 {
215     if (memory.ReservedCapacity < memoryReservationStep)
216     {
217         memory.ReservedCapacity = memoryReservationStep;
218     }
219     SetPointers(memory);
220     ref var header = ref GetHeaderReference();
221     // Гарантия корректности _memory.UsedCapacity относительно _header->AllocatedLinks
222     memory.UsedCapacity = (ConvertToInt64(header.AllocatedLinks) * LinkSizeInBytes) +
    ↳ LinkHeaderSizeInBytes;
223     // Гарантия корректности _header->ReservedLinks относительно _memory.ReservedCapacity
224     header.ReservedLinks = ConvertToAddress((memory.ReservedCapacity -
    ↳ LinkHeaderSizeInBytes) / LinkSizeInBytes);
225 }
226
227 /// <summary>
228 /// <para>
229 /// Counts the restrictions.
230 /// </para>
231 /// <para></para>
232 /// </summary>
233 /// <param name="restrictions">
234 /// <para>The restrictions.</para>
235 /// <para></para>
236 /// </param>
237 /// <exception cref="NotSupportedException">
238 /// <para>Другие размеры и способы ограничений не поддерживаются.</para>
239 /// <para></para>
240 /// </exception>
241 /// <returns>
242 /// <para>The link</para>
243 /// <para></para>
244 /// </returns>
245 [MethodImpl(MethodImplOptions.AggressiveInlining)]
246 public virtual TLink Count(ICollection<TLink> restrictions)
247 {
248     // Если нет ограничений, тогда возвращаем общее число связей находящихся в хранилище.
249     if (restrictions.Count == 0)
250     {
251         return Total;
252     }
253     var constants = Constants;
254     var any = constants.Any;
255     var index = restrictions[constants.IndexPart];
256     if (restrictions.Count == 1)
257     {
258         if (AreEqual(index, any))
259         {
260             return Total;
261         }
262         return Exists(index) ? GetOne() : GetZero();
263     }
264     if (restrictions.Count == 2)
265     {
266         var value = restrictions[1];
267         if (AreEqual(index, any))
268         {
269             if (AreEqual(value, any))

```

```

270         {
271             return Total; // Any - как отсутствие ограничения
272         }
273         return Add(SourcesTreeMethods.CountUsages(value),
274             ↪ TargetsTreeMethods.CountUsages(value));
275     }
276     else
277     {
278         if (!Exists(index))
279         {
280             return GetZero();
281         }
282         if (AreEqual(value, any))
283         {
284             return GetOne();
285         }
286         ref var storedLinkValue = ref GetLinkReference(index);
287         if (AreEqual(storedLinkValue.Source, value) ||
288             ↪ AreEqual(storedLinkValue.Target, value))
289         {
290             return GetOne();
291         }
292         return GetZero();
293     }
294 }
295 if (restrictions.Count == 3)
296 {
297     var source = restrictions[constants.SourcePart];
298     var target = restrictions[constants.TargetPart];
299     if (AreEqual(index, any))
300     {
301         if (AreEqual(source, any) && AreEqual(target, any))
302         {
303             return Total;
304         }
305         else if (AreEqual(source, any))
306         {
307             return TargetsTreeMethods.CountUsages(target);
308         }
309         else if (AreEqual(target, any))
310         {
311             return SourcesTreeMethods.CountUsages(source);
312         }
313         else //if(source != Any && target != Any)
314         {
315             // Эквивалент Exists(source, target) => Count(Any, source, target) > 0
316             var link = SourcesTreeMethods.Search(source, target);
317             return AreEqual(link, constants.Null) ? GetZero() : GetOne();
318         }
319     }
320     else
321     {
322         if (!Exists(index))
323         {
324             return GetZero();
325         }
326         if (AreEqual(source, any) && AreEqual(target, any))
327         {
328             return GetOne();
329         }
330         ref var storedLinkValue = ref GetLinkReference(index);
331         if (!AreEqual(source, any) && !AreEqual(target, any))
332         {
333             if (AreEqual(storedLinkValue.Source, source) &&
334                 ↪ AreEqual(storedLinkValue.Target, target))
335             {
336                 return GetOne();
337             }
338             return GetZero();
339         }
340         var value = default(TLink);
341         if (AreEqual(source, any))
342         {
343             value = target;
344         }
345         if (AreEqual(target, any))
346         {
347             value = source;
348         }
349     }
350 }

```

```

345     }
346     if (AreEqual(storedLinkValue.Source, value) ||
        ↪ AreEqual(storedLinkValue.Target, value))
347     {
348         return GetOne();
349     }
350     return GetZero();
351 }
352 }
353 throw new NotSupportedException("Другие размеры и способы ограничений не
    ↪ поддерживаются.");
354 }
355
356 /// <summary>
357 /// <para>
358 /// Eaches the handler.
359 /// </para>
360 /// <para></para>
361 /// </summary>
362 /// <param name="handler">
363 /// <para>The handler.</para>
364 /// <para></para>
365 /// </param>
366 /// <param name="restrictions">
367 /// <para>The restrictions.</para>
368 /// <para></para>
369 /// </param>
370 /// <exception cref="NotSupportedException">
371 /// <para>Другие размеры и способы ограничений не поддерживаются.</para>
372 /// <para></para>
373 /// </exception>
374 /// <returns>
375 /// <para>The link</para>
376 /// <para></para>
377 /// </returns>
378 [MethodImpl(MethodImplOptions.AggressiveInlining)]
379 public virtual TLink Each(Func<IList<TLink>, TLink> handler, IList<TLink> restrictions)
380 {
381     var constants = Constants;
382     var @break = constants.Break;
383     if (restrictions.Count == 0)
384     {
385         for (var link = GetOne(); LessOrEqualThan(link,
            ↪ GetHeaderReference().AllocatedLinks); link = Increment(link))
386         {
387             if (Exists(link) && AreEqual(handler(GetLinkStruct(link)), @break))
388             {
389                 return @break;
390             }
391         }
392         return @break;
393     }
394     var @continue = constants.Continue;
395     var any = constants.Any;
396     var index = restrictions[constants.IndexPart];
397     if (restrictions.Count == 1)
398     {
399         if (AreEqual(index, any))
400         {
401             return Each(handler, Array.Empty<TLink>());
402         }
403         if (!Exists(index))
404         {
405             return @continue;
406         }
407         return handler(GetLinkStruct(index));
408     }
409     if (restrictions.Count == 2)
410     {
411         var value = restrictions[1];
412         if (AreEqual(index, any))
413         {
414             if (AreEqual(value, any))
415             {
416                 return Each(handler, Array.Empty<TLink>());
417             }
418             if (AreEqual(Each(handler, new Link<TLink>(index, value, any)), @break))
419             {

```

```

420         return @break;
421     }
422     return Each(handler, new Link<TLink>(index, any, value));
423 }
424 else
425 {
426     if (!Exists(index))
427     {
428         return @continue;
429     }
430     if (AreEqual(value, any))
431     {
432         return handler(GetLinkStruct(index));
433     }
434     ref var storedLinkValue = ref GetLinkReference(index);
435     if (AreEqual(storedLinkValue.Source, value) ||
436         AreEqual(storedLinkValue.Target, value))
437     {
438         return handler(GetLinkStruct(index));
439     }
440     return @continue;
441 }
442 }
443 if (restrictions.Count == 3)
444 {
445     var source = restrictions[constants.SourcePart];
446     var target = restrictions[constants.TargetPart];
447     if (AreEqual(index, any))
448     {
449         if (AreEqual(source, any) && AreEqual(target, any))
450         {
451             return Each(handler, Array.Empty<TLink>());
452         }
453         else if (AreEqual(source, any))
454         {
455             return TargetsTreeMethods.EachUsage(target, handler);
456         }
457         else if (AreEqual(target, any))
458         {
459             return SourcesTreeMethods.EachUsage(source, handler);
460         }
461         else //if(source != Any && target != Any)
462         {
463             var link = SourcesTreeMethods.Search(source, target);
464             return AreEqual(link, constants.Null) ? @continue :
465                 ↪ handler(GetLinkStruct(link));
466         }
467     }
468     else
469     {
470         if (!Exists(index))
471         {
472             return @continue;
473         }
474         if (AreEqual(source, any) && AreEqual(target, any))
475         {
476             return handler(GetLinkStruct(index));
477         }
478         ref var storedLinkValue = ref GetLinkReference(index);
479         if (!AreEqual(source, any) && !AreEqual(target, any))
480         {
481             if (AreEqual(storedLinkValue.Source, source) &&
482                 AreEqual(storedLinkValue.Target, target))
483             {
484                 return handler(GetLinkStruct(index));
485             }
486             return @continue;
487         }
488         var value = default(TLink);
489         if (AreEqual(source, any))
490         {
491             value = target;
492         }
493         if (AreEqual(target, any))
494         {
495             value = source;
496         }
497         if (AreEqual(storedLinkValue.Source, value) ||

```

```

497         AreEqual(storedLinkValue.Target, value))
498     {
499         return handler(GetLinkStruct(index));
500     }
501     return @continue;
502 }
503 }
504 throw new NotSupportedException("Другие размеры и способы ограничений не
    ↳ поддерживаются.");
505 }
506
507 /// <remarks>
508 /// TODO: Возможно можно перемещать значения, если указан индекс, но значение существует
    ↳ в другом месте (но не в менеджере памяти, а в логике Links)
509 /// </remarks>
510 [MethodImpl(MethodImplOptions.AggressiveInlining)]
511 public virtual TLink Update(ICollection<TLink> restrictions, ICollection<TLink> substitution)
512 {
513     var constants = Constants;
514     var @null = constants.Null;
515     var linkIndex = restrictions[constants.IndexPart];
516     ref var link = ref GetLinkReference(linkIndex);
517     ref var header = ref GetHeaderReference();
518     ref var firstAsSource = ref header.RootAsSource;
519     ref var firstAsTarget = ref header.RootAsTarget;
520     // Будет корректно работать только в том случае, если пространство выделенной связи
    ↳ предварительно заполнено нулями
521     if (!AreEqual(link.Source, @null))
522     {
523         SourcesTreeMethods.Detach(ref firstAsSource, linkIndex);
524     }
525     if (!AreEqual(link.Target, @null))
526     {
527         TargetsTreeMethods.Detach(ref firstAsTarget, linkIndex);
528     }
529     link.Source = substitution[constants.SourcePart];
530     link.Target = substitution[constants.TargetPart];
531     if (!AreEqual(link.Source, @null))
532     {
533         SourcesTreeMethods.Attach(ref firstAsSource, linkIndex);
534     }
535     if (!AreEqual(link.Target, @null))
536     {
537         TargetsTreeMethods.Attach(ref firstAsTarget, linkIndex);
538     }
539     return linkIndex;
540 }
541
542 /// <remarks>
543 /// TODO: Возможно нужно будет заполнение нулями, если внешнее API ими не заполняет
    ↳ пространство
544 /// </remarks>
545 [MethodImpl(MethodImplOptions.AggressiveInlining)]
546 public virtual TLink Create(ICollection<TLink> restrictions)
547 {
548     ref var header = ref GetHeaderReference();
549     var freeLink = header.FirstFreeLink;
550     if (!AreEqual(freeLink, Constants.Null))
551     {
552         UnusedLinksListMethods.Detach(freeLink);
553     }
554     else
555     {
556         var maximumPossibleInnerReference = Constants.InternalReferencesRange.Maximum;
557         if (GreaterThan(header.AllocatedLinks, maximumPossibleInnerReference))
558         {
559             throw new LinksLimitReachedException<TLink>(maximumPossibleInnerReference);
560         }
561         if (GreaterOrEqualThan(header.AllocatedLinks, Decrement(header.ReservedLinks))
562         {
563             _memory.ReservedCapacity += _memory.ReservationStep;
564             SetPointers(_memory);
565             header = ref GetHeaderReference();
566             header.ReservedLinks = ConvertToAddress(_memory.ReservedCapacity /
    ↳ LinkSizeInBytes);
567         }
568         freeLink = header.AllocatedLinks = Increment(header.AllocatedLinks);
569         _memory.UsedCapacity += LinkSizeInBytes;
570     }

```

```

571     return freeLink;
572 }
573
574 /// <summary>
575 /// <para>
576 /// Deletes the restrictions.
577 /// </para>
578 /// <para></para>
579 /// </summary>
580 /// <param name="restrictions">
581 /// <para>The restrictions.</para>
582 /// <para></para>
583 /// </param>
584 [MethodImpl(MethodImplOptions.AggressiveInlining)]
585 public virtual void Delete(ICollection<TLink> restrictions)
586 {
587     ref var header = ref GetHeaderReference();
588     var link = restrictions[Constants.IndexPart];
589     if (LessThan(link, header.AllocatedLinks))
590     {
591         UnusedLinksListMethods.AttachAsFirst(link);
592     }
593     else if (AreEqual(link, header.AllocatedLinks))
594     {
595         header.AllocatedLinks = Decrement(header.AllocatedLinks);
596         _memory.UsedCapacity -= LinkSizeInBytes;
597         // Убираем все связи, находящиеся в списке свободных в конце файла, до тех пор,
598         //   ↳ пока не дойдём до первой существующей связи
599         // Позволяет оптимизировать количество выделенных связей (AllocatedLinks)
600         while (GreaterThan(header.AllocatedLinks, GetZero()) &&
601             ↳ IsUnusedLink(header.AllocatedLinks))
602         {
603             UnusedLinksListMethods.Detach(header.AllocatedLinks);
604             header.AllocatedLinks = Decrement(header.AllocatedLinks);
605             _memory.UsedCapacity -= LinkSizeInBytes;
606         }
607     }
608 }
609
610 /// <summary>
611 /// <para>
612 /// Gets the link struct using the specified link index.
613 /// </para>
614 /// <para></para>
615 /// </summary>
616 /// <param name="linkIndex">
617 /// <para>The link index.</para>
618 /// <para></para>
619 /// </param>
620 /// <returns>
621 /// <para>A list of t link</para>
622 /// <para></para>
623 /// </returns>
624 [MethodImpl(MethodImplOptions.AggressiveInlining)]
625 public IList<TLink> GetLinkStruct(TLink linkIndex)
626 {
627     ref var link = ref GetLinkReference(linkIndex);
628     return new Link<TLink>(linkIndex, link.Source, link.Target);
629 }
630
631 /// <remarks>
632 /// TODO: Возможно это должно быть событием, вызываемым из IMemory, в том случае, если
633   ↳ адрес реально поменялся
634 ///
635 /// Указатель this.links может быть в том же месте,
636 /// так как 0-я связь не используется и имеет такой же размер как Header,
637 /// поэтому header размещается в том же месте, что и 0-я связь
638 /// </remarks>
639 [MethodImpl(MethodImplOptions.AggressiveInlining)]
640 protected abstract void SetPointers(IResizableDirectMemory memory);
641
642 /// <summary>
643 /// <para>
644 /// Resets the pointers.
645 /// </para>
646 /// <para></para>
647 /// </summary>
648 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```



```

646 protected virtual void ResetPointers()
647 {
648     SourcesTreeMethods = null;
649     TargetsTreeMethods = null;
650     UnusedLinksListMethods = null;
651 }
652
653 /// <summary>
654 /// <para>
655 /// Gets the header reference.
656 /// </para>
657 /// <para></para>
658 /// </summary>
659 /// <returns>
660 /// <para>A ref links header of t link</para>
661 /// <para></para>
662 /// </returns>
663 [MethodImpl(MethodImplOptions.AggressiveInlining)]
664 protected abstract ref LinksHeader<TLink> GetHeaderReference();
665
666 /// <summary>
667 /// <para>
668 /// Gets the link reference using the specified link index.
669 /// </para>
670 /// <para></para>
671 /// </summary>
672 /// <param name="linkIndex">
673 /// <para>The link index.</para>
674 /// <para></para>
675 /// </param>
676 /// <returns>
677 /// <para>A ref raw link of t link</para>
678 /// <para></para>
679 /// </returns>
680 [MethodImpl(MethodImplOptions.AggressiveInlining)]
681 protected abstract ref RawLink<TLink> GetLinkReference(TLink linkIndex);
682
683 /// <summary>
684 /// <para>
685 /// Determines whether this instance exists.
686 /// </para>
687 /// <para></para>
688 /// </summary>
689 /// <param name="link">
690 /// <para>The link.</para>
691 /// <para></para>
692 /// </param>
693 /// <returns>
694 /// <para>The bool</para>
695 /// <para></para>
696 /// </returns>
697 [MethodImpl(MethodImplOptions.AggressiveInlining)]
698 protected virtual bool Exists(TLink link)
699     => GreaterOrEqualThan(link, Constants.InternalReferencesRange.Minimum)
700     && LessOrEqualThan(link, GetHeaderReference().AllocatedLinks)
701     && !IsUnusedLink(link);
702
703 /// <summary>
704 /// <para>
705 /// Determines whether this instance is unused link.
706 /// </para>
707 /// <para></para>
708 /// </summary>
709 /// <param name="linkIndex">
710 /// <para>The link index.</para>
711 /// <para></para>
712 /// </param>
713 /// <returns>
714 /// <para>The bool</para>
715 /// <para></para>
716 /// </returns>
717 [MethodImpl(MethodImplOptions.AggressiveInlining)]
718 protected virtual bool IsUnusedLink(TLink linkIndex)
719 {
720     if (!AreEqual(GetHeaderReference().FirstFreeLink, linkIndex)) // May be this check
721         ↪ is not needed
722     {
723         ref var link = ref GetLinkReference(linkIndex);

```

```

723         return AreEqual(link.SizeAsSource, default) && !AreEqual(link.Source, default);
724     }
725     else
726     {
727         return true;
728     }
729 }
730
731 /// <summary>
732 /// <para>
733 /// Gets the one.
734 /// </para>
735 /// <para></para>
736 /// </summary>
737 /// <returns>
738 /// <para>The link</para>
739 /// <para></para>
740 /// </returns>
741 [MethodImpl(MethodImplOptions.AggressiveInlining)]
742 protected virtual TLink GetOne() => _one;
743
744 /// <summary>
745 /// <para>
746 /// Gets the zero.
747 /// </para>
748 /// <para></para>
749 /// </summary>
750 /// <returns>
751 /// <para>The link</para>
752 /// <para></para>
753 /// </returns>
754 [MethodImpl(MethodImplOptions.AggressiveInlining)]
755 protected virtual TLink GetZero() => default;
756
757 /// <summary>
758 /// <para>
759 /// Determines whether this instance are equal.
760 /// </para>
761 /// <para></para>
762 /// </summary>
763 /// <param name="first">
764 /// <para>The first.</para>
765 /// <para></para>
766 /// </param>
767 /// <param name="second">
768 /// <para>The second.</para>
769 /// <para></para>
770 /// </param>
771 /// <returns>
772 /// <para>The bool</para>
773 /// <para></para>
774 /// </returns>
775 [MethodImpl(MethodImplOptions.AggressiveInlining)]
776 protected virtual bool AreEqual(TLink first, TLink second) =>
777     ↪ _equalityComparer.Equals(first, second);
778
779 /// <summary>
780 /// <para>
781 /// Determines whether this instance less than.
782 /// </para>
783 /// <para></para>
784 /// </summary>
785 /// <param name="first">
786 /// <para>The first.</para>
787 /// <para></para>
788 /// </param>
789 /// <param name="second">
790 /// <para>The second.</para>
791 /// <para></para>
792 /// </param>
793 /// <returns>
794 /// <para>The bool</para>
795 /// <para></para>
796 /// </returns>
797 [MethodImpl(MethodImplOptions.AggressiveInlining)]
798 protected virtual bool LessThan(TLink first, TLink second) => _comparer.Compare(first,
    ↪ second) < 0;

```

```

799     /// <summary>
800     /// <para>
801     /// Determines whether this instance less or equal than.
802     /// </para>
803     /// <para></para>
804     /// </summary>
805     /// <param name="first">
806     /// <para>The first.</para>
807     /// <para></para>
808     /// </param>
809     /// <param name="second">
810     /// <para>The second.</para>
811     /// <para></para>
812     /// </param>
813     /// <returns>
814     /// <para>The bool</para>
815     /// <para></para>
816     /// </returns>
817     [MethodImpl(MethodImplOptions.AggressiveInlining)]
818     protected virtual bool LessOrEqualThan(TLink first, TLink second) =>
819         ↪ _comparer.Compare(first, second) <= 0;
820
821     /// <summary>
822     /// <para>
823     /// Determines whether this instance greater than.
824     /// </para>
825     /// <para></para>
826     /// </summary>
827     /// <param name="first">
828     /// <para>The first.</para>
829     /// <para></para>
830     /// </param>
831     /// <param name="second">
832     /// <para>The second.</para>
833     /// <para></para>
834     /// </param>
835     /// <returns>
836     /// <para>The bool</para>
837     /// <para></para>
838     /// </returns>
839     [MethodImpl(MethodImplOptions.AggressiveInlining)]
840     protected virtual bool GreaterThan(TLink first, TLink second) =>
841         ↪ _comparer.Compare(first, second) > 0;
842
843     /// <summary>
844     /// <para>
845     /// Determines whether this instance greater or equal than.
846     /// </para>
847     /// <para></para>
848     /// </summary>
849     /// <param name="first">
850     /// <para>The first.</para>
851     /// <para></para>
852     /// </param>
853     /// <param name="second">
854     /// <para>The second.</para>
855     /// <para></para>
856     /// </param>
857     /// <returns>
858     /// <para>The bool</para>
859     /// <para></para>
860     /// </returns>
861     [MethodImpl(MethodImplOptions.AggressiveInlining)]
862     protected virtual bool GreaterOrEqualThan(TLink first, TLink second) =>
863         ↪ _comparer.Compare(first, second) >= 0;
864
865     /// <summary>
866     /// <para>
867     /// Converts the to int 64 using the specified value.
868     /// </para>
869     /// <para></para>
870     /// </summary>
871     /// <param name="value">
872     /// <para>The value.</para>
873     /// <para></para>
874     /// </param>
875     /// <returns>
876     /// <para>The long</para>

```

```

874     /// <para></para>
875     /// </returns>
876     [MethodImpl(MethodImplOptions.AggressiveInlining)]
877     protected virtual long ConvertToInt64(TLink value) =>
878         ↪ _addressToInt64Converter.Convert(value);
879
880     /// <summary>
881     /// <para>
882     /// Converts the to address using the specified value.
883     /// </para>
884     /// <para></para>
885     /// </summary>
886     /// <param name="value">
887     /// <para>The value.</para>
888     /// </param>
889     /// <returns>
890     /// <para>The link</para>
891     /// <para></para>
892     /// </returns>
893     [MethodImpl(MethodImplOptions.AggressiveInlining)]
894     protected virtual TLink ConvertToAddress(long value) =>
895         ↪ _int64ToAddressConverter.Convert(value);
896
897     /// <summary>
898     /// <para>
899     /// Adds the first.
900     /// </para>
901     /// <para></para>
902     /// </summary>
903     /// <param name="first">
904     /// <para>The first.</para>
905     /// </param>
906     /// <param name="second">
907     /// <para>The second.</para>
908     /// </param>
909     /// <returns>
910     /// <para>The link</para>
911     /// <para></para>
912     /// </returns>
913     [MethodImpl(MethodImplOptions.AggressiveInlining)]
914     protected virtual TLink Add(TLink first, TLink second) => Arithmetic<TLink>.Add(first,
915         ↪ second);
916
917     /// <summary>
918     /// <para>
919     /// Subtracts the first.
920     /// </para>
921     /// <para></para>
922     /// </summary>
923     /// <param name="first">
924     /// <para>The first.</para>
925     /// </param>
926     /// <param name="second">
927     /// <para>The second.</para>
928     /// </param>
929     /// <returns>
930     /// <para>The link</para>
931     /// <para></para>
932     /// </returns>
933     [MethodImpl(MethodImplOptions.AggressiveInlining)]
934     protected virtual TLink Subtract(TLink first, TLink second) =>
935         ↪ Arithmetic<TLink>.Subtract(first, second);
936
937     /// <summary>
938     /// <para>
939     /// Increments the link.
940     /// </para>
941     /// <para></para>
942     /// </summary>
943     /// <param name="link">
944     /// <para>The link.</para>
945     /// </param>
946     /// </summary>
947     /// </param>

```

```

948     /// <returns>
949     /// <para>The link</para>
950     /// <para></para>
951     /// </returns>
952     [MethodImpl(MethodImplOptions.AggressiveInlining)]
953     protected virtual TLink Increment(TLink link) => Arithmetic<TLink>.Increment(link);
954
955     /// <summary>
956     /// <para>
957     /// Decrements the link.
958     /// </para>
959     /// <para></para>
960     /// </summary>
961     /// <param name="link">
962     /// <para>The link.</para>
963     /// <para></para>
964     /// </param>
965     /// <returns>
966     /// <para>The link</para>
967     /// <para></para>
968     /// </returns>
969     [MethodImpl(MethodImplOptions.AggressiveInlining)]
970     protected virtual TLink Decrement(TLink link) => Arithmetic<TLink>.Decrement(link);
971
972     #region Disposable
973
974     /// <summary>
975     /// <para>
976     /// Gets the allow multiple dispose calls value.
977     /// </para>
978     /// <para></para>
979     /// </summary>
980     protected override bool AllowMultipleDisposeCalls
981     {
982         [MethodImpl(MethodImplOptions.AggressiveInlining)]
983         get => true;
984     }
985
986     /// <summary>
987     /// <para>
988     /// Disposes the manual.
989     /// </para>
990     /// <para></para>
991     /// </summary>
992     /// <param name="manual">
993     /// <para>The manual.</para>
994     /// <para></para>
995     /// </param>
996     /// <param name="wasDisposed">
997     /// <para>The was disposed.</para>
998     /// <para></para>
999     /// </param>
1000     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1001     protected override void Dispose(bool manual, bool wasDisposed)
1002     {
1003         if (!wasDisposed)
1004         {
1005             ResetPointers();
1006             _memory.DisposeIfPossible();
1007         }
1008     }
1009
1010     #endregion
1011 }
1012 }

```

## 1.88 ./csharp/Platform.Data.Doublets/Memory/United/Generic/UnusedLinksListMethods.cs

```

1  using System.Runtime.CompilerServices;
2  using Platform.Collections.Methods.Lists;
3  using Platform.Converters;
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.Data.Doublets.Memory.United.Generic
9  {
10     /// <summary>
11     /// <para>
12     /// Represents the unused links list methods.

```

```

13  /// </para>
14  /// <para></para>
15  /// </summary>
16  /// <seealso cref="AbsoluteCircularDoublyLinkedListMethods{TLink}"/>
17  /// <seealso cref="ILinksListMethods{TLink}"/>
18  public unsafe class UnusedLinksListMethods<TLink> :
    ↳ AbsoluteCircularDoublyLinkedListMethods<TLink>, ILinksListMethods<TLink>
19  {
20      /// <summary>
21      /// <para>
22      /// The default.
23      /// </para>
24      /// <para></para>
25      /// </summary>
26      private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
    ↳ UncheckedConverter<TLink, long>.Default;
27
28      /// <summary>
29      /// <para>
30      /// The links.
31      /// </para>
32      /// <para></para>
33      /// </summary>
34      private readonly byte* _links;
35      /// <summary>
36      /// <para>
37      /// The header.
38      /// </para>
39      /// <para></para>
40      /// </summary>
41      private readonly byte* _header;
42
43      /// <summary>
44      /// <para>
45      /// Initializes a new <see cref="UnusedLinksListMethods"/> instance.
46      /// </para>
47      /// <para></para>
48      /// </summary>
49      /// <param name="links">
50      /// <para>A links.</para>
51      /// <para></para>
52      /// </param>
53      /// <param name="header">
54      /// <para>A header.</para>
55      /// <para></para>
56      /// </param>
57      [MethodImpl(MethodImplOptions.AggressiveInlining)]
58      public UnusedLinksListMethods(byte* links, byte* header)
59      {
60          _links = links;
61          _header = header;
62      }
63
64      /// <summary>
65      /// <para>
66      /// Gets the header reference.
67      /// </para>
68      /// <para></para>
69      /// </summary>
70      /// <returns>
71      /// <para>A ref links header of t link</para>
72      /// <para></para>
73      /// </returns>
74      [MethodImpl(MethodImplOptions.AggressiveInlining)]
75      protected virtual ref LinksHeader<TLink> GetHeaderReference() => ref
    ↳ AsRef<LinksHeader<TLink>>(_header);
76
77      /// <summary>
78      /// <para>
79      /// Gets the link reference using the specified link.
80      /// </para>
81      /// <para></para>
82      /// </summary>
83      /// <param name="link">
84      /// <para>The link.</para>
85      /// <para></para>
86      /// </param>
87      /// </returns>

```

```

88     /// <para>A ref raw link of t link</para>
89     /// <para></para>
90     /// </returns>
91     [MethodImpl(MethodImplOptions.AggressiveInlining)]
92     protected virtual ref RawLink<TLink> GetLinkReference(TLink link) => ref
        ↳ AsRef<RawLink<TLink>>(_links + (RawLink<TLink>.SizeInBytes *
        ↳ _addressToInt64Converter.Convert(link)));
93
94     /// <summary>
95     /// <para>
96     /// Gets the first.
97     /// </para>
98     /// <para></para>
99     /// </summary>
100    /// <returns>
101    /// <para>The link</para>
102    /// <para></para>
103    /// </returns>
104    [MethodImpl(MethodImplOptions.AggressiveInlining)]
105    protected override TLink GetFirst() => GetHeaderReference().FirstFreeLink;
106
107    /// <summary>
108    /// <para>
109    /// Gets the last.
110    /// </para>
111    /// <para></para>
112    /// </summary>
113    /// <returns>
114    /// <para>The link</para>
115    /// <para></para>
116    /// </returns>
117    [MethodImpl(MethodImplOptions.AggressiveInlining)]
118    protected override TLink GetLast() => GetHeaderReference().LastFreeLink;
119
120    /// <summary>
121    /// <para>
122    /// Gets the previous using the specified element.
123    /// </para>
124    /// <para></para>
125    /// </summary>
126    /// <param name="element">
127    /// <para>The element.</para>
128    /// <para></para>
129    /// </param>
130    /// <returns>
131    /// <para>The link</para>
132    /// <para></para>
133    /// </returns>
134    [MethodImpl(MethodImplOptions.AggressiveInlining)]
135    protected override TLink GetPrevious(TLink element) => GetLinkReference(element).Source;
136
137    /// <summary>
138    /// <para>
139    /// Gets the next using the specified element.
140    /// </para>
141    /// <para></para>
142    /// </summary>
143    /// <param name="element">
144    /// <para>The element.</para>
145    /// <para></para>
146    /// </param>
147    /// <returns>
148    /// <para>The link</para>
149    /// <para></para>
150    /// </returns>
151    [MethodImpl(MethodImplOptions.AggressiveInlining)]
152    protected override TLink GetNext(TLink element) => GetLinkReference(element).Target;
153
154    /// <summary>
155    /// <para>
156    /// Gets the size.
157    /// </para>
158    /// <para></para>
159    /// </summary>
160    /// <returns>
161    /// <para>The link</para>
162    /// <para></para>
163    /// </returns>

```

```

164 [MethodImpl(MethodImplOptions.AggressiveInlining)]
165 protected override TLink GetSize() => GetHeaderReference().FreeLinks;
166
167 /// <summary>
168 /// <para>
169 /// Sets the first using the specified element.
170 /// </para>
171 /// <para></para>
172 /// </summary>
173 /// <param name="element">
174 /// <para>The element.</para>
175 /// <para></para>
176 /// </param>
177 [MethodImpl(MethodImplOptions.AggressiveInlining)]
178 protected override void SetFirst(TLink element) => GetHeaderReference().FirstFreeLink =
    ↪ element;
179
180 /// <summary>
181 /// <para>
182 /// Sets the last using the specified element.
183 /// </para>
184 /// <para></para>
185 /// </summary>
186 /// <param name="element">
187 /// <para>The element.</para>
188 /// <para></para>
189 /// </param>
190 [MethodImpl(MethodImplOptions.AggressiveInlining)]
191 protected override void SetLast(TLink element) => GetHeaderReference().LastFreeLink =
    ↪ element;
192
193 /// <summary>
194 /// <para>
195 /// Sets the previous using the specified element.
196 /// </para>
197 /// <para></para>
198 /// </summary>
199 /// <param name="element">
200 /// <para>The element.</para>
201 /// <para></para>
202 /// </param>
203 /// <param name="previous">
204 /// <para>The previous.</para>
205 /// <para></para>
206 /// </param>
207 [MethodImpl(MethodImplOptions.AggressiveInlining)]
208 protected override void SetPrevious(TLink element, TLink previous) =>
    ↪ GetLinkReference(element).Source = previous;
209
210 /// <summary>
211 /// <para>
212 /// Sets the next using the specified element.
213 /// </para>
214 /// <para></para>
215 /// </summary>
216 /// <param name="element">
217 /// <para>The element.</para>
218 /// <para></para>
219 /// </param>
220 /// <param name="next">
221 /// <para>The next.</para>
222 /// <para></para>
223 /// </param>
224 [MethodImpl(MethodImplOptions.AggressiveInlining)]
225 protected override void SetNext(TLink element, TLink next) =>
    ↪ GetLinkReference(element).Target = next;
226
227 /// <summary>
228 /// <para>
229 /// Sets the size using the specified size.
230 /// </para>
231 /// <para></para>
232 /// </summary>
233 /// <param name="size">
234 /// <para>The size.</para>
235 /// <para></para>
236 /// </param>
237 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```





```

74     /// </summary>
75     public TLink LeftAsTarget;
76     /// <summary>
77     /// <para>
78     /// The right as target.
79     /// </para>
80     /// <para></para>
81     /// </summary>
82     public TLink RightAsTarget;
83     /// <summary>
84     /// <para>
85     /// The size as target.
86     /// </para>
87     /// <para></para>
88     /// </summary>
89     public TLink SizeAsTarget;
90
91     /// <summary>
92     /// <para>
93     /// Determines whether this instance equals.
94     /// </para>
95     /// <para></para>
96     /// </summary>
97     /// <param name="obj">
98     /// <para>The obj.</para>
99     /// <para></para>
100    /// </param>
101    /// <returns>
102    /// <para>The bool</para>
103    /// <para></para>
104    /// </returns>
105    [MethodImpl(MethodImplOptions.AggressiveInlining)]
106    public override bool Equals(object obj) => obj is RawLink<TLink> link ? Equals(link) :
    ↪ false;
107
108    /// <summary>
109    /// <para>
110    /// Determines whether this instance equals.
111    /// </para>
112    /// <para></para>
113    /// </summary>
114    /// <param name="other">
115    /// <para>The other.</para>
116    /// <para></para>
117    /// </param>
118    /// <returns>
119    /// <para>The bool</para>
120    /// <para></para>
121    /// </returns>
122    [MethodImpl(MethodImplOptions.AggressiveInlining)]
123    public bool Equals(RawLink<TLink> other)
124        => _equalityComparer.Equals(Source, other.Source)
125        && _equalityComparer.Equals(Target, other.Target)
126        && _equalityComparer.Equals(LeftAsSource, other.LeftAsSource)
127        && _equalityComparer.Equals(RightAsSource, other.RightAsSource)
128        && _equalityComparer.Equals(SizeAsSource, other.SizeAsSource)
129        && _equalityComparer.Equals(LeftAsTarget, other.LeftAsTarget)
130        && _equalityComparer.Equals(RightAsTarget, other.RightAsTarget)
131        && _equalityComparer.Equals(SizeAsTarget, other.SizeAsTarget);
132
133    /// <summary>
134    /// <para>
135    /// Gets the hash code.
136    /// </para>
137    /// <para></para>
138    /// </summary>
139    /// <returns>
140    /// <para>The int</para>
141    /// <para></para>
142    /// </returns>
143    [MethodImpl(MethodImplOptions.AggressiveInlining)]
144    public override int GetHashCode() => (Source, Target, LeftAsSource, RightAsSource,
    ↪ SizeAsSource, LeftAsTarget, RightAsTarget, SizeAsTarget).GetHashCode();
145
146    [MethodImpl(MethodImplOptions.AggressiveInlining)]
147    public static bool operator ==(RawLink<TLink> left, RawLink<TLink> right) =>
    ↪ left.Equals(right);
148

```

```

149     [MethodImpl(MethodImplOptions.AggressiveInlining)]
150     public static bool operator !=(RawLink<TLink> left, RawLink<TLink> right) => !(left ==
    ↪ right);
151 }
152 }

```

## 1.90 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt32LinksRecursionlessSizeBalancedTreeMethods

```

1  using System.Runtime.CompilerServices;
2  using Platform.Data.Doublets.Memory.United.Generic;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.United.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 32 links recursionless size balanced tree methods base.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="LinksRecursionlessSizeBalancedTreeMethodsBase{uint}"/>
15     public unsafe abstract class UInt32LinksRecursionlessSizeBalancedTreeMethodsBase :
    ↪ LinksRecursionlessSizeBalancedTreeMethodsBase<uint>
16     {
17         /// <summary>
18         /// <para>
19         /// The links.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         protected new readonly RawLink<uint>* Links;
24         /// <summary>
25         /// <para>
26         /// The header.
27         /// </para>
28         /// <para></para>
29         /// </summary>
30         protected new readonly LinksHeader<uint>* Header;
31
32         /// <summary>
33         /// <para>
34         /// Initializes a new <see cref="UInt32LinksRecursionlessSizeBalancedTreeMethodsBase"/>
    ↪ instance.
35         /// </para>
36         /// <para></para>
37         /// </summary>
38         /// <param name="constants">
39         /// <para>A constants.</para>
40         /// <para></para>
41         /// </param>
42         /// <param name="links">
43         /// <para>A links.</para>
44         /// <para></para>
45         /// </param>
46         /// <param name="header">
47         /// <para>A header.</para>
48         /// <para></para>
49         /// </param>
50         protected UInt32LinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<uint>
    ↪ constants, RawLink<uint>* links, LinksHeader<uint>* header)
    : base(constants, (byte*)links, (byte*)header)
51     {
52         Links = links;
53         Header = header;
54     }
55
56     /// <summary>
57     /// <para>
58     /// Gets the zero.
59     /// </para>
60     /// <para></para>
61     /// </summary>
62     /// <returns>
63     /// <para>The uint</para>
64     /// <para></para>
65     /// </returns>
66     [MethodImpl(MethodImplOptions.AggressiveInlining)]
67     protected override uint GetZero() => 0U;
68
69

```

```

70     /// <summary>
71     /// <para>
72     /// Determines whether this instance equal to zero.
73     /// </para>
74     /// <para></para>
75     /// </summary>
76     /// <param name="value">
77     /// <para>The value.</para>
78     /// <para></para>
79     /// </param>
80     /// <returns>
81     /// <para>The bool</para>
82     /// <para></para>
83     /// </returns>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     protected override bool EqualToZero(uint value) => value == 0U;
86
87     /// <summary>
88     /// <para>
89     /// Determines whether this instance are equal.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <param name="first">
94     /// <para>The first.</para>
95     /// <para></para>
96     /// </param>
97     /// <param name="second">
98     /// <para>The second.</para>
99     /// <para></para>
100    /// </param>
101    /// <returns>
102    /// <para>The bool</para>
103    /// <para></para>
104    /// </returns>
105    [MethodImpl(MethodImplOptions.AggressiveInlining)]
106    protected override bool AreEqual(uint first, uint second) => first == second;
107
108    /// <summary>
109    /// <para>
110    /// Determines whether this instance greater than zero.
111    /// </para>
112    /// <para></para>
113    /// </summary>
114    /// <param name="value">
115    /// <para>The value.</para>
116    /// <para></para>
117    /// </param>
118    /// <returns>
119    /// <para>The bool</para>
120    /// <para></para>
121    /// </returns>
122    [MethodImpl(MethodImplOptions.AggressiveInlining)]
123    protected override bool GreaterThanZero(uint value) => value > 0U;
124
125    /// <summary>
126    /// <para>
127    /// Determines whether this instance greater than.
128    /// </para>
129    /// <para></para>
130    /// </summary>
131    /// <param name="first">
132    /// <para>The first.</para>
133    /// <para></para>
134    /// </param>
135    /// <param name="second">
136    /// <para>The second.</para>
137    /// <para></para>
138    /// </param>
139    /// <returns>
140    /// <para>The bool</para>
141    /// <para></para>
142    /// </returns>
143    [MethodImpl(MethodImplOptions.AggressiveInlining)]
144    protected override bool GreaterThan(uint first, uint second) => first > second;
145
146    /// <summary>
147    /// <para>

```

```

148     /// Determines whether this instance greater or equal than.
149     /// </para>
150     /// <para></para>
151     /// </summary>
152     /// <param name="first">
153     /// <para>The first.</para>
154     /// <para></para>
155     /// </param>
156     /// <param name="second">
157     /// <para>The second.</para>
158     /// <para></para>
159     /// </param>
160     /// <returns>
161     /// <para>The bool</para>
162     /// <para></para>
163     /// </returns>
164     [MethodImpl(MethodImplOptions.AggressiveInlining)]
165     protected override bool GreaterOrEqualThan(uint first, uint second) => first >= second;
166
167     /// <summary>
168     /// <para>
169     /// Determines whether this instance greater or equal than zero.
170     /// </para>
171     /// <para></para>
172     /// </summary>
173     /// <param name="value">
174     /// <para>The value.</para>
175     /// <para></para>
176     /// </param>
177     /// <returns>
178     /// <para>The bool</para>
179     /// <para></para>
180     /// </returns>
181     [MethodImpl(MethodImplOptions.AggressiveInlining)]
182     protected override bool GreaterOrEqualThanZero(uint value) => true; // value >= 0 is
    ↪ always true for uint
183
184     /// <summary>
185     /// <para>
186     /// Determines whether this instance less or equal than zero.
187     /// </para>
188     /// <para></para>
189     /// </summary>
190     /// <param name="value">
191     /// <para>The value.</para>
192     /// <para></para>
193     /// </param>
194     /// <returns>
195     /// <para>The bool</para>
196     /// <para></para>
197     /// </returns>
198     [MethodImpl(MethodImplOptions.AggressiveInlining)]
199     protected override bool LessOrEqualThanZero(uint value) => value == 0U; // value is
    ↪ always >= 0 for uint
200
201     /// <summary>
202     /// <para>
203     /// Determines whether this instance less or equal than.
204     /// </para>
205     /// <para></para>
206     /// </summary>
207     /// <param name="first">
208     /// <para>The first.</para>
209     /// <para></para>
210     /// </param>
211     /// <param name="second">
212     /// <para>The second.</para>
213     /// <para></para>
214     /// </param>
215     /// <returns>
216     /// <para>The bool</para>
217     /// <para></para>
218     /// </returns>
219     [MethodImpl(MethodImplOptions.AggressiveInlining)]
220     protected override bool LessOrEqualThan(uint first, uint second) => first <= second;
221
222     /// <summary>
223     /// <para>

```

```

224     /// Determines whether this instance less than zero.
225     /// </para>
226     /// <para></para>
227     /// </summary>
228     /// <param name="value">
229     /// <para>The value.</para>
230     /// <para></para>
231     /// </param>
232     /// <returns>
233     /// <para>The bool</para>
234     /// <para></para>
235     /// </returns>
236     [MethodImpl(MethodImplOptions.AggressiveInlining)]
237     protected override bool LessThanZero(uint value) => false; // value < 0 is always false
238     ↪ for uint
239
240     /// <summary>
241     /// <para>
242     /// Determines whether this instance less than.
243     /// </para>
244     /// <para></para>
245     /// </summary>
246     /// <param name="first">
247     /// <para>The first.</para>
248     /// <para></para>
249     /// </param>
250     /// <param name="second">
251     /// <para>The second.</para>
252     /// <para></para>
253     /// </param>
254     /// <returns>
255     /// <para>The bool</para>
256     /// <para></para>
257     /// </returns>
258     [MethodImpl(MethodImplOptions.AggressiveInlining)]
259     protected override bool LessThan(uint first, uint second) => first < second;
260
261     /// <summary>
262     /// <para>
263     /// Increments the value.
264     /// </para>
265     /// <para></para>
266     /// </summary>
267     /// <param name="value">
268     /// <para>The value.</para>
269     /// <para></para>
270     /// </param>
271     /// <returns>
272     /// <para>The uint</para>
273     /// <para></para>
274     /// </returns>
275     [MethodImpl(MethodImplOptions.AggressiveInlining)]
276     protected override uint Increment(uint value) => ++value;
277
278     /// <summary>
279     /// <para>
280     /// Decrements the value.
281     /// </para>
282     /// <para></para>
283     /// </summary>
284     /// <param name="value">
285     /// <para>The value.</para>
286     /// <para></para>
287     /// </param>
288     /// <returns>
289     /// <para>The uint</para>
290     /// <para></para>
291     /// </returns>
292     [MethodImpl(MethodImplOptions.AggressiveInlining)]
293     protected override uint Decrement(uint value) => --value;
294
295     /// <summary>
296     /// <para>
297     /// Adds the first.
298     /// </para>
299     /// <para></para>
300     /// </summary>
    /// <param name="first">

```

```

301     /// <para>The first.</para>
302     /// <para></para>
303     /// </param>
304     /// <param name="second">
305     /// <para>The second.</para>
306     /// <para></para>
307     /// </param>
308     /// <returns>
309     /// <para>The uint</para>
310     /// <para></para>
311     /// </returns>
312     [MethodImpl(MethodImplOptions.AggressiveInlining)]
313     protected override uint Add(uint first, uint second) => first + second;
314
315     /// <summary>
316     /// <para>
317     /// Subtracts the first.
318     /// </para>
319     /// <para></para>
320     /// </summary>
321     /// <param name="first">
322     /// <para>The first.</para>
323     /// <para></para>
324     /// </param>
325     /// <param name="second">
326     /// <para>The second.</para>
327     /// <para></para>
328     /// </param>
329     /// <returns>
330     /// <para>The uint</para>
331     /// <para></para>
332     /// </returns>
333     [MethodImpl(MethodImplOptions.AggressiveInlining)]
334     protected override uint Subtract(uint first, uint second) => first - second;
335
336     /// <summary>
337     /// <para>
338     /// Determines whether this instance first is to the left of second.
339     /// </para>
340     /// <para></para>
341     /// </summary>
342     /// <param name="first">
343     /// <para>The first.</para>
344     /// <para></para>
345     /// </param>
346     /// <param name="second">
347     /// <para>The second.</para>
348     /// <para></para>
349     /// </param>
350     /// <returns>
351     /// <para>The bool</para>
352     /// <para></para>
353     /// </returns>
354     [MethodImpl(MethodImplOptions.AggressiveInlining)]
355     protected override bool FirstIsToTheLeftOfSecond(uint first, uint second)
356     {
357         ref var firstLink = ref Links[first];
358         ref var secondLink = ref Links[second];
359         return FirstIsToTheLeftOfSecond(firstLink.Source, firstLink.Target,
360             ↪ secondLink.Source, secondLink.Target);
361     }
362
363     /// <summary>
364     /// <para>
365     /// Determines whether this instance first is to the right of second.
366     /// </para>
367     /// <para></para>
368     /// </summary>
369     /// <param name="first">
370     /// <para>The first.</para>
371     /// <para></para>
372     /// </param>
373     /// <param name="second">
374     /// <para>The second.</para>
375     /// <para></para>
376     /// </param>
377     /// <returns>
378     /// <para>The bool</para>

```

```

378     /// <para></para>
379     /// </returns>
380     [MethodImpl(MethodImplOptions.AggressiveInlining)]
381     protected override bool FirstIsToTheRightOfSecond(uint first, uint second)
382     {
383         ref var firstLink = ref Links[first];
384         ref var secondLink = ref Links[second];
385         return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
386             ↪ secondLink.Source, secondLink.Target);
387     }
388     /// <summary>
389     /// <para>
390     /// Gets the header reference.
391     /// </para>
392     /// <para></para>
393     /// </summary>
394     /// <returns>
395     /// <para>A ref links header of uint</para>
396     /// <para></para>
397     /// </returns>
398     [MethodImpl(MethodImplOptions.AggressiveInlining)]
399     protected override ref LinksHeader<uint> GetHeaderReference() => ref *Header;
400
401     /// <summary>
402     /// <para>
403     /// Gets the link reference using the specified link.
404     /// </para>
405     /// <para></para>
406     /// </summary>
407     /// <param name="link">
408     /// <para>The link.</para>
409     /// <para></para>
410     /// </param>
411     /// <returns>
412     /// <para>A ref raw link of uint</para>
413     /// <para></para>
414     /// </returns>
415     [MethodImpl(MethodImplOptions.AggressiveInlining)]
416     protected override ref RawLink<uint> GetLinkReference(uint link) => ref Links[link];
417 }
418 }

```

## 1.91 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt32LinksSizeBalancedTreeMethodsBase.cs

```

1 using System.Runtime.CompilerServices;
2 using Platform.Data.Doublets.Memory.United.Generic;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6 namespace Platform.Data.Doublets.Memory.United.Specific
7 {
8     /// <summary>
9     /// <para>
10     /// Represents the int 32 links size balanced tree methods base.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="LinksSizeBalancedTreeMethodsBase{uint}"/>
15     public unsafe abstract class UInt32LinksSizeBalancedTreeMethodsBase :
16     ↪ LinksSizeBalancedTreeMethodsBase<uint>
17     {
18         /// <summary>
19         /// <para>
20         /// The links.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         protected new readonly RawLink<uint>* Links;
25
26         /// <summary>
27         /// <para>
28         /// The header.
29         /// </para>
30         /// <para></para>
31         /// </summary>
32         protected new readonly LinksHeader<uint>* Header;
33
34         /// <summary>
35         /// <para>
36         /// Initializes a new <see cref="UInt32LinksSizeBalancedTreeMethodsBase"/> instance.

```



```

35     /// </para>
36     /// <para></para>
37     /// </summary>
38     /// <param name="constants">
39     /// <para>A constants.</para>
40     /// <para></para>
41     /// </param>
42     /// <param name="links">
43     /// <para>A links.</para>
44     /// <para></para>
45     /// </param>
46     /// <param name="header">
47     /// <para>A header.</para>
48     /// <para></para>
49     /// </param>
50     protected UInt32LinksSizeBalancedTreeMethodsBase(LinksConstants<uint> constants,
51     ↪ RawLink<uint>* links, LinksHeader<uint>* header)
52     : base(constants, (byte*)links, (byte*)header)
53     {
54         Links = links;
55         Header = header;
56     }
57     /// <summary>
58     /// <para>
59     /// Gets the zero.
60     /// </para>
61     /// <para></para>
62     /// </summary>
63     /// <returns>
64     /// <para>The uint</para>
65     /// <para></para>
66     /// </returns>
67     [MethodImpl(MethodImplOptions.AggressiveInlining)]
68     protected override uint GetZero() => 0U;
69
70     /// <summary>
71     /// <para>
72     /// Determines whether this instance equal to zero.
73     /// </para>
74     /// <para></para>
75     /// </summary>
76     /// <param name="value">
77     /// <para>The value.</para>
78     /// <para></para>
79     /// </param>
80     /// <returns>
81     /// <para>The bool</para>
82     /// <para></para>
83     /// </returns>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     protected override bool EqualToZero(uint value) => value == 0U;
86
87     /// <summary>
88     /// <para>
89     /// Determines whether this instance are equal.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <param name="first">
94     /// <para>The first.</para>
95     /// <para></para>
96     /// </param>
97     /// <param name="second">
98     /// <para>The second.</para>
99     /// <para></para>
100    /// </param>
101    /// <returns>
102    /// <para>The bool</para>
103    /// <para></para>
104    /// </returns>
105    [MethodImpl(MethodImplOptions.AggressiveInlining)]
106    protected override bool AreEqual(uint first, uint second) => first == second;
107
108    /// <summary>
109    /// <para>
110    /// Determines whether this instance greater than zero.
111    /// </para>

```

```

112     /// <para></para>
113     /// </summary>
114     /// <param name="value">
115     /// <para>The value.</para>
116     /// <para></para>
117     /// </param>
118     /// <returns>
119     /// <para>The bool</para>
120     /// <para></para>
121     /// </returns>
122     [MethodImpl(MethodImplOptions.AggressiveInlining)]
123     protected override bool GreaterThanZero(uint value) => value > 0U;
124
125     /// <summary>
126     /// <para>
127     /// Determines whether this instance greater than.
128     /// </para>
129     /// <para></para>
130     /// </summary>
131     /// <param name="first">
132     /// <para>The first.</para>
133     /// <para></para>
134     /// </param>
135     /// <param name="second">
136     /// <para>The second.</para>
137     /// <para></para>
138     /// </param>
139     /// <returns>
140     /// <para>The bool</para>
141     /// <para></para>
142     /// </returns>
143     [MethodImpl(MethodImplOptions.AggressiveInlining)]
144     protected override bool GreaterThan(uint first, uint second) => first > second;
145
146     /// <summary>
147     /// <para>
148     /// Determines whether this instance greater or equal than.
149     /// </para>
150     /// <para></para>
151     /// </summary>
152     /// <param name="first">
153     /// <para>The first.</para>
154     /// <para></para>
155     /// </param>
156     /// <param name="second">
157     /// <para>The second.</para>
158     /// <para></para>
159     /// </param>
160     /// <returns>
161     /// <para>The bool</para>
162     /// <para></para>
163     /// </returns>
164     [MethodImpl(MethodImplOptions.AggressiveInlining)]
165     protected override bool GreaterOrEqualThan(uint first, uint second) => first >= second;
166
167     /// <summary>
168     /// <para>
169     /// Determines whether this instance greater or equal than zero.
170     /// </para>
171     /// <para></para>
172     /// </summary>
173     /// <param name="value">
174     /// <para>The value.</para>
175     /// <para></para>
176     /// </param>
177     /// <returns>
178     /// <para>The bool</para>
179     /// <para></para>
180     /// </returns>
181     [MethodImpl(MethodImplOptions.AggressiveInlining)]
182     protected override bool GreaterOrEqualThanZero(uint value) => true; // value >= 0 is
    ↪ always true for uint
183
184     /// <summary>
185     /// <para>
186     /// Determines whether this instance less or equal than zero.
187     /// </para>
188     /// <para></para>

```

```

189     /// </summary>
190     /// <param name="value">
191     /// <para>The value.</para>
192     /// <para></para>
193     /// </param>
194     /// <returns>
195     /// <para>The bool</para>
196     /// <para></para>
197     /// </returns>
198     [MethodImpl(MethodImplOptions.AggressiveInlining)]
199     protected override bool LessOrEqualThanZero(uint value) => value == 0U; // value is
    ↪ always >= 0 for uint
200
201     /// <summary>
202     /// <para>
203     /// Determines whether this instance less or equal than.
204     /// </para>
205     /// <para></para>
206     /// </summary>
207     /// <param name="first">
208     /// <para>The first.</para>
209     /// <para></para>
210     /// </param>
211     /// <param name="second">
212     /// <para>The second.</para>
213     /// <para></para>
214     /// </param>
215     /// <returns>
216     /// <para>The bool</para>
217     /// <para></para>
218     /// </returns>
219     [MethodImpl(MethodImplOptions.AggressiveInlining)]
220     protected override bool LessOrEqualThan(uint first, uint second) => first <= second;
221
222     /// <summary>
223     /// <para>
224     /// Determines whether this instance less than zero.
225     /// </para>
226     /// <para></para>
227     /// </summary>
228     /// <param name="value">
229     /// <para>The value.</para>
230     /// <para></para>
231     /// </param>
232     /// <returns>
233     /// <para>The bool</para>
234     /// <para></para>
235     /// </returns>
236     [MethodImpl(MethodImplOptions.AggressiveInlining)]
237     protected override bool LessThanZero(uint value) => false; // value < 0 is always false
    ↪ for uint
238
239     /// <summary>
240     /// <para>
241     /// Determines whether this instance less than.
242     /// </para>
243     /// <para></para>
244     /// </summary>
245     /// <param name="first">
246     /// <para>The first.</para>
247     /// <para></para>
248     /// </param>
249     /// <param name="second">
250     /// <para>The second.</para>
251     /// <para></para>
252     /// </param>
253     /// <returns>
254     /// <para>The bool</para>
255     /// <para></para>
256     /// </returns>
257     [MethodImpl(MethodImplOptions.AggressiveInlining)]
258     protected override bool LessThan(uint first, uint second) => first < second;
259
260     /// <summary>
261     /// <para>
262     /// Increments the value.
263     /// </para>
264     /// <para></para>

```

```

265     /// </summary>
266     /// <param name="value">
267     /// <para>The value.</para>
268     /// <para></para>
269     /// </param>
270     /// <returns>
271     /// <para>The uint</para>
272     /// <para></para>
273     /// </returns>
274     [MethodImpl(MethodImplOptions.AggressiveInlining)]
275     protected override uint Increment(uint value) => ++value;
276
277     /// <summary>
278     /// <para>
279     /// Decrements the value.
280     /// </para>
281     /// <para></para>
282     /// </summary>
283     /// <param name="value">
284     /// <para>The value.</para>
285     /// <para></para>
286     /// </param>
287     /// <returns>
288     /// <para>The uint</para>
289     /// <para></para>
290     /// </returns>
291     [MethodImpl(MethodImplOptions.AggressiveInlining)]
292     protected override uint Decrement(uint value) => --value;
293
294     /// <summary>
295     /// <para>
296     /// Adds the first.
297     /// </para>
298     /// <para></para>
299     /// </summary>
300     /// <param name="first">
301     /// <para>The first.</para>
302     /// <para></para>
303     /// </param>
304     /// <param name="second">
305     /// <para>The second.</para>
306     /// <para></para>
307     /// </param>
308     /// <returns>
309     /// <para>The uint</para>
310     /// <para></para>
311     /// </returns>
312     [MethodImpl(MethodImplOptions.AggressiveInlining)]
313     protected override uint Add(uint first, uint second) => first + second;
314
315     /// <summary>
316     /// <para>
317     /// Subtracts the first.
318     /// </para>
319     /// <para></para>
320     /// </summary>
321     /// <param name="first">
322     /// <para>The first.</para>
323     /// <para></para>
324     /// </param>
325     /// <param name="second">
326     /// <para>The second.</para>
327     /// <para></para>
328     /// </param>
329     /// <returns>
330     /// <para>The uint</para>
331     /// <para></para>
332     /// </returns>
333     [MethodImpl(MethodImplOptions.AggressiveInlining)]
334     protected override uint Subtract(uint first, uint second) => first - second;
335
336     /// <summary>
337     /// <para>
338     /// Determines whether this instance first is to the left of second.
339     /// </para>
340     /// <para></para>
341     /// </summary>
342     /// <param name="first">

```

```

343    /// <para>The first.</para>
344    /// <para></para>
345    /// </param>
346    /// <param name="second">
347    /// <para>The second.</para>
348    /// <para></para>
349    /// </param>
350    /// <returns>
351    /// <para>The bool</para>
352    /// <para></para>
353    /// </returns>
354    [MethodImpl(MethodImplOptions.AggressiveInlining)]
355    protected override bool FirstIsToTheLeftOfSecond(uint first, uint second)
356    {
357        ref var firstLink = ref Links[first];
358        ref var secondLink = ref Links[second];
359        return FirstIsToTheLeftOfSecond(firstLink.Source, firstLink.Target,
360            ↪ secondLink.Source, secondLink.Target);
361    }
362    /// <summary>
363    /// <para>
364    /// Determines whether this instance first is to the right of second.
365    /// </para>
366    /// <para></para>
367    /// </summary>
368    /// <param name="first">
369    /// <para>The first.</para>
370    /// <para></para>
371    /// </param>
372    /// <param name="second">
373    /// <para>The second.</para>
374    /// <para></para>
375    /// </param>
376    /// <returns>
377    /// <para>The bool</para>
378    /// <para></para>
379    /// </returns>
380    [MethodImpl(MethodImplOptions.AggressiveInlining)]
381    protected override bool FirstIsToTheRightOfSecond(uint first, uint second)
382    {
383        ref var firstLink = ref Links[first];
384        ref var secondLink = ref Links[second];
385        return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
386            ↪ secondLink.Source, secondLink.Target);
387    }
388    /// <summary>
389    /// <para>
390    /// Gets the header reference.
391    /// </para>
392    /// <para></para>
393    /// </summary>
394    /// <returns>
395    /// <para>A ref links header of uint</para>
396    /// <para></para>
397    /// </returns>
398    [MethodImpl(MethodImplOptions.AggressiveInlining)]
399    protected override ref LinksHeader<uint> GetHeaderReference() => ref *Header;
400
401    /// <summary>
402    /// <para>
403    /// Gets the link reference using the specified link.
404    /// </para>
405    /// <para></para>
406    /// </summary>
407    /// <param name="link">
408    /// <para>The link.</para>
409    /// <para></para>
410    /// </param>
411    /// <returns>
412    /// <para>A ref raw link of uint</para>
413    /// <para></para>
414    /// </returns>
415    [MethodImpl(MethodImplOptions.AggressiveInlining)]
416    protected override ref RawLink<uint> GetLinkReference(uint link) => ref Links[link];
417 }
418 }

```

1.92 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt32LinksSourcesRecursionlessSizeBalancedTree

```
1  using System.Runtime.CompilerServices;
2
3  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5  namespace Platform.Data.Doublets.Memory.United.Specific
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the int 32 links sources recursionless size balanced tree methods.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="UInt32LinksRecursionlessSizeBalancedTreeMethodsBase"/>
14     public unsafe class UInt32LinksSourcesRecursionlessSizeBalancedTreeMethods :
15         ↳ UInt32LinksRecursionlessSizeBalancedTreeMethodsBase
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see
20         ↳ cref="UInt32LinksSourcesRecursionlessSizeBalancedTreeMethods"/> instance.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         /// <param name="constants">
25         /// <para>A constants.</para>
26         /// <para></para>
27         /// </param>
28         /// <param name="links">
29         /// <para>A links.</para>
30         /// <para></para>
31         /// </param>
32         /// <param name="header">
33         /// <para>A header.</para>
34         /// <para></para>
35         /// </param>
36         public UInt32LinksSourcesRecursionlessSizeBalancedTreeMethods(LinksConstants<uint>
37             ↳ constants, RawLink<uint>* links, LinksHeader<uint>* header) : base(constants, links,
38             ↳ header) { }
39
40         /// <summary>
41         /// <para>
42         /// Gets the left reference using the specified node.
43         /// </para>
44         /// <para></para>
45         /// </summary>
46         /// <param name="node">
47         /// <para>The node.</para>
48         /// <para></para>
49         /// </param>
50         /// <returns>
51         /// <para>The ref uint</para>
52         /// <para></para>
53         /// </returns>
54         [MethodImpl(MethodImplOptions.AggressiveInlining)]
55         protected override ref uint GetLeftReference(uint node) => ref Links[node].LeftAsSource;
56
57         /// <summary>
58         /// <para>
59         /// Gets the right reference using the specified node.
60         /// </para>
61         /// <para></para>
62         /// </summary>
63         /// <param name="node">
64         /// <para>The node.</para>
65         /// <para></para>
66         /// </param>
67         /// <returns>
68         /// <para>The ref uint</para>
69         /// <para></para>
70         /// </returns>
71         [MethodImpl(MethodImplOptions.AggressiveInlining)]
72         protected override ref uint GetRightReference(uint node) => ref
73             ↳ Links[node].RightAsSource;
74
75         /// <summary>
76         /// <para>
77         /// Gets the left using the specified node.
78         /// </para>
79         /// </summary>
80         /// <param name="node">
81         /// <para>The node.</para>
82         /// <para></para>
83         /// </param>
84         /// <returns>
85         /// <para>The ref uint</para>
86         /// <para></para>
87         /// </returns>
88         [MethodImpl(MethodImplOptions.AggressiveInlining)]
89         protected override ref uint GetLeftUsingNode(uint node) => ref
90             ↳ Links[node].LeftUsingNode;
91
92         /// <summary>
93         /// <para>
94         /// Gets the right using the specified node.
95         /// </para>
96         /// </summary>
97         /// <param name="node">
98         /// <para>The node.</para>
99         /// <para></para>
100        /// </param>
101        /// <returns>
102        /// <para>The ref uint</para>
103        /// <para></para>
104        /// </returns>
105        [MethodImpl(MethodImplOptions.AggressiveInlining)]
106        protected override ref uint GetRightUsingNode(uint node) => ref
107            ↳ Links[node].RightUsingNode;
108    }
109 }
```

```

73     /// </para>
74     /// <para></para>
75     /// </summary>
76     /// <param name="node">
77     /// <para>The node.</para>
78     /// <para></para>
79     /// </param>
80     /// <returns>
81     /// <para>The uint</para>
82     /// <para></para>
83     /// </returns>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     protected override uint GetLeft(uint node) => Links[node].LeftAsSource;
86
87     /// <summary>
88     /// <para>
89     /// Gets the right using the specified node.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <param name="node">
94     /// <para>The node.</para>
95     /// <para></para>
96     /// </param>
97     /// <returns>
98     /// <para>The uint</para>
99     /// <para></para>
100    /// </returns>
101    [MethodImpl(MethodImplOptions.AggressiveInlining)]
102    protected override uint GetRight(uint node) => Links[node].RightAsSource;
103
104    /// <summary>
105    /// <para>
106    /// Sets the left using the specified node.
107    /// </para>
108    /// <para></para>
109    /// </summary>
110    /// <param name="node">
111    /// <para>The node.</para>
112    /// <para></para>
113    /// </param>
114    /// <param name="left">
115    /// <para>The left.</para>
116    /// <para></para>
117    /// </param>
118    [MethodImpl(MethodImplOptions.AggressiveInlining)]
119    protected override void SetLeft(uint node, uint left) => Links[node].LeftAsSource = left;
120
121    /// <summary>
122    /// <para>
123    /// Sets the right using the specified node.
124    /// </para>
125    /// <para></para>
126    /// </summary>
127    /// <param name="node">
128    /// <para>The node.</para>
129    /// <para></para>
130    /// </param>
131    /// <param name="right">
132    /// <para>The right.</para>
133    /// <para></para>
134    /// </param>
135    [MethodImpl(MethodImplOptions.AggressiveInlining)]
136    protected override void SetRight(uint node, uint right) => Links[node].RightAsSource =
        ↳ right;
137
138    /// <summary>
139    /// <para>
140    /// Gets the size using the specified node.
141    /// </para>
142    /// <para></para>
143    /// </summary>
144    /// <param name="node">
145    /// <para>The node.</para>
146    /// <para></para>
147    /// </param>
148    /// <returns>
149    /// <para>The uint</para>

```

```

150     /// <para></para>
151     /// </returns>
152     [MethodImpl(MethodImplOptions.AggressiveInlining)]
153     protected override uint GetSize(uint node) => Links[node].SizeAsSource;
154
155     /// <summary>
156     /// <para>
157     /// Sets the size using the specified node.
158     /// </para>
159     /// <para></para>
160     /// </summary>
161     /// <param name="node">
162     /// <para>The node.</para>
163     /// <para></para>
164     /// </param>
165     /// <param name="size">
166     /// <para>The size.</para>
167     /// <para></para>
168     /// </param>
169     [MethodImpl(MethodImplOptions.AggressiveInlining)]
170     protected override void SetSize(uint node, uint size) => Links[node].SizeAsSource = size;
171
172     /// <summary>
173     /// <para>
174     /// Gets the tree root.
175     /// </para>
176     /// <para></para>
177     /// </summary>
178     /// <returns>
179     /// <para>The uint</para>
180     /// <para></para>
181     /// </returns>
182     [MethodImpl(MethodImplOptions.AggressiveInlining)]
183     protected override uint GetTreeRoot() => Header->RootAsSource;
184
185     /// <summary>
186     /// <para>
187     /// Gets the base part value using the specified link.
188     /// </para>
189     /// <para></para>
190     /// </summary>
191     /// <param name="link">
192     /// <para>The link.</para>
193     /// <para></para>
194     /// </param>
195     /// <returns>
196     /// <para>The uint</para>
197     /// <para></para>
198     /// </returns>
199     [MethodImpl(MethodImplOptions.AggressiveInlining)]
200     protected override uint GetBasePartValue(uint link) => Links[link].Source;
201
202     /// <summary>
203     /// <para>
204     /// Determines whether this instance first is to the left of second.
205     /// </para>
206     /// <para></para>
207     /// </summary>
208     /// <param name="firstSource">
209     /// <para>The first source.</para>
210     /// <para></para>
211     /// </param>
212     /// <param name="firstTarget">
213     /// <para>The first target.</para>
214     /// <para></para>
215     /// </param>
216     /// <param name="secondSource">
217     /// <para>The second source.</para>
218     /// <para></para>
219     /// </param>
220     /// <param name="secondTarget">
221     /// <para>The second target.</para>
222     /// <para></para>
223     /// </param>
224     /// <returns>
225     /// <para>The bool</para>
226     /// <para></para>
227     /// </returns>

```



```

228 [MethodImpl(MethodImplOptions.AggressiveInlining)]
229 protected override bool FirstIsToLeftOfSecond(uint firstSource, uint firstTarget,
230     ↪ uint secondSource, uint secondTarget)
231     => firstSource < secondSource || (firstSource == secondSource && firstTarget <
232     ↪ secondTarget);
233
234 /// <summary>
235 /// <para>
236 /// Determines whether this instance first is to the right of second.
237 /// </para>
238 /// </summary>
239 /// <param name="firstSource">
240 /// <para>The first source.</para>
241 /// </param>
242 /// <param name="firstTarget">
243 /// <para>The first target.</para>
244 /// </param>
245 /// <param name="secondSource">
246 /// <para>The second source.</para>
247 /// </param>
248 /// <param name="secondTarget">
249 /// <para>The second target.</para>
250 /// </param>
251 /// <returns>
252 /// <para>The bool</para>
253 /// </returns>
254 [MethodImpl(MethodImplOptions.AggressiveInlining)]
255 protected override bool FirstIsToTheRightOfSecond(uint firstSource, uint firstTarget,
256     ↪ uint secondSource, uint secondTarget)
257     => firstSource > secondSource || (firstSource == secondSource && firstTarget >
258     ↪ secondTarget);
259
260 /// <summary>
261 /// <para>
262 /// Clears the node using the specified node.
263 /// </para>
264 /// </summary>
265 /// <param name="node">
266 /// <para>The node.</para>
267 /// </param>
268 [MethodImpl(MethodImplOptions.AggressiveInlining)]
269 protected override void ClearNode(uint node)
270 {
271     ref var link = ref Links[node];
272     link.LeftAsSource = 0U;
273     link.RightAsSource = 0U;
274     link.SizeAsSource = 0U;
275 }
276
277 }
278
279 }
280
281 }

```

### 1.93 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt32LinksSourcesSizeBalancedTreeMethods.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.Data.Doublets.Memory.United.Specific
6 {
7     /// <summary>
8     /// <para>
9     /// Represents the int 32 links sources size balanced tree methods.
10    /// </para>
11    /// </summary>
12    /// <seealso cref="UInt32LinksSizeBalancedTreeMethodsBase"/>
13    public unsafe class UInt32LinksSourcesSizeBalancedTreeMethods :
14        ↪ UInt32LinksSizeBalancedTreeMethodsBase
15    {
16        /// <summary>
17        /// <para>

```

```

18     /// Initializes a new <see cref="UInt32LinksSourcesSizeBalancedTreeMethods"/> instance.
19     /// </para>
20     /// </summary>
21     /// <param name="constants">
22     /// <para>A constants.</para>
23     /// </param>
24     /// <param name="links">
25     /// <para>A links.</para>
26     /// </param>
27     /// <param name="header">
28     /// <para>A header.</para>
29     /// </param>
30     public UInt32LinksSourcesSizeBalancedTreeMethods(LinksConstants<uint> constants,
31     ↪ RawLink<uint>* links, LinksHeader<uint>* header) : base(constants, links, header) { }
32
33     /// <summary>
34     /// <para>
35     /// Gets the left reference using the specified node.
36     /// </para>
37     /// </summary>
38     /// <param name="node">
39     /// <para>The node.</para>
40     /// </param>
41     /// <returns>
42     /// <para>The ref uint</para>
43     /// </returns>
44     [MethodImpl(MethodImplOptions.AggressiveInlining)]
45     protected override ref uint GetLeftReference(uint node) => ref Links[node].LeftAsSource;
46
47     /// <summary>
48     /// <para>
49     /// Gets the right reference using the specified node.
50     /// </para>
51     /// </summary>
52     /// <param name="node">
53     /// <para>The node.</para>
54     /// </param>
55     /// <returns>
56     /// <para>The ref uint</para>
57     /// </returns>
58     [MethodImpl(MethodImplOptions.AggressiveInlining)]
59     protected override ref uint GetRightReference(uint node) => ref
60     ↪ Links[node].RightAsSource;
61
62     /// <summary>
63     /// <para>
64     /// Gets the left using the specified node.
65     /// </para>
66     /// </summary>
67     /// <param name="node">
68     /// <para>The node.</para>
69     /// </param>
70     /// <returns>
71     /// <para>The uint</para>
72     /// </returns>
73     [MethodImpl(MethodImplOptions.AggressiveInlining)]
74     protected override uint GetLeft(uint node) => Links[node].LeftAsSource;
75
76     /// <summary>
77     /// <para>
78     /// Gets the right using the specified node.
79     /// </para>
80     /// </summary>
81     /// <param name="node">
82     /// <para>The node.</para>
83     /// </param>
84     /// <returns>
85     /// <para>The uint</para>
86     /// </returns>
87     [MethodImpl(MethodImplOptions.AggressiveInlining)]
88     protected override uint GetRight(uint node) => Links[node].RightAsSource;
89
90     /// <summary>
91     /// <para>
92     /// Gets the left using the specified node.
93     /// </para>
94     /// </summary>
95     /// <param name="node">
96     /// <para>The node.</para>
97     /// </param>
98     /// <returns>
99     /// <para>The uint</para>
100    /// </returns>
101    [MethodImpl(MethodImplOptions.AggressiveInlining)]
102    protected override uint GetLeft(uint node) => Links[node].LeftAsSource;
103
104    /// <summary>
105    /// <para>
106    /// Gets the right using the specified node.
107    /// </para>
108    /// </summary>
109    /// <param name="node">
110    /// <para>The node.</para>
111    /// </param>
112    /// <returns>
113    /// <para>The uint</para>
114    /// </returns>
115    [MethodImpl(MethodImplOptions.AggressiveInlining)]
116    protected override uint GetRight(uint node) => Links[node].RightAsSource;

```

```

94    /// <para>The node.</para>
95    /// <para></para>
96    /// </param>
97    /// <returns>
98    /// <para>The uint</para>
99    /// <para></para>
100   /// </returns>
101   [MethodImpl(MethodImplOptions.AggressiveInlining)]
102   protected override uint GetRight(uint node) => Links[node].RightAsSource;
103
104   /// <summary>
105   /// <para>
106   /// Sets the left using the specified node.
107   /// </para>
108   /// <para></para>
109   /// </summary>
110   /// <param name="node">
111   /// <para>The node.</para>
112   /// <para></para>
113   /// </param>
114   /// <param name="left">
115   /// <para>The left.</para>
116   /// <para></para>
117   /// </param>
118   [MethodImpl(MethodImplOptions.AggressiveInlining)]
119   protected override void SetLeft(uint node, uint left) => Links[node].LeftAsSource = left;
120
121   /// <summary>
122   /// <para>
123   /// Sets the right using the specified node.
124   /// </para>
125   /// <para></para>
126   /// </summary>
127   /// <param name="node">
128   /// <para>The node.</para>
129   /// <para></para>
130   /// </param>
131   /// <param name="right">
132   /// <para>The right.</para>
133   /// <para></para>
134   /// </param>
135   [MethodImpl(MethodImplOptions.AggressiveInlining)]
136   protected override void SetRight(uint node, uint right) => Links[node].RightAsSource =
    ↪ right;
137
138   /// <summary>
139   /// <para>
140   /// Gets the size using the specified node.
141   /// </para>
142   /// <para></para>
143   /// </summary>
144   /// <param name="node">
145   /// <para>The node.</para>
146   /// <para></para>
147   /// </param>
148   /// <returns>
149   /// <para>The uint</para>
150   /// <para></para>
151   /// </returns>
152   [MethodImpl(MethodImplOptions.AggressiveInlining)]
153   protected override uint GetSize(uint node) => Links[node].SizeAsSource;
154
155   /// <summary>
156   /// <para>
157   /// Sets the size using the specified node.
158   /// </para>
159   /// <para></para>
160   /// </summary>
161   /// <param name="node">
162   /// <para>The node.</para>
163   /// <para></para>
164   /// </param>
165   /// <param name="size">
166   /// <para>The size.</para>
167   /// <para></para>
168   /// </param>
169   [MethodImpl(MethodImplOptions.AggressiveInlining)]
170   protected override void SetSize(uint node, uint size) => Links[node].SizeAsSource = size;

```

```

171     /// <summary>
172     /// <para>
173     /// Gets the tree root.
174     /// </para>
175     /// </summary>
176     /// <para></para>
177     /// </summary>
178     /// <returns>
179     /// <para>The uint</para>
180     /// <para></para>
181     /// </returns>
182     [MethodImpl(MethodImplOptions.AggressiveInlining)]
183     protected override uint GetTreeRoot() => Header->RootAsSource;
184
185     /// <summary>
186     /// <para>
187     /// Gets the base part value using the specified link.
188     /// </para>
189     /// <para></para>
190     /// </summary>
191     /// <param name="link">
192     /// <para>The link.</para>
193     /// <para></para>
194     /// </param>
195     /// <returns>
196     /// <para>The uint</para>
197     /// <para></para>
198     /// </returns>
199     [MethodImpl(MethodImplOptions.AggressiveInlining)]
200     protected override uint GetBasePartValue(uint link) => Links[link].Source;
201
202     /// <summary>
203     /// <para>
204     /// Determines whether this instance first is to the left of second.
205     /// </para>
206     /// <para></para>
207     /// </summary>
208     /// <param name="firstSource">
209     /// <para>The first source.</para>
210     /// <para></para>
211     /// </param>
212     /// <param name="firstTarget">
213     /// <para>The first target.</para>
214     /// <para></para>
215     /// </param>
216     /// <param name="secondSource">
217     /// <para>The second source.</para>
218     /// <para></para>
219     /// </param>
220     /// <param name="secondTarget">
221     /// <para>The second target.</para>
222     /// <para></para>
223     /// </param>
224     /// <returns>
225     /// <para>The bool</para>
226     /// <para></para>
227     /// </returns>
228     [MethodImpl(MethodImplOptions.AggressiveInlining)]
229     protected override bool FirstIsToLeftOfSecond(uint firstSource, uint firstTarget,
230     ↪ uint secondSource, uint secondTarget)
231     => firstSource < secondSource || (firstSource == secondSource && firstTarget <
232     ↪ secondTarget);
233
234     /// <summary>
235     /// <para>
236     /// Determines whether this instance first is to the right of second.
237     /// </para>
238     /// <para></para>
239     /// </summary>
240     /// <param name="firstSource">
241     /// <para>The first source.</para>
242     /// <para></para>
243     /// </param>
244     /// <param name="firstTarget">
245     /// <para>The first target.</para>
246     /// <para></para>
247     /// </param>
248     /// <param name="secondSource">

```

```

247     /// <para>The second source.</para>
248     /// <para></para>
249     /// </param>
250     /// <param name="secondTarget">
251     /// <para>The second target.</para>
252     /// <para></para>
253     /// </param>
254     /// <returns>
255     /// <para>The bool</para>
256     /// <para></para>
257     /// </returns>
258     [MethodImpl(MethodImplOptions.AggressiveInlining)]
259     protected override bool FirstIsToTheRightOfSecond(uint firstSource, uint firstTarget,
    ↪ uint secondSource, uint secondTarget)
    ↪ => firstSource > secondSource || (firstSource == secondSource && firstTarget >
    ↪ secondTarget);

261
262     /// <summary>
263     /// <para>
264     /// Clears the node using the specified node.
265     /// </para>
266     /// <para></para>
267     /// </summary>
268     /// <param name="node">
269     /// <para>The node.</para>
270     /// <para></para>
271     /// </param>
272     [MethodImpl(MethodImplOptions.AggressiveInlining)]
273     protected override void ClearNode(uint node)
274     {
275         ref var link = ref Links[node];
276         link.LeftAsSource = 0U;
277         link.RightAsSource = 0U;
278         link.SizeAsSource = 0U;
279     }
280 }
281 }

```

#### 1.94 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt32LinksTargetsRecursionlessSizeBalancedTree

```

1 using System.Runtime.CompilerServices;
2
3 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5 namespace Platform.Data.Doublets.Memory.United.Specific
6 {
7     /// <summary>
8     /// <para>
9     /// Represents the int 32 links targets recursionless size balanced tree methods.
10    /// </para>
11    /// <para></para>
12    /// </summary>
13    /// <seealso cref="UInt32LinksRecursionlessSizeBalancedTreeMethodsBase"/>
14    public unsafe class UInt32LinksTargetsRecursionlessSizeBalancedTreeMethods :
    ↪ UInt32LinksRecursionlessSizeBalancedTreeMethodsBase
15    {
16        /// <summary>
17        /// <para>
18        /// Initializes a new <see
19        ↪ cref="UInt32LinksTargetsRecursionlessSizeBalancedTreeMethods"/> instance.
20        /// </para>
21        /// <para></para>
22        /// </summary>
23        /// <param name="constants">
24        /// <para>A constants.</para>
25        /// <para></para>
26        /// </param>
27        /// <param name="links">
28        /// <para>A links.</para>
29        /// <para></para>
30        /// </param>
31        /// <param name="header">
32        /// <para>A header.</para>
33        /// <para></para>
34        /// </param>
35        public UInt32LinksTargetsRecursionlessSizeBalancedTreeMethods(LinksConstants<uint>
    ↪ constants, RawLink<uint>* links, LinksHeader<uint>* header) : base(constants, links,
    ↪ header) { }

```

```

36    /// <summary>
37    /// <para>
38    /// Gets the left reference using the specified node.
39    /// </para>
40    /// <para></para>
41    /// </summary>
42    /// <param name="node">
43    /// <para>The node.</para>
44    /// <para></para>
45    /// </param>
46    /// <returns>
47    /// <para>The ref uint</para>
48    /// <para></para>
49    /// </returns>
50    [MethodImpl(MethodImplOptions.AggressiveInlining)]
51    protected override ref uint GetLeftReference(uint node) => ref Links[node].LeftAsTarget;
52
53    /// <summary>
54    /// <para>
55    /// Gets the right reference using the specified node.
56    /// </para>
57    /// <para></para>
58    /// </summary>
59    /// <param name="node">
60    /// <para>The node.</para>
61    /// <para></para>
62    /// </param>
63    /// <returns>
64    /// <para>The ref uint</para>
65    /// <para></para>
66    /// </returns>
67    [MethodImpl(MethodImplOptions.AggressiveInlining)]
68    protected override ref uint GetRightReference(uint node) => ref
69    ↪ Links[node].RightAsTarget;
70
71    /// <summary>
72    /// <para>
73    /// Gets the left using the specified node.
74    /// </para>
75    /// <para></para>
76    /// </summary>
77    /// <param name="node">
78    /// <para>The node.</para>
79    /// <para></para>
80    /// </param>
81    /// <returns>
82    /// <para>The uint</para>
83    /// <para></para>
84    /// </returns>
85    [MethodImpl(MethodImplOptions.AggressiveInlining)]
86    protected override uint GetLeft(uint node) => Links[node].LeftAsTarget;
87
88    /// <summary>
89    /// <para>
90    /// Gets the right using the specified node.
91    /// </para>
92    /// <para></para>
93    /// </summary>
94    /// <param name="node">
95    /// <para>The node.</para>
96    /// <para></para>
97    /// </param>
98    /// <returns>
99    /// <para>The uint</para>
100    /// <para></para>
101    /// </returns>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    protected override uint GetRight(uint node) => Links[node].RightAsTarget;
104
105    /// <summary>
106    /// <para>
107    /// Sets the left using the specified node.
108    /// </para>
109    /// <para></para>
110    /// </summary>
111    /// <param name="node">
112    /// <para>The node.</para>
113    /// <para></para>

```

```

113     /// </param>
114     /// <param name="left">
115     /// <para>The left.</para>
116     /// <para></para>
117     /// </param>
118     [MethodImpl(MethodImplOptions.AggressiveInlining)]
119     protected override void SetLeft(uint node, uint left) => Links[node].LeftAsTarget = left;
120
121     /// <summary>
122     /// <para>
123     /// Sets the right using the specified node.
124     /// </para>
125     /// <para></para>
126     /// </summary>
127     /// <param name="node">
128     /// <para>The node.</para>
129     /// <para></para>
130     /// </param>
131     /// <param name="right">
132     /// <para>The right.</para>
133     /// <para></para>
134     /// </param>
135     [MethodImpl(MethodImplOptions.AggressiveInlining)]
136     protected override void SetRight(uint node, uint right) => Links[node].RightAsTarget =
        ↪ right;
137
138     /// <summary>
139     /// <para>
140     /// Gets the size using the specified node.
141     /// </para>
142     /// <para></para>
143     /// </summary>
144     /// <param name="node">
145     /// <para>The node.</para>
146     /// <para></para>
147     /// </param>
148     /// <returns>
149     /// <para>The uint</para>
150     /// <para></para>
151     /// </returns>
152     [MethodImpl(MethodImplOptions.AggressiveInlining)]
153     protected override uint GetSize(uint node) => Links[node].SizeAsTarget;
154
155     /// <summary>
156     /// <para>
157     /// Sets the size using the specified node.
158     /// </para>
159     /// <para></para>
160     /// </summary>
161     /// <param name="node">
162     /// <para>The node.</para>
163     /// <para></para>
164     /// </param>
165     /// <param name="size">
166     /// <para>The size.</para>
167     /// <para></para>
168     /// </param>
169     [MethodImpl(MethodImplOptions.AggressiveInlining)]
170     protected override void SetSize(uint node, uint size) => Links[node].SizeAsTarget = size;
171
172     /// <summary>
173     /// <para>
174     /// Gets the tree root.
175     /// </para>
176     /// <para></para>
177     /// </summary>
178     /// <returns>
179     /// <para>The uint</para>
180     /// <para></para>
181     /// </returns>
182     [MethodImpl(MethodImplOptions.AggressiveInlining)]
183     protected override uint GetTreeRoot() => Header->RootAsTarget;
184
185     /// <summary>
186     /// <para>
187     /// Gets the base part value using the specified link.
188     /// </para>
189     /// <para></para>

```

```

190     /// </summary>
191     /// <param name="link">
192     /// <para>The link.</para>
193     /// <para></para>
194     /// </param>
195     /// <returns>
196     /// <para>The uint</para>
197     /// <para></para>
198     /// </returns>
199     [MethodImpl(MethodImplOptions.AggressiveInlining)]
200     protected override uint GetBasePartValue(uint link) => Links[link].Target;
201
202     /// <summary>
203     /// <para>
204     /// <para>Determines whether this instance first is to the left of second.
205     /// </para>
206     /// <para></para>
207     /// </summary>
208     /// <param name="firstSource">
209     /// <para>The first source.</para>
210     /// <para></para>
211     /// </param>
212     /// <param name="firstTarget">
213     /// <para>The first target.</para>
214     /// <para></para>
215     /// </param>
216     /// <param name="secondSource">
217     /// <para>The second source.</para>
218     /// <para></para>
219     /// </param>
220     /// <param name="secondTarget">
221     /// <para>The second target.</para>
222     /// <para></para>
223     /// </param>
224     /// <returns>
225     /// <para>The bool</para>
226     /// <para></para>
227     /// </returns>
228     [MethodImpl(MethodImplOptions.AggressiveInlining)]
229     protected override bool FirstIsToTheLeftOfSecond(uint firstSource, uint firstTarget,
230     ↪ uint secondSource, uint secondTarget)
231     ↪ => firstTarget < secondTarget || (firstTarget == secondTarget && firstSource <
232     ↪ secondSource);
233
234     /// <summary>
235     /// <para>
236     /// <para>Determines whether this instance first is to the right of second.
237     /// </para>
238     /// <para></para>
239     /// </summary>
240     /// <param name="firstSource">
241     /// <para>The first source.</para>
242     /// <para></para>
243     /// </param>
244     /// <param name="firstTarget">
245     /// <para>The first target.</para>
246     /// <para></para>
247     /// </param>
248     /// <param name="secondSource">
249     /// <para>The second source.</para>
250     /// <para></para>
251     /// </param>
252     /// <param name="secondTarget">
253     /// <para>The second target.</para>
254     /// <para></para>
255     /// </param>
256     /// <returns>
257     /// <para>The bool</para>
258     /// <para></para>
259     /// </returns>
260     [MethodImpl(MethodImplOptions.AggressiveInlining)]
261     protected override bool FirstIsToTheRightOfSecond(uint firstSource, uint firstTarget,
262     ↪ uint secondSource, uint secondTarget)
263     ↪ => firstTarget > secondTarget || (firstTarget == secondTarget && firstSource >
264     ↪ secondSource);
265
266     /// <summary>

```



```

263     /// <para>
264     /// Clears the node using the specified node.
265     /// </para>
266     /// <para></para>
267     /// </summary>
268     /// <param name="node">
269     /// <para>The node.</para>
270     /// <para></para>
271     /// </param>
272     [MethodImpl(MethodImplOptions.AggressiveInlining)]
273     protected override void ClearNode(uint node)
274     {
275         ref var link = ref Links[node];
276         link.LeftAsTarget = 0U;
277         link.RightAsTarget = 0U;
278         link.SizeAsTarget = 0U;
279     }
280 }
281 }

```

## 1.95 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt32LinksTargetsSizeBalancedTreeMethods.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.Data.Doublets.Memory.United.Specific
6 {
7     /// <summary>
8     /// <para>
9     /// Represents the int 32 links targets size balanced tree methods.
10    /// </para>
11    /// <para></para>
12    /// </summary>
13    /// <seealso cref="UInt32LinksSizeBalancedTreeMethodsBase"/>
14    public unsafe class UInt32LinksTargetsSizeBalancedTreeMethods :
15        ↳ UInt32LinksSizeBalancedTreeMethodsBase
16    {
17        /// <summary>
18        /// <para>
19        /// Initializes a new <see cref="UInt32LinksTargetsSizeBalancedTreeMethods"/> instance.
20        /// </para>
21        /// <para></para>
22        /// </summary>
23        /// <param name="constants">
24        /// <para>A constants.</para>
25        /// <para></para>
26        /// </param>
27        /// <param name="links">
28        /// <para>A links.</para>
29        /// <para></para>
30        /// </param>
31        /// <param name="header">
32        /// <para>A header.</para>
33        /// <para></para>
34        /// </param>
35        public UInt32LinksTargetsSizeBalancedTreeMethods(LinksConstants<uint> constants,
36            ↳ RawLink<uint>* links, LinksHeader<uint>* header) : base(constants, links, header) { }
37
38        /// <summary>
39        /// <para>
40        /// Gets the left reference using the specified node.
41        /// </para>
42        /// <para></para>
43        /// </summary>
44        /// <param name="node">
45        /// <para>The node.</para>
46        /// <para></para>
47        /// </param>
48        /// <returns>
49        /// <para>The ref uint</para>
50        /// <para></para>
51        /// </returns>
52        [MethodImpl(MethodImplOptions.AggressiveInlining)]
53        protected override ref uint GetLeftReference(uint node) => ref Links[node].LeftAsTarget;
54
55        /// <summary>
56        /// <para>
57        /// Gets the right reference using the specified node.

```

```

56     /// </para>
57     /// <para></para>
58     /// </summary>
59     /// <param name="node">
60     /// <para>The node.</para>
61     /// <para></para>
62     /// </param>
63     /// <returns>
64     /// <para>The ref uint</para>
65     /// <para></para>
66     /// </returns>
67     [MethodImpl(MethodImplOptions.AggressiveInlining)]
68     protected override ref uint GetRightReference(uint node) => ref
        ↳ Links[node].RightAsTarget;

69
70     /// <summary>
71     /// <para>
72     /// Gets the left using the specified node.
73     /// </para>
74     /// <para></para>
75     /// </summary>
76     /// <param name="node">
77     /// <para>The node.</para>
78     /// <para></para>
79     /// </param>
80     /// <returns>
81     /// <para>The uint</para>
82     /// <para></para>
83     /// </returns>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     protected override uint GetLeft(uint node) => Links[node].LeftAsTarget;
86
87     /// <summary>
88     /// <para>
89     /// Gets the right using the specified node.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <param name="node">
94     /// <para>The node.</para>
95     /// <para></para>
96     /// </param>
97     /// <returns>
98     /// <para>The uint</para>
99     /// <para></para>
100    /// </returns>
101    [MethodImpl(MethodImplOptions.AggressiveInlining)]
102    protected override uint GetRight(uint node) => Links[node].RightAsTarget;
103
104    /// <summary>
105    /// <para>
106    /// Sets the left using the specified node.
107    /// </para>
108    /// <para></para>
109    /// </summary>
110    /// <param name="node">
111    /// <para>The node.</para>
112    /// <para></para>
113    /// </param>
114    /// <param name="left">
115    /// <para>The left.</para>
116    /// <para></para>
117    /// </param>
118    [MethodImpl(MethodImplOptions.AggressiveInlining)]
119    protected override void SetLeft(uint node, uint left) => Links[node].LeftAsTarget = left;
120
121    /// <summary>
122    /// <para>
123    /// Sets the right using the specified node.
124    /// </para>
125    /// <para></para>
126    /// </summary>
127    /// <param name="node">
128    /// <para>The node.</para>
129    /// <para></para>
130    /// </param>
131    /// <param name="right">
132    /// <para>The right.</para>

```

```

133     /// <para></para>
134     /// </param>
135     [MethodImpl(MethodImplOptions.AggressiveInlining)]
136     protected override void SetRight(uint node, uint right) => Links[node].RightAsTarget =
        ↳ right;
137
138     /// <summary>
139     /// <para>
140     /// Gets the size using the specified node.
141     /// </para>
142     /// <para></para>
143     /// </summary>
144     /// <param name="node">
145     /// <para>The node.</para>
146     /// <para></para>
147     /// </param>
148     /// <returns>
149     /// <para>The uint</para>
150     /// <para></para>
151     /// </returns>
152     [MethodImpl(MethodImplOptions.AggressiveInlining)]
153     protected override uint GetSize(uint node) => Links[node].SizeAsTarget;
154
155     /// <summary>
156     /// <para>
157     /// Sets the size using the specified node.
158     /// </para>
159     /// <para></para>
160     /// </summary>
161     /// <param name="node">
162     /// <para>The node.</para>
163     /// <para></para>
164     /// </param>
165     /// <param name="size">
166     /// <para>The size.</para>
167     /// <para></para>
168     /// </param>
169     [MethodImpl(MethodImplOptions.AggressiveInlining)]
170     protected override void SetSize(uint node, uint size) => Links[node].SizeAsTarget = size;
171
172     /// <summary>
173     /// <para>
174     /// Gets the tree root.
175     /// </para>
176     /// <para></para>
177     /// </summary>
178     /// <returns>
179     /// <para>The uint</para>
180     /// <para></para>
181     /// </returns>
182     [MethodImpl(MethodImplOptions.AggressiveInlining)]
183     protected override uint GetTreeRoot() => Header->RootAsTarget;
184
185     /// <summary>
186     /// <para>
187     /// Gets the base part value using the specified link.
188     /// </para>
189     /// <para></para>
190     /// </summary>
191     /// <param name="link">
192     /// <para>The link.</para>
193     /// <para></para>
194     /// </param>
195     /// <returns>
196     /// <para>The uint</para>
197     /// <para></para>
198     /// </returns>
199     [MethodImpl(MethodImplOptions.AggressiveInlining)]
200     protected override uint GetBasePartValue(uint link) => Links[link].Target;
201
202     /// <summary>
203     /// <para>
204     /// Determines whether this instance first is to the left of second.
205     /// </para>
206     /// <para></para>
207     /// </summary>
208     /// <param name="firstSource">
209     /// <para>The first source.</para>

```

```

210    /// <para></para>
211    /// </param>
212    /// <param name="firstTarget">
213    /// <para>The first target.</para>
214    /// <para></para>
215    /// </param>
216    /// <param name="secondSource">
217    /// <para>The second source.</para>
218    /// <para></para>
219    /// </param>
220    /// <param name="secondTarget">
221    /// <para>The second target.</para>
222    /// <para></para>
223    /// </param>
224    /// <returns>
225    /// <para>The bool</para>
226    /// <para></para>
227    /// </returns>
228    [MethodImpl(MethodImplOptions.AggressiveInlining)]
229    protected override bool FirstIsToLeftOfSecond(uint firstSource, uint firstTarget,
    ↪ uint secondSource, uint secondTarget)
230        => firstTarget < secondTarget || (firstTarget == secondTarget && firstSource <
    ↪ secondSource);
231
232    /// <summary>
233    /// <para>
234    /// Determines whether this instance first is to the right of second.
235    /// </para>
236    /// <para></para>
237    /// </summary>
238    /// <param name="firstSource">
239    /// <para>The first source.</para>
240    /// <para></para>
241    /// </param>
242    /// <param name="firstTarget">
243    /// <para>The first target.</para>
244    /// <para></para>
245    /// </param>
246    /// <param name="secondSource">
247    /// <para>The second source.</para>
248    /// <para></para>
249    /// </param>
250    /// <param name="secondTarget">
251    /// <para>The second target.</para>
252    /// <para></para>
253    /// </param>
254    /// <returns>
255    /// <para>The bool</para>
256    /// <para></para>
257    /// </returns>
258    [MethodImpl(MethodImplOptions.AggressiveInlining)]
259    protected override bool FirstIsToTheRightOfSecond(uint firstSource, uint firstTarget,
    ↪ uint secondSource, uint secondTarget)
260        => firstTarget > secondTarget || (firstTarget == secondTarget && firstSource >
    ↪ secondSource);
261
262    /// <summary>
263    /// <para>
264    /// Clears the node using the specified node.
265    /// </para>
266    /// <para></para>
267    /// </summary>
268    /// <param name="node">
269    /// <para>The node.</para>
270    /// <para></para>
271    /// </param>
272    [MethodImpl(MethodImplOptions.AggressiveInlining)]
273    protected override void ClearNode(uint node)
274    {
275        ref var link = ref Links[node];
276        link.LeftAsTarget = 0U;
277        link.RightAsTarget = 0U;
278        link.SizeAsTarget = 0U;
279    }
280 }
281 }

```

1.96 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt32UnitedMemoryLinks.cs

```
1 using System;
2 using System.Runtime.CompilerServices;
3 using Platform.Memory;
4 using Platform.Singletons;
5 using Platform.Data.Doublets.Memory.United.Generic;
6
7 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
8
9 namespace Platform.Data.Doublets.Memory.United.Specific
10 {
11     /// <summary>
12     /// <para>Represents a low-level implementation of direct access to resizable memory, for
13     ///   ↳ organizing the storage of links with addresses represented as <see cref="uint" />.</para>
14     /// <para>Представляет низкоуровневую реализация прямого доступа к памяти с переменным
15     ///   ↳ размером, для организации хранения связей с адресами представленными в виде <see
16     ///   ↳ cref="uint"/>.</para>
17     /// </summary>
18     public unsafe class UInt32UnitedMemoryLinks : UnitedMemoryLinksBase<uint>
19     {
20         /// <summary>
21         /// <para>
22         ///   The create source tree methods.
23         /// </para>
24         /// <para></para>
25         /// </summary>
26         private readonly Func<ILinksTreeMethods<uint>> _createSourceTreeMethods;
27         /// <summary>
28         /// <para>
29         ///   The create target tree methods.
30         /// </para>
31         /// <para></para>
32         /// </summary>
33         private readonly Func<ILinksTreeMethods<uint>> _createTargetTreeMethods;
34         /// <summary>
35         /// <para>
36         ///   The header.
37         /// </para>
38         /// <para></para>
39         /// </summary>
40         private LinksHeader<uint>* _header;
41         /// <summary>
42         /// <para>
43         ///   The links.
44         /// </para>
45         /// <para></para>
46         /// </summary>
47         private RawLink<uint>* _links;
48
49         /// <summary>
50         /// <para>
51         ///   Initializes a new <see cref="UInt32UnitedMemoryLinks"/> instance.
52         /// </para>
53         /// <para></para>
54         /// </summary>
55         /// <param name="address">
56         /// <para>A address.</para>
57         /// <para></para>
58         /// </param>
59         [MethodImpl(MethodImplOptions.AggressiveInlining)]
60         public UInt32UnitedMemoryLinks(string address) : this(address, DefaultLinksSizeStep) { }
61
62         /// <summary>
63         /// <para>Создаёт экземпляр базы данных Links в файле по указанному адресу, с указанным
64         ///   ↳ минимальным шагом расширения базы данных.
65         /// </para>
66         /// </summary>
67         /// <param name="address">Полный путь к файлу базы данных.</param>
68         /// <param name="memoryReservationStep">Минимальный шаг расширения базы данных в
69         ///   ↳ байтах.</param>
70         [MethodImpl(MethodImplOptions.AggressiveInlining)]
71         public UInt32UnitedMemoryLinks(string address, long memoryReservationStep) : this(new
72         ///   ↳ FileMappedResizableDirectMemory(address, memoryReservationStep),
73         ///   ↳ memoryReservationStep) { }
74
75         /// <summary>
76         /// <para>
77         ///   Initializes a new <see cref="UInt32UnitedMemoryLinks"/> instance.
78         /// </para>
79     }
```

```

71     /// <para></para>
72     /// </summary>
73     /// <param name="memory">
74     /// <para>A memory.</para>
75     /// <para></para>
76     /// </param>
77     [MethodImpl(MethodImplOptions.AggressiveInlining)]
78     public UInt32UnitedMemoryLinks(IResizableDirectMemory memory) : this(memory,
79         ↪ DefaultLinksSizeStep) { }
80
81     /// <summary>
82     /// <para>
83     /// Initializes a new <see cref="UInt32UnitedMemoryLinks"/> instance.
84     /// </para>
85     /// <para></para>
86     /// </summary>
87     /// <param name="memory">
88     /// <para>A memory.</para>
89     /// <para></para>
90     /// </param>
91     /// <param name="memoryReservationStep">
92     /// <para>A memory reservation step.</para>
93     /// <para></para>
94     /// </param>
95     [MethodImpl(MethodImplOptions.AggressiveInlining)]
96     public UInt32UnitedMemoryLinks(IResizableDirectMemory memory, long
97         ↪ memoryReservationStep) : this(memory, memoryReservationStep,
98         ↪ Default<LinksConstants<uint>>.Instance, IndexTreeType.Default) { }
99
100     /// <summary>
101     /// <para>
102     /// Initializes a new <see cref="UInt32UnitedMemoryLinks"/> instance.
103     /// </para>
104     /// <para></para>
105     /// </summary>
106     /// <param name="memory">
107     /// <para>A memory.</para>
108     /// <para></para>
109     /// </param>
110     /// <param name="memoryReservationStep">
111     /// <para>A memory reservation step.</para>
112     /// <para></para>
113     /// </param>
114     /// <param name="constants">
115     /// <para>A constants.</para>
116     /// <para></para>
117     /// </param>
118     /// <param name="indexTreeType">
119     /// <para>A index tree type.</para>
120     /// <para></para>
121     /// </param>
122     [MethodImpl(MethodImplOptions.AggressiveInlining)]
123     public UInt32UnitedMemoryLinks(IResizableDirectMemory memory, long
124         ↪ memoryReservationStep, LinksConstants<uint> constants, IndexTreeType indexTreeType)
125         : base(memory, memoryReservationStep, constants)
126     {
127         if (indexTreeType == IndexTreeType.SizeBalancedTree)
128         {
129             _createSourceTreeMethods = () => new
130                 ↪ UInt32LinksSourcesSizeBalancedTreeMethods(Constants, _links, _header);
131             _createTargetTreeMethods = () => new
132                 ↪ UInt32LinksTargetsSizeBalancedTreeMethods(Constants, _links, _header);
133         }
134         else
135         {
136             _createSourceTreeMethods = () => new
137                 ↪ UInt32LinksSourcesRecursionlessSizeBalancedTreeMethods(Constants, _links,
138                 ↪ _header);
139             _createTargetTreeMethods = () => new
140                 ↪ UInt32LinksTargetsRecursionlessSizeBalancedTreeMethods(Constants, _links,
141                 ↪ _header);
142         }
143         Init(memory, memoryReservationStep);
144     }
145
146     /// <summary>
147     /// <para>

```

```

137 /// Sets the pointers using the specified memory.
138 /// </para>
139 /// <para></para>
140 /// </summary>
141 /// <param name="memory">
142 /// <para>The memory.</para>
143 /// <para></para>
144 /// </param>
145 [MethodImpl(MethodImplOptions.AggressiveInlining)]
146 protected override void SetPointers(IResizableDirectMemory memory)
147 {
148     _header = (LinksHeader<uint>*)memory.Pointer;
149     _links = (RawLink<uint>*)memory.Pointer;
150     SourcesTreeMethods = _createSourceTreeMethods();
151     TargetsTreeMethods = _createTargetTreeMethods();
152     UnusedLinksListMethods = new UInt32UnusedLinksListMethods(_links, _header);
153 }
154
155 /// <summary>
156 /// <para>
157 /// Resets the pointers.
158 /// </para>
159 /// <para></para>
160 /// </summary>
161 [MethodImpl(MethodImplOptions.AggressiveInlining)]
162 protected override void ResetPointers()
163 {
164     base.ResetPointers();
165     _links = null;
166     _header = null;
167 }
168
169 /// <summary>
170 /// <para>
171 /// Gets the header reference.
172 /// </para>
173 /// <para></para>
174 /// </summary>
175 /// <returns>
176 /// <para>A ref links header of uint</para>
177 /// <para></para>
178 /// </returns>
179 [MethodImpl(MethodImplOptions.AggressiveInlining)]
180 protected override ref LinksHeader<uint> GetHeaderReference() => ref *_header;
181
182 /// <summary>
183 /// <para>
184 /// Gets the link reference using the specified link index.
185 /// </para>
186 /// <para></para>
187 /// </summary>
188 /// <param name="linkIndex">
189 /// <para>The link index.</para>
190 /// <para></para>
191 /// </param>
192 /// <returns>
193 /// <para>A ref raw link of uint</para>
194 /// <para></para>
195 /// </returns>
196 [MethodImpl(MethodImplOptions.AggressiveInlining)]
197 protected override ref RawLink<uint> GetLinkReference(uint linkIndex) => ref
    ↪ _links[linkIndex];
198
199 /// <summary>
200 /// <para>
201 /// Determines whether this instance are equal.
202 /// </para>
203 /// <para></para>
204 /// </summary>
205 /// <param name="first">
206 /// <para>The first.</para>
207 /// <para></para>
208 /// </param>
209 /// <param name="second">
210 /// <para>The second.</para>
211 /// <para></para>
212 /// </param>
213 /// </returns>

```

```

214    /// <para>The bool</para>
215    /// <para></para>
216    /// </returns>
217    [MethodImpl(MethodImplOptions.AggressiveInlining)]
218    protected override bool AreEqual(uint first, uint second) => first == second;
219
220    /// <summary>
221    /// <para>
222    /// Determines whether this instance less than.
223    /// </para>
224    /// <para></para>
225    /// </summary>
226    /// <param name="first">
227    /// <para>The first.</para>
228    /// <para></para>
229    /// </param>
230    /// <param name="second">
231    /// <para>The second.</para>
232    /// <para></para>
233    /// </param>
234    /// <returns>
235    /// <para>The bool</para>
236    /// <para></para>
237    /// </returns>
238    [MethodImpl(MethodImplOptions.AggressiveInlining)]
239    protected override bool LessThan(uint first, uint second) => first < second;
240
241    /// <summary>
242    /// <para>
243    /// Determines whether this instance less or equal than.
244    /// </para>
245    /// <para></para>
246    /// </summary>
247    /// <param name="first">
248    /// <para>The first.</para>
249    /// <para></para>
250    /// </param>
251    /// <param name="second">
252    /// <para>The second.</para>
253    /// <para></para>
254    /// </param>
255    /// <returns>
256    /// <para>The bool</para>
257    /// <para></para>
258    /// </returns>
259    [MethodImpl(MethodImplOptions.AggressiveInlining)]
260    protected override bool LessOrEqualThan(uint first, uint second) => first <= second;
261
262    /// <summary>
263    /// <para>
264    /// Determines whether this instance greater than.
265    /// </para>
266    /// <para></para>
267    /// </summary>
268    /// <param name="first">
269    /// <para>The first.</para>
270    /// <para></para>
271    /// </param>
272    /// <param name="second">
273    /// <para>The second.</para>
274    /// <para></para>
275    /// </param>
276    /// <returns>
277    /// <para>The bool</para>
278    /// <para></para>
279    /// </returns>
280    [MethodImpl(MethodImplOptions.AggressiveInlining)]
281    protected override bool GreaterThan(uint first, uint second) => first > second;
282
283    /// <summary>
284    /// <para>
285    /// Determines whether this instance greater or equal than.
286    /// </para>
287    /// <para></para>
288    /// </summary>
289    /// <param name="first">
290    /// <para>The first.</para>
291    /// <para></para>

```



```

292     /// </param>
293     /// <param name="second">
294     /// <para>The second.</para>
295     /// <para></para>
296     /// </param>
297     /// <returns>
298     /// <para>The bool</para>
299     /// <para></para>
300     /// </returns>
301     [MethodImpl(MethodImplOptions.AggressiveInlining)]
302     protected override bool GreaterOrEqualThan(uint first, uint second) => first >= second;
303
304     /// <summary>
305     /// <para>
306     /// Gets the zero.
307     /// </para>
308     /// <para></para>
309     /// </summary>
310     /// <returns>
311     /// <para>The uint</para>
312     /// <para></para>
313     /// </returns>
314     [MethodImpl(MethodImplOptions.AggressiveInlining)]
315     protected override uint GetZero() => 0U;
316
317     /// <summary>
318     /// <para>
319     /// Gets the one.
320     /// </para>
321     /// <para></para>
322     /// </summary>
323     /// <returns>
324     /// <para>The uint</para>
325     /// <para></para>
326     /// </returns>
327     [MethodImpl(MethodImplOptions.AggressiveInlining)]
328     protected override uint GetOne() => 1U;
329
330     /// <summary>
331     /// <para>
332     /// Converts the to int 64 using the specified value.
333     /// </para>
334     /// <para></para>
335     /// </summary>
336     /// <param name="value">
337     /// <para>The value.</para>
338     /// <para></para>
339     /// </param>
340     /// <returns>
341     /// <para>The long</para>
342     /// <para></para>
343     /// </returns>
344     [MethodImpl(MethodImplOptions.AggressiveInlining)]
345     protected override long ConvertToInt64(uint value) => (long)value;
346
347     /// <summary>
348     /// <para>
349     /// Converts the to address using the specified value.
350     /// </para>
351     /// <para></para>
352     /// </summary>
353     /// <param name="value">
354     /// <para>The value.</para>
355     /// <para></para>
356     /// </param>
357     /// <returns>
358     /// <para>The uint</para>
359     /// <para></para>
360     /// </returns>
361     [MethodImpl(MethodImplOptions.AggressiveInlining)]
362     protected override uint ConvertToAddress(long value) => (uint)value;
363
364     /// <summary>
365     /// <para>
366     /// Adds the first.
367     /// </para>
368     /// <para></para>
369     /// </summary>

```

```

370     /// <param name="first">
371     /// <para>The first.</para>
372     /// <para></para>
373     /// </param>
374     /// <param name="second">
375     /// <para>The second.</para>
376     /// <para></para>
377     /// </param>
378     /// <returns>
379     /// <para>The uint</para>
380     /// <para></para>
381     /// </returns>
382     [MethodImpl(MethodImplOptions.AggressiveInlining)]
383     protected override uint Add(uint first, uint second) => first + second;
384
385     /// <summary>
386     /// <para>
387     /// Subtracts the first.
388     /// </para>
389     /// <para></para>
390     /// </summary>
391     /// <param name="first">
392     /// <para>The first.</para>
393     /// <para></para>
394     /// </param>
395     /// <param name="second">
396     /// <para>The second.</para>
397     /// <para></para>
398     /// </param>
399     /// <returns>
400     /// <para>The uint</para>
401     /// <para></para>
402     /// </returns>
403     [MethodImpl(MethodImplOptions.AggressiveInlining)]
404     protected override uint Subtract(uint first, uint second) => first - second;
405
406     /// <summary>
407     /// <para>
408     /// Increments the link.
409     /// </para>
410     /// <para></para>
411     /// </summary>
412     /// <param name="link">
413     /// <para>The link.</para>
414     /// <para></para>
415     /// </param>
416     /// <returns>
417     /// <para>The uint</para>
418     /// <para></para>
419     /// </returns>
420     [MethodImpl(MethodImplOptions.AggressiveInlining)]
421     protected override uint Increment(uint link) => ++link;
422
423     /// <summary>
424     /// <para>
425     /// Decrements the link.
426     /// </para>
427     /// <para></para>
428     /// </summary>
429     /// <param name="link">
430     /// <para>The link.</para>
431     /// <para></para>
432     /// </param>
433     /// <returns>
434     /// <para>The uint</para>
435     /// <para></para>
436     /// </returns>
437     [MethodImpl(MethodImplOptions.AggressiveInlining)]
438     protected override uint Decrement(uint link) => --link;
439 }
440 }

```

## 1.97 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt32UnusedLinksListMethods.cs

```

1 using System.Runtime.CompilerServices;
2 using Platform.Data.Doublets.Memory.United.Generic;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5

```

```

6 namespace Platform.Data.Doublets.Memory.United.Specific
7 {
8     /// <summary>
9     /// <para>
10    /// Represents the int 32 unused links list methods.
11    /// </para>
12    /// <para></para>
13    /// </summary>
14    /// <seealso cref="UnusedLinksListMethods{uint}"/>
15    public unsafe class UInt32UnusedLinksListMethods : UnusedLinksListMethods<uint>
16    {
17        /// <summary>
18        /// <para>
19        /// The links.
20        /// </para>
21        /// <para></para>
22        /// </summary>
23        private readonly RawLink<uint>* _links;
24        /// <summary>
25        /// <para>
26        /// The header.
27        /// </para>
28        /// <para></para>
29        /// </summary>
30        private readonly LinksHeader<uint>* _header;
31
32        /// <summary>
33        /// <para>
34        /// Initializes a new <see cref="UInt32UnusedLinksListMethods"/> instance.
35        /// </para>
36        /// <para></para>
37        /// </summary>
38        /// <param name="links">
39        /// <para>A links.</para>
40        /// <para></para>
41        /// </param>
42        /// <param name="header">
43        /// <para>A header.</para>
44        /// <para></para>
45        /// </param>
46        [MethodImpl(MethodImplOptions.AggressiveInlining)]
47        public UInt32UnusedLinksListMethods(RawLink<uint>* links, LinksHeader<uint>* header)
48            : base((byte*)links, (byte*)header)
49        {
50            _links = links;
51            _header = header;
52        }
53
54        /// <summary>
55        /// <para>
56        /// Gets the link reference using the specified link.
57        /// </para>
58        /// <para></para>
59        /// </summary>
60        /// <param name="link">
61        /// <para>The link.</para>
62        /// <para></para>
63        /// </param>
64        /// <returns>
65        /// <para>A ref raw link of uint</para>
66        /// <para></para>
67        /// </returns>
68        [MethodImpl(MethodImplOptions.AggressiveInlining)]
69        protected override ref RawLink<uint> GetLinkReference(uint link) => ref _links[link];
70
71        /// <summary>
72        /// <para>
73        /// Gets the header reference.
74        /// </para>
75        /// <para></para>
76        /// </summary>
77        /// <returns>
78        /// <para>A ref links header of uint</para>
79        /// <para></para>
80        /// </returns>
81        [MethodImpl(MethodImplOptions.AggressiveInlining)]
82        protected override ref LinksHeader<uint> GetHeaderReference() => ref *_header;
83    }

```

84 }

1.98 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt64LinksAvlBalancedTreeMethodsBase.cs

```
1 using System.Runtime.CompilerServices;
2 using Platform.Data.Doublets.Memory.United.Generic;
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.Data.Doublets.Memory.United.Specific
8 {
9     /// <summary>
10    /// <para>
11    /// Represents the int 64 links avl balanced tree methods base.
12    /// </para>
13    /// <para></para>
14    /// </summary>
15    /// <seealso cref="LinksAvlBalancedTreeMethodsBase{ulong}"/>
16    public unsafe abstract class UInt64LinksAvlBalancedTreeMethodsBase :
17    ↪ LinksAvlBalancedTreeMethodsBase<ulong>
18    {
19        /// <summary>
20        /// <para>
21        /// The links.
22        /// </para>
23        /// <para></para>
24        /// </summary>
25        protected new readonly RawLink<ulong>* Links;
26        /// <summary>
27        /// <para>
28        /// The header.
29        /// </para>
30        /// <para></para>
31        /// </summary>
32        protected new readonly LinksHeader<ulong>* Header;
33
34        /// <summary>
35        /// <para>
36        /// Initializes a new <see cref="UInt64LinksAvlBalancedTreeMethodsBase"/> instance.
37        /// </para>
38        /// <para></para>
39        /// </summary>
40        /// <param name="constants">
41        /// <para>A constants.</para>
42        /// <para></para>
43        /// </param>
44        /// <param name="links">
45        /// <para>A links.</para>
46        /// <para></para>
47        /// </param>
48        /// <param name="header">
49        /// <para>A header.</para>
50        /// <para></para>
51        /// </param>
52        protected UInt64LinksAvlBalancedTreeMethodsBase(LinksConstants<ulong> constants,
53    ↪ RawLink<ulong>* links, LinksHeader<ulong>* header)
54        : base(constants, (byte*)links, (byte*)header)
55        {
56            Links = links;
57            Header = header;
58        }
59
60        /// <summary>
61        /// <para>
62        /// Gets the zero.
63        /// </para>
64        /// <para></para>
65        /// </summary>
66        /// <returns>
67        /// <para>The ulong</para>
68        /// <para></para>
69        /// </returns>
70        [MethodImpl(MethodImplOptions.AggressiveInlining)]
71        protected override ulong GetZero() => 0UL;
72
73        /// <summary>
74        /// <para>
75        /// Determines whether this instance equal to zero.
76        /// </para>
```

```

75     /// <para></para>
76     /// </summary>
77     /// <param name="value">
78     /// <para>The value.</para>
79     /// <para></para>
80     /// </param>
81     /// <returns>
82     /// <para>The bool</para>
83     /// <para></para>
84     /// </returns>
85     [MethodImpl(MethodImplOptions.AggressiveInlining)]
86     protected override bool EqualToZero(ulong value) => value == 0UL;
87
88     /// <summary>
89     /// <para>
90     /// Determines whether this instance are equal.
91     /// </para>
92     /// <para></para>
93     /// </summary>
94     /// <param name="first">
95     /// <para>The first.</para>
96     /// <para></para>
97     /// </param>
98     /// <param name="second">
99     /// <para>The second.</para>
100    /// <para></para>
101    /// </param>
102    /// <returns>
103    /// <para>The bool</para>
104    /// <para></para>
105    /// </returns>
106    [MethodImpl(MethodImplOptions.AggressiveInlining)]
107    protected override bool AreEqual(ulong first, ulong second) => first == second;
108
109    /// <summary>
110    /// <para>
111    /// Determines whether this instance greater than zero.
112    /// </para>
113    /// <para></para>
114    /// </summary>
115    /// <param name="value">
116    /// <para>The value.</para>
117    /// <para></para>
118    /// </param>
119    /// <returns>
120    /// <para>The bool</para>
121    /// <para></para>
122    /// </returns>
123    [MethodImpl(MethodImplOptions.AggressiveInlining)]
124    protected override bool GreaterThanZero(ulong value) => value > 0UL;
125
126    /// <summary>
127    /// <para>
128    /// Determines whether this instance greater than.
129    /// </para>
130    /// <para></para>
131    /// </summary>
132    /// <param name="first">
133    /// <para>The first.</para>
134    /// <para></para>
135    /// </param>
136    /// <param name="second">
137    /// <para>The second.</para>
138    /// <para></para>
139    /// </param>
140    /// <returns>
141    /// <para>The bool</para>
142    /// <para></para>
143    /// </returns>
144    [MethodImpl(MethodImplOptions.AggressiveInlining)]
145    protected override bool GreaterThan(ulong first, ulong second) => first > second;
146
147    /// <summary>
148    /// <para>
149    /// Determines whether this instance greater or equal than.
150    /// </para>
151    /// <para></para>
152    /// </summary>

```

```

153     /// <param name="first">
154     /// <para>The first.</para>
155     /// <para></para>
156     /// </param>
157     /// <param name="second">
158     /// <para>The second.</para>
159     /// <para></para>
160     /// </param>
161     /// <returns>
162     /// <para>The bool</para>
163     /// <para></para>
164     /// </returns>
165     [MethodImpl(MethodImplOptions.AggressiveInlining)]
166     protected override bool GreaterOrEqualThan(ulong first, ulong second) => first >= second;
167
168     /// <summary>
169     /// <para>
170     /// Determines whether this instance greater or equal than zero.
171     /// </para>
172     /// <para></para>
173     /// </summary>
174     /// <param name="value">
175     /// <para>The value.</para>
176     /// <para></para>
177     /// </param>
178     /// <returns>
179     /// <para>The bool</para>
180     /// <para></para>
181     /// </returns>
182     [MethodImpl(MethodImplOptions.AggressiveInlining)]
183     protected override bool GreaterOrEqualThanZero(ulong value) => true; // value >= 0 is
    ↪ always true for ulong
184
185     /// <summary>
186     /// <para>
187     /// Determines whether this instance less or equal than zero.
188     /// </para>
189     /// <para></para>
190     /// </summary>
191     /// <param name="value">
192     /// <para>The value.</para>
193     /// <para></para>
194     /// </param>
195     /// <returns>
196     /// <para>The bool</para>
197     /// <para></para>
198     /// </returns>
199     [MethodImpl(MethodImplOptions.AggressiveInlining)]
200     protected override bool LessOrEqualThanZero(ulong value) => value == 0UL; // value is
    ↪ always >= 0 for ulong
201
202     /// <summary>
203     /// <para>
204     /// Determines whether this instance less or equal than.
205     /// </para>
206     /// <para></para>
207     /// </summary>
208     /// <param name="first">
209     /// <para>The first.</para>
210     /// <para></para>
211     /// </param>
212     /// <param name="second">
213     /// <para>The second.</para>
214     /// <para></para>
215     /// </param>
216     /// <returns>
217     /// <para>The bool</para>
218     /// <para></para>
219     /// </returns>
220     [MethodImpl(MethodImplOptions.AggressiveInlining)]
221     protected override bool LessOrEqualThan(ulong first, ulong second) => first <= second;
222
223     /// <summary>
224     /// <para>
225     /// Determines whether this instance less than zero.
226     /// </para>
227     /// <para></para>
228     /// </summary>

```

```

229     /// <param name="value">
230     /// <para>The value.</para>
231     /// <para></para>
232     /// </param>
233     /// <returns>
234     /// <para>The bool</para>
235     /// <para></para>
236     /// </returns>
237     [MethodImpl(MethodImplOptions.AggressiveInlining)]
238     protected override bool LessThanZero(ulong value) => false; // value < 0 is always false
    ↪   for ulong
239
240     /// <summary>
241     /// <para>
242     /// Determines whether this instance less than.
243     /// </para>
244     /// <para></para>
245     /// </summary>
246     /// <param name="first">
247     /// <para>The first.</para>
248     /// <para></para>
249     /// </param>
250     /// <param name="second">
251     /// <para>The second.</para>
252     /// <para></para>
253     /// </param>
254     /// <returns>
255     /// <para>The bool</para>
256     /// <para></para>
257     /// </returns>
258     [MethodImpl(MethodImplOptions.AggressiveInlining)]
259     protected override bool LessThan(ulong first, ulong second) => first < second;
260
261     /// <summary>
262     /// <para>
263     /// Increments the value.
264     /// </para>
265     /// <para></para>
266     /// </summary>
267     /// <param name="value">
268     /// <para>The value.</para>
269     /// <para></para>
270     /// </param>
271     /// <returns>
272     /// <para>The ulong</para>
273     /// <para></para>
274     /// </returns>
275     [MethodImpl(MethodImplOptions.AggressiveInlining)]
276     protected override ulong Increment(ulong value) => ++value;
277
278     /// <summary>
279     /// <para>
280     /// Decrements the value.
281     /// </para>
282     /// <para></para>
283     /// </summary>
284     /// <param name="value">
285     /// <para>The value.</para>
286     /// <para></para>
287     /// </param>
288     /// <returns>
289     /// <para>The ulong</para>
290     /// <para></para>
291     /// </returns>
292     [MethodImpl(MethodImplOptions.AggressiveInlining)]
293     protected override ulong Decrement(ulong value) => --value;
294
295     /// <summary>
296     /// <para>
297     /// Adds the first.
298     /// </para>
299     /// <para></para>
300     /// </summary>
301     /// <param name="first">
302     /// <para>The first.</para>
303     /// <para></para>
304     /// </param>
305     /// <param name="second">

```

```

306    /// <para>The second.</para>
307    /// <para></para>
308    /// </param>
309    /// <returns>
310    /// <para>The ulong</para>
311    /// <para></para>
312    /// </returns>
313    [MethodImpl(MethodImplOptions.AggressiveInlining)]
314    protected override ulong Add(ulong first, ulong second) => first + second;
315
316    /// <summary>
317    /// <para>
318    /// Subtracts the first.
319    /// </para>
320    /// <para></para>
321    /// </summary>
322    /// <param name="first">
323    /// <para>The first.</para>
324    /// <para></para>
325    /// </param>
326    /// <param name="second">
327    /// <para>The second.</para>
328    /// <para></para>
329    /// </param>
330    /// <returns>
331    /// <para>The ulong</para>
332    /// <para></para>
333    /// </returns>
334    [MethodImpl(MethodImplOptions.AggressiveInlining)]
335    protected override ulong Subtract(ulong first, ulong second) => first - second;
336
337    /// <summary>
338    /// <para>
339    /// Determines whether this instance first is to the left of second.
340    /// </para>
341    /// <para></para>
342    /// </summary>
343    /// <param name="first">
344    /// <para>The first.</para>
345    /// <para></para>
346    /// </param>
347    /// <param name="second">
348    /// <para>The second.</para>
349    /// <para></para>
350    /// </param>
351    /// <returns>
352    /// <para>The bool</para>
353    /// <para></para>
354    /// </returns>
355    [MethodImpl(MethodImplOptions.AggressiveInlining)]
356    protected override bool FirstIsToLeftOfSecond(ulong first, ulong second)
357    {
358        ref var firstLink = ref Links[first];
359        ref var secondLink = ref Links[second];
360        return FirstIsToLeftOfSecond(firstLink.Source, firstLink.Target,
361            ↪ secondLink.Source, secondLink.Target);
362    }
363
364    /// <summary>
365    /// <para>
366    /// Determines whether this instance first is to the right of second.
367    /// </para>
368    /// <para></para>
369    /// </summary>
370    /// <param name="first">
371    /// <para>The first.</para>
372    /// <para></para>
373    /// </param>
374    /// <param name="second">
375    /// <para>The second.</para>
376    /// <para></para>
377    /// </param>
378    /// <returns>
379    /// <para>The bool</para>
380    /// <para></para>
381    /// </returns>
382    [MethodImpl(MethodImplOptions.AggressiveInlining)]
    protected override bool FirstIsToTheRightOfSecond(ulong first, ulong second)

```



```

383 {
384     ref var firstLink = ref Links[first];
385     ref var secondLink = ref Links[second];
386     return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
        ↪ secondLink.Source, secondLink.Target);
387 }
388
389 /// <summary>
390 /// <para>
391 /// Gets the size value using the specified value.
392 /// </para>
393 /// <para></para>
394 /// </summary>
395 /// <param name="value">
396 /// <para>The value.</para>
397 /// <para></para>
398 /// </param>
399 /// <returns>
400 /// <para>The ulong</para>
401 /// <para></para>
402 /// </returns>
403 [MethodImpl(MethodImplOptions.AggressiveInlining)]
404 protected override ulong GetSizeValue(ulong value) => (value & 4294967264UL) >> 5;
405
406 /// <summary>
407 /// <para>
408 /// Sets the size value using the specified stored value.
409 /// </para>
410 /// <para></para>
411 /// </summary>
412 /// <param name="storedValue">
413 /// <para>The stored value.</para>
414 /// <para></para>
415 /// </param>
416 /// <param name="size">
417 /// <para>The size.</para>
418 /// <para></para>
419 /// </param>
420 [MethodImpl(MethodImplOptions.AggressiveInlining)]
421 protected override void SetSizeValue(ref ulong storedValue, ulong size) => storedValue =
    ↪ storedValue & 31UL | (size & 134217727UL) << 5;
422
423 /// <summary>
424 /// <para>
425 /// Determines whether this instance get left is child value.
426 /// </para>
427 /// <para></para>
428 /// </summary>
429 /// <param name="value">
430 /// <para>The value.</para>
431 /// <para></para>
432 /// </param>
433 /// <returns>
434 /// <para>The bool</para>
435 /// <para></para>
436 /// </returns>
437 [MethodImpl(MethodImplOptions.AggressiveInlining)]
438 protected override bool GetLeftIsChildValue(ulong value) => (value & 16UL) >> 4 == 1UL;
439
440 /// <summary>
441 /// <para>
442 /// Sets the left is child value using the specified stored value.
443 /// </para>
444 /// <para></para>
445 /// </summary>
446 /// <param name="storedValue">
447 /// <para>The stored value.</para>
448 /// <para></para>
449 /// </param>
450 /// <param name="value">
451 /// <para>The value.</para>
452 /// <para></para>
453 /// </param>
454 [MethodImpl(MethodImplOptions.AggressiveInlining)]
455 protected override void SetLeftIsChildValue(ref ulong storedValue, bool value) =>
    ↪ storedValue = storedValue & 4294967279UL | (As<bool, byte>(ref value) & 1UL) << 4;
456
457 /// <summary>

```

```

458     /// <para>
459     /// Determines whether this instance get right is child value.
460     /// </para>
461     /// <para></para>
462     /// </summary>
463     /// <param name="value">
464     /// <para>The value.</para>
465     /// <para></para>
466     /// </param>
467     /// <returns>
468     /// <para>The bool</para>
469     /// <para></para>
470     /// </returns>
471     [MethodImpl(MethodImplOptions.AggressiveInlining)]
472     protected override bool GetRightIsChildValue(ulong value) => (value & 8UL) >> 3 == 1UL;
473
474     /// <summary>
475     /// <para>
476     /// Sets the right is child value using the specified stored value.
477     /// </para>
478     /// <para></para>
479     /// </summary>
480     /// <param name="storedValue">
481     /// <para>The stored value.</para>
482     /// <para></para>
483     /// </param>
484     /// <param name="value">
485     /// <para>The value.</para>
486     /// <para></para>
487     /// </param>
488     [MethodImpl(MethodImplOptions.AggressiveInlining)]
489     protected override void SetRightIsChildValue(ref ulong storedValue, bool value) =>
490     ↪ storedValue = storedValue & 4294967287UL | (As<bool, byte>(ref value) & 1UL) << 3;
491
492     /// <summary>
493     /// <para>
494     /// Gets the balance value using the specified value.
495     /// </para>
496     /// <para></para>
497     /// </summary>
498     /// <param name="value">
499     /// <para>The value.</para>
500     /// <para></para>
501     /// </param>
502     /// <returns>
503     /// <para>The sbyte</para>
504     /// <para></para>
505     /// </returns>
506     [MethodImpl(MethodImplOptions.AggressiveInlining)]
507     protected override sbyte GetBalanceValue(ulong value) => unchecked((sbyte)(value & 7UL |
508     ↪ 0xF8UL * ((value & 4UL) >> 2))); // if negative, then continue ones to the end of
509     ↪ sbyte
510
511     /// <summary>
512     /// <para>
513     /// Sets the balance value using the specified stored value.
514     /// </para>
515     /// <para></para>
516     /// </summary>
517     /// <param name="storedValue">
518     /// <para>The stored value.</para>
519     /// <para></para>
520     /// </param>
521     /// <param name="value">
522     /// <para>The value.</para>
523     /// <para></para>
524     /// </param>
525     [MethodImpl(MethodImplOptions.AggressiveInlining)]
526     protected override void SetBalanceValue(ref ulong storedValue, sbyte value) =>
527     ↪ storedValue = unchecked(storedValue & 4294967288UL | (ulong)((byte)value >> 5 & 4 |
528     ↪ value & 3) & 7UL);
529
530     /// <summary>
531     /// <para>
532     /// Gets the header reference.
533     /// </para>
534     /// <para></para>
535     /// </summary>

```

```

531     /// <returns>
532     /// <para>A ref links header of ulong</para>
533     /// <para></para>
534     /// </returns>
535     [MethodImpl(MethodImplOptions.AggressiveInlining)]
536     protected override ref LinksHeader<ulong> GetHeaderReference() => ref *Header;
537
538     /// <summary>
539     /// <para>
540     /// Gets the link reference using the specified link.
541     /// </para>
542     /// <para></para>
543     /// </summary>
544     /// <param name="link">
545     /// <para>The link.</para>
546     /// <para></para>
547     /// </param>
548     /// <returns>
549     /// <para>A ref raw link of ulong</para>
550     /// <para></para>
551     /// </returns>
552     [MethodImpl(MethodImplOptions.AggressiveInlining)]
553     protected override ref RawLink<ulong> GetLinkReference(ulong link) => ref Links[link];
554 }
555 }

```

## 1.99 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt64LinksRecursionlessSizeBalancedTreeMethods

```

1  using System.Runtime.CompilerServices;
2  using Platform.Data.Doublets.Memory.United.Generic;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Doublets.Memory.United.Specific
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the int 64 links recursionless size balanced tree methods base.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="LinksRecursionlessSizeBalancedTreeMethodsBase{ulong}" />
15     public unsafe abstract class UInt64LinksRecursionlessSizeBalancedTreeMethodsBase :
16     ↪ LinksRecursionlessSizeBalancedTreeMethodsBase<ulong>
17     {
18         /// <summary>
19         /// <para>
20         /// The links.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         protected new readonly RawLink<ulong>* Links;
25         /// <summary>
26         /// <para>
27         /// The header.
28         /// </para>
29         /// <para></para>
30         /// </summary>
31         protected new readonly LinksHeader<ulong>* Header;
32
33         /// <summary>
34         /// <para>
35         /// Initializes a new <see cref="UInt64LinksRecursionlessSizeBalancedTreeMethodsBase" />
36         ↪ instance.
37         /// </para>
38         /// <para></para>
39         /// </summary>
40         /// <param name="constants">
41         /// <para>A constants.</para>
42         /// <para></para>
43         /// </param>
44         /// <param name="links">
45         /// <para>A links.</para>
46         /// <para></para>
47         /// </param>
48         /// <param name="header">
49         /// <para>A header.</para>
50         /// <para></para>
51         /// </param>

```

```

50     protected UInt64LinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<ulong>
    ↪     constants, RawLink<ulong>* links, LinksHeader<ulong>* header)
51         : base(constants, (byte*)links, (byte*)header)
52     {
53         Links = links;
54         Header = header;
55     }
56
57     /// <summary>
58     /// <para>
59     /// Gets the zero.
60     /// </para>
61     /// <para></para>
62     /// </summary>
63     /// <returns>
64     /// <para>The ulong</para>
65     /// <para></para>
66     /// </returns>
67     [MethodImpl(MethodImplOptions.AggressiveInlining)]
68     protected override ulong GetZero() => OUL;
69
70     /// <summary>
71     /// <para>
72     /// Determines whether this instance equal to zero.
73     /// </para>
74     /// <para></para>
75     /// </summary>
76     /// <param name="value">
77     /// <para>The value.</para>
78     /// <para></para>
79     /// </param>
80     /// <returns>
81     /// <para>The bool</para>
82     /// <para></para>
83     /// </returns>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     protected override bool EqualToZero(ulong value) => value == OUL;
86
87     /// <summary>
88     /// <para>
89     /// Determines whether this instance are equal.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <param name="first">
94     /// <para>The first.</para>
95     /// <para></para>
96     /// </param>
97     /// <param name="second">
98     /// <para>The second.</para>
99     /// <para></para>
100    /// </param>
101    /// <returns>
102    /// <para>The bool</para>
103    /// <para></para>
104    /// </returns>
105    [MethodImpl(MethodImplOptions.AggressiveInlining)]
106    protected override bool AreEqual(ulong first, ulong second) => first == second;
107
108    /// <summary>
109    /// <para>
110    /// Determines whether this instance greater than zero.
111    /// </para>
112    /// <para></para>
113    /// </summary>
114    /// <param name="value">
115    /// <para>The value.</para>
116    /// <para></para>
117    /// </param>
118    /// <returns>
119    /// <para>The bool</para>
120    /// <para></para>
121    /// </returns>
122    [MethodImpl(MethodImplOptions.AggressiveInlining)]
123    protected override bool GreaterThanZero(ulong value) => value > OUL;
124
125    /// <summary>
126    /// <para>

```

```

127     /// Determines whether this instance greater than.
128     /// </para>
129     /// <para></para>
130     /// </summary>
131     /// <param name="first">
132     /// <para>The first.</para>
133     /// <para></para>
134     /// </param>
135     /// <param name="second">
136     /// <para>The second.</para>
137     /// <para></para>
138     /// </param>
139     /// <returns>
140     /// <para>The bool</para>
141     /// <para></para>
142     /// </returns>
143     [MethodImpl(MethodImplOptions.AggressiveInlining)]
144     protected override bool GreaterThan(ulong first, ulong second) => first > second;
145
146     /// <summary>
147     /// <para>
148     /// Determines whether this instance greater or equal than.
149     /// </para>
150     /// <para></para>
151     /// </summary>
152     /// <param name="first">
153     /// <para>The first.</para>
154     /// <para></para>
155     /// </param>
156     /// <param name="second">
157     /// <para>The second.</para>
158     /// <para></para>
159     /// </param>
160     /// <returns>
161     /// <para>The bool</para>
162     /// <para></para>
163     /// </returns>
164     [MethodImpl(MethodImplOptions.AggressiveInlining)]
165     protected override bool GreaterOrEqualThan(ulong first, ulong second) => first >= second;
166
167     /// <summary>
168     /// <para>
169     /// Determines whether this instance greater or equal than zero.
170     /// </para>
171     /// <para></para>
172     /// </summary>
173     /// <param name="value">
174     /// <para>The value.</para>
175     /// <para></para>
176     /// </param>
177     /// <returns>
178     /// <para>The bool</para>
179     /// <para></para>
180     /// </returns>
181     [MethodImpl(MethodImplOptions.AggressiveInlining)]
182     protected override bool GreaterOrEqualThanZero(ulong value) => true; // value >= 0 is
    ↪ always true for ulong
183
184     /// <summary>
185     /// <para>
186     /// Determines whether this instance less or equal than zero.
187     /// </para>
188     /// <para></para>
189     /// </summary>
190     /// <param name="value">
191     /// <para>The value.</para>
192     /// <para></para>
193     /// </param>
194     /// <returns>
195     /// <para>The bool</para>
196     /// <para></para>
197     /// </returns>
198     [MethodImpl(MethodImplOptions.AggressiveInlining)]
199     protected override bool LessOrEqualThanZero(ulong value) => value == 0UL; // value is
    ↪ always >= 0 for ulong
200
201     /// <summary>
202     /// <para>

```

```

203     /// Determines whether this instance less or equal than.
204     /// </para>
205     /// <para></para>
206     /// </summary>
207     /// <param name="first">
208     /// <para>The first.</para>
209     /// <para></para>
210     /// </param>
211     /// <param name="second">
212     /// <para>The second.</para>
213     /// <para></para>
214     /// </param>
215     /// <returns>
216     /// <para>The bool</para>
217     /// <para></para>
218     /// </returns>
219     [MethodImpl(MethodImplOptions.AggressiveInlining)]
220     protected override bool LessOrEqualThan(ulong first, ulong second) => first <= second;
221
222     /// <summary>
223     /// <para>
224     /// Determines whether this instance less than zero.
225     /// </para>
226     /// <para></para>
227     /// </summary>
228     /// <param name="value">
229     /// <para>The value.</para>
230     /// <para></para>
231     /// </param>
232     /// <returns>
233     /// <para>The bool</para>
234     /// <para></para>
235     /// </returns>
236     [MethodImpl(MethodImplOptions.AggressiveInlining)]
237     protected override bool LessThanZero(ulong value) => false; // value < 0 is always false
238     ↪ for ulong
239
240     /// <summary>
241     /// <para>
242     /// Determines whether this instance less than.
243     /// </para>
244     /// <para></para>
245     /// </summary>
246     /// <param name="first">
247     /// <para>The first.</para>
248     /// <para></para>
249     /// </param>
250     /// <param name="second">
251     /// <para>The second.</para>
252     /// <para></para>
253     /// </param>
254     /// <returns>
255     /// <para>The bool</para>
256     /// <para></para>
257     /// </returns>
258     [MethodImpl(MethodImplOptions.AggressiveInlining)]
259     protected override bool LessThan(ulong first, ulong second) => first < second;
260
261     /// <summary>
262     /// <para>
263     /// Increments the value.
264     /// </para>
265     /// <para></para>
266     /// </summary>
267     /// <param name="value">
268     /// <para>The value.</para>
269     /// <para></para>
270     /// </param>
271     /// <returns>
272     /// <para>The ulong</para>
273     /// <para></para>
274     /// </returns>
275     [MethodImpl(MethodImplOptions.AggressiveInlining)]
276     protected override ulong Increment(ulong value) => ++value;
277
278     /// <summary>
279     /// <para>
280     /// Decrements the value.

```

```

280    /// </para>
281    /// <para></para>
282    /// </summary>
283    /// <param name="value">
284    /// <para>The value.</para>
285    /// <para></para>
286    /// </param>
287    /// <returns>
288    /// <para>The ulong</para>
289    /// <para></para>
290    /// </returns>
291    [MethodImpl(MethodImplOptions.AggressiveInlining)]
292    protected override ulong Decrement(ulong value) => --value;
293
294    /// <summary>
295    /// <para>
296    /// Adds the first.
297    /// </para>
298    /// <para></para>
299    /// </summary>
300    /// <param name="first">
301    /// <para>The first.</para>
302    /// <para></para>
303    /// </param>
304    /// <param name="second">
305    /// <para>The second.</para>
306    /// <para></para>
307    /// </param>
308    /// <returns>
309    /// <para>The ulong</para>
310    /// <para></para>
311    /// </returns>
312    [MethodImpl(MethodImplOptions.AggressiveInlining)]
313    protected override ulong Add(ulong first, ulong second) => first + second;
314
315    /// <summary>
316    /// <para>
317    /// Subtracts the first.
318    /// </para>
319    /// <para></para>
320    /// </summary>
321    /// <param name="first">
322    /// <para>The first.</para>
323    /// <para></para>
324    /// </param>
325    /// <param name="second">
326    /// <para>The second.</para>
327    /// <para></para>
328    /// </param>
329    /// <returns>
330    /// <para>The ulong</para>
331    /// <para></para>
332    /// </returns>
333    [MethodImpl(MethodImplOptions.AggressiveInlining)]
334    protected override ulong Subtract(ulong first, ulong second) => first - second;
335
336    /// <summary>
337    /// <para>
338    /// Determines whether this instance first is to the left of second.
339    /// </para>
340    /// <para></para>
341    /// </summary>
342    /// <param name="first">
343    /// <para>The first.</para>
344    /// <para></para>
345    /// </param>
346    /// <param name="second">
347    /// <para>The second.</para>
348    /// <para></para>
349    /// </param>
350    /// <returns>
351    /// <para>The bool</para>
352    /// <para></para>
353    /// </returns>
354    [MethodImpl(MethodImplOptions.AggressiveInlining)]
355    protected override bool FirstIsToLeftOfSecond(ulong first, ulong second)
356    {
357        ref var firstLink = ref Links[first];

```

```

358         ref var secondLink = ref Links[second];
359         return FirstIsToTheLeftOfSecond(firstLink.Source, firstLink.Target,
        ↪ secondLink.Source, secondLink.Target);
360     }
361
362     /// <summary>
363     /// <para>
364     /// Determines whether this instance first is to the right of second.
365     /// </para>
366     /// <para></para>
367     /// </summary>
368     /// <param name="first">
369     /// <para>The first.</para>
370     /// <para></para>
371     /// </param>
372     /// <param name="second">
373     /// <para>The second.</para>
374     /// <para></para>
375     /// </param>
376     /// <returns>
377     /// <para>The bool</para>
378     /// <para></para>
379     /// </returns>
380     [MethodImpl(MethodImplOptions.AggressiveInlining)]
381     protected override bool FirstIsToTheRightOfSecond(ulong first, ulong second)
382     {
383         ref var firstLink = ref Links[first];
384         ref var secondLink = ref Links[second];
385         return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
        ↪ secondLink.Source, secondLink.Target);
386     }
387
388     /// <summary>
389     /// <para>
390     /// Gets the header reference.
391     /// </para>
392     /// <para></para>
393     /// </summary>
394     /// <returns>
395     /// <para>A ref links header of ulong</para>
396     /// <para></para>
397     /// </returns>
398     [MethodImpl(MethodImplOptions.AggressiveInlining)]
399     protected override ref LinksHeader<ulong> GetHeaderReference() => ref *Header;
400
401     /// <summary>
402     /// <para>
403     /// Gets the link reference using the specified link.
404     /// </para>
405     /// <para></para>
406     /// </summary>
407     /// <param name="link">
408     /// <para>The link.</para>
409     /// <para></para>
410     /// </param>
411     /// <returns>
412     /// <para>A ref raw link of ulong</para>
413     /// <para></para>
414     /// </returns>
415     [MethodImpl(MethodImplOptions.AggressiveInlining)]
416     protected override ref RawLink<ulong> GetLinkReference(ulong link) => ref Links[link];
417 }
418 }

```

## 1.100 ./csharp/Platform.Data.Doublets.Memory.United/Specific/UInt64LinksSizeBalancedTreeMethodsBase.cs

```

1 using System.Runtime.CompilerServices;
2 using Platform.Data.Doublets.Memory.United.Generic;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6 namespace Platform.Data.Doublets.Memory.United.Specific
7 {
8     /// <summary>
9     /// <para>
10     /// Represents the int 64 links size balanced tree methods base.
11     /// </para>
12     /// <para></para>
13     /// </summary>

```



```

14  /// <seealso cref="LinksSizeBalancedTreeMethodsBase{ulong}"/>
15  public unsafe abstract class UInt64LinksSizeBalancedTreeMethodsBase :
    ↳ LinksSizeBalancedTreeMethodsBase<ulong>
16  {
17      /// <summary>
18      /// <para>
19      /// The links.
20      /// </para>
21      /// <para></para>
22      /// </summary>
23      protected new readonly RawLink<ulong>* Links;
24      /// <summary>
25      /// <para>
26      /// The header.
27      /// </para>
28      /// <para></para>
29      /// </summary>
30      protected new readonly LinksHeader<ulong>* Header;
31
32      /// <summary>
33      /// <para>
34      /// Initializes a new <see cref="UInt64LinksSizeBalancedTreeMethodsBase"/> instance.
35      /// </para>
36      /// <para></para>
37      /// </summary>
38      /// <param name="constants">
39      /// <para>A constants.</para>
40      /// <para></para>
41      /// </param>
42      /// <param name="links">
43      /// <para>A links.</para>
44      /// <para></para>
45      /// </param>
46      /// <param name="header">
47      /// <para>A header.</para>
48      /// <para></para>
49      /// </param>
50      protected UInt64LinksSizeBalancedTreeMethodsBase(LinksConstants<ulong> constants,
    ↳ RawLink<ulong>* links, LinksHeader<ulong>* header)
    : base(constants, (byte*)links, (byte*)header)
51      {
52          Links = links;
53          Header = header;
54      }
55
56
57      /// <summary>
58      /// <para>
59      /// Gets the zero.
60      /// </para>
61      /// <para></para>
62      /// </summary>
63      /// <returns>
64      /// <para>The ulong</para>
65      /// <para></para>
66      /// </returns>
67      [MethodImpl(MethodImplOptions.AggressiveInlining)]
68      protected override ulong GetZero() => OUL;
69
70      /// <summary>
71      /// <para>
72      /// Determines whether this instance equal to zero.
73      /// </para>
74      /// <para></para>
75      /// </summary>
76      /// <param name="value">
77      /// <para>The value.</para>
78      /// <para></para>
79      /// </param>
80      /// <returns>
81      /// <para>The bool</para>
82      /// <para></para>
83      /// </returns>
84      [MethodImpl(MethodImplOptions.AggressiveInlining)]
85      protected override bool EqualToZero(ulong value) => value == OUL;
86
87      /// <summary>
88      /// <para>
89      /// Determines whether this instance are equal.

```

```

90    /// </para>
91    /// <para></para>
92    /// </summary>
93    /// <param name="first">
94    /// <para>The first.</para>
95    /// <para></para>
96    /// </param>
97    /// <param name="second">
98    /// <para>The second.</para>
99    /// <para></para>
100   /// </param>
101   /// <returns>
102   /// <para>The bool</para>
103   /// <para></para>
104   /// </returns>
105   [MethodImpl(MethodImplOptions.AggressiveInlining)]
106   protected override bool AreEqual(ulong first, ulong second) => first == second;
107
108   /// <summary>
109   /// <para>
110   /// Determines whether this instance greater than zero.
111   /// </para>
112   /// <para></para>
113   /// </summary>
114   /// <param name="value">
115   /// <para>The value.</para>
116   /// <para></para>
117   /// </param>
118   /// <returns>
119   /// <para>The bool</para>
120   /// <para></para>
121   /// </returns>
122   [MethodImpl(MethodImplOptions.AggressiveInlining)]
123   protected override bool GreaterThanZero(ulong value) => value > 0UL;
124
125   /// <summary>
126   /// <para>
127   /// Determines whether this instance greater than.
128   /// </para>
129   /// <para></para>
130   /// </summary>
131   /// <param name="first">
132   /// <para>The first.</para>
133   /// <para></para>
134   /// </param>
135   /// <param name="second">
136   /// <para>The second.</para>
137   /// <para></para>
138   /// </param>
139   /// <returns>
140   /// <para>The bool</para>
141   /// <para></para>
142   /// </returns>
143   [MethodImpl(MethodImplOptions.AggressiveInlining)]
144   protected override bool GreaterThan(ulong first, ulong second) => first > second;
145
146   /// <summary>
147   /// <para>
148   /// Determines whether this instance greater or equal than.
149   /// </para>
150   /// <para></para>
151   /// </summary>
152   /// <param name="first">
153   /// <para>The first.</para>
154   /// <para></para>
155   /// </param>
156   /// <param name="second">
157   /// <para>The second.</para>
158   /// <para></para>
159   /// </param>
160   /// <returns>
161   /// <para>The bool</para>
162   /// <para></para>
163   /// </returns>
164   [MethodImpl(MethodImplOptions.AggressiveInlining)]
165   protected override bool GreaterOrEqualThan(ulong first, ulong second) => first >= second;
166
167   /// <summary>

```

```

168     /// <para>
169     /// Determines whether this instance greater or equal than zero.
170     /// </para>
171     /// <para></para>
172     /// </summary>
173     /// <param name="value">
174     /// <para>The value.</para>
175     /// <para></para>
176     /// </param>
177     /// <returns>
178     /// <para>The bool</para>
179     /// <para></para>
180     /// </returns>
181     [MethodImpl(MethodImplOptions.AggressiveInlining)]
182     protected override bool GreaterOrEqualThanZero(ulong value) => true; // value >= 0 is
    ↪ always true for ulong
183
184     /// <summary>
185     /// <para>
186     /// Determines whether this instance less or equal than zero.
187     /// </para>
188     /// <para></para>
189     /// </summary>
190     /// <param name="value">
191     /// <para>The value.</para>
192     /// <para></para>
193     /// </param>
194     /// <returns>
195     /// <para>The bool</para>
196     /// <para></para>
197     /// </returns>
198     [MethodImpl(MethodImplOptions.AggressiveInlining)]
199     protected override bool LessOrEqualThanZero(ulong value) => value == 0UL; // value is
    ↪ always >= 0 for ulong
200
201     /// <summary>
202     /// <para>
203     /// Determines whether this instance less or equal than.
204     /// </para>
205     /// <para></para>
206     /// </summary>
207     /// <param name="first">
208     /// <para>The first.</para>
209     /// <para></para>
210     /// </param>
211     /// <param name="second">
212     /// <para>The second.</para>
213     /// <para></para>
214     /// </param>
215     /// <returns>
216     /// <para>The bool</para>
217     /// <para></para>
218     /// </returns>
219     [MethodImpl(MethodImplOptions.AggressiveInlining)]
220     protected override bool LessOrEqualThan(ulong first, ulong second) => first <= second;
221
222     /// <summary>
223     /// <para>
224     /// Determines whether this instance less than zero.
225     /// </para>
226     /// <para></para>
227     /// </summary>
228     /// <param name="value">
229     /// <para>The value.</para>
230     /// <para></para>
231     /// </param>
232     /// <returns>
233     /// <para>The bool</para>
234     /// <para></para>
235     /// </returns>
236     [MethodImpl(MethodImplOptions.AggressiveInlining)]
237     protected override bool LessThanZero(ulong value) => false; // value < 0 is always false
    ↪ for ulong
238
239     /// <summary>
240     /// <para>
241     /// Determines whether this instance less than.
242     /// </para>

```

```

243     /// <para></para>
244     /// </summary>
245     /// <param name="first">
246     /// <para>The first.</para>
247     /// <para></para>
248     /// </param>
249     /// <param name="second">
250     /// <para>The second.</para>
251     /// <para></para>
252     /// </param>
253     /// <returns>
254     /// <para>The bool</para>
255     /// <para></para>
256     /// </returns>
257     [MethodImpl(MethodImplOptions.AggressiveInlining)]
258     protected override bool LessThan(ulong first, ulong second) => first < second;
259
260     /// <summary>
261     /// <para>
262     /// Increments the value.
263     /// </para>
264     /// <para></para>
265     /// </summary>
266     /// <param name="value">
267     /// <para>The value.</para>
268     /// <para></para>
269     /// </param>
270     /// <returns>
271     /// <para>The ulong</para>
272     /// <para></para>
273     /// </returns>
274     [MethodImpl(MethodImplOptions.AggressiveInlining)]
275     protected override ulong Increment(ulong value) => ++value;
276
277     /// <summary>
278     /// <para>
279     /// Decrements the value.
280     /// </para>
281     /// <para></para>
282     /// </summary>
283     /// <param name="value">
284     /// <para>The value.</para>
285     /// <para></para>
286     /// </param>
287     /// <returns>
288     /// <para>The ulong</para>
289     /// <para></para>
290     /// </returns>
291     [MethodImpl(MethodImplOptions.AggressiveInlining)]
292     protected override ulong Decrement(ulong value) => --value;
293
294     /// <summary>
295     /// <para>
296     /// Adds the first.
297     /// </para>
298     /// <para></para>
299     /// </summary>
300     /// <param name="first">
301     /// <para>The first.</para>
302     /// <para></para>
303     /// </param>
304     /// <param name="second">
305     /// <para>The second.</para>
306     /// <para></para>
307     /// </param>
308     /// <returns>
309     /// <para>The ulong</para>
310     /// <para></para>
311     /// </returns>
312     [MethodImpl(MethodImplOptions.AggressiveInlining)]
313     protected override ulong Add(ulong first, ulong second) => first + second;
314
315     /// <summary>
316     /// <para>
317     /// Subtracts the first.
318     /// </para>
319     /// <para></para>
320     /// </summary>

```

```

321    /// <param name="first">
322    /// <para>The first.</para>
323    /// <para></para>
324    /// </param>
325    /// <param name="second">
326    /// <para>The second.</para>
327    /// <para></para>
328    /// </param>
329    /// <returns>
330    /// <para>The ulong</para>
331    /// <para></para>
332    /// </returns>
333    [MethodImpl(MethodImplOptions.AggressiveInlining)]
334    protected override ulong Subtract(ulong first, ulong second) => first - second;
335
336    /// <summary>
337    /// <para>
338    /// Determines whether this instance first is to the left of second.
339    /// </para>
340    /// <para></para>
341    /// </summary>
342    /// <param name="first">
343    /// <para>The first.</para>
344    /// <para></para>
345    /// </param>
346    /// <param name="second">
347    /// <para>The second.</para>
348    /// <para></para>
349    /// </param>
350    /// <returns>
351    /// <para>The bool</para>
352    /// <para></para>
353    /// </returns>
354    [MethodImpl(MethodImplOptions.AggressiveInlining)]
355    protected override bool FirstIsToTheLeftOfSecond(ulong first, ulong second)
356    {
357        ref var firstLink = ref Links[first];
358        ref var secondLink = ref Links[second];
359        return FirstIsToTheLeftOfSecond(firstLink.Source, firstLink.Target,
360            ↪ secondLink.Source, secondLink.Target);
361    }
362
363    /// <summary>
364    /// <para>
365    /// Determines whether this instance first is to the right of second.
366    /// </para>
367    /// <para></para>
368    /// </summary>
369    /// <param name="first">
370    /// <para>The first.</para>
371    /// <para></para>
372    /// </param>
373    /// <param name="second">
374    /// <para>The second.</para>
375    /// <para></para>
376    /// </param>
377    /// <returns>
378    /// <para>The bool</para>
379    /// <para></para>
380    /// </returns>
381    [MethodImpl(MethodImplOptions.AggressiveInlining)]
382    protected override bool FirstIsToTheRightOfSecond(ulong first, ulong second)
383    {
384        ref var firstLink = ref Links[first];
385        ref var secondLink = ref Links[second];
386        return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
387            ↪ secondLink.Source, secondLink.Target);
388    }
389
390    /// <summary>
391    /// <para>
392    /// Gets the header reference.
393    /// </para>
394    /// <para></para>
395    /// </summary>
396    /// <returns>
397    /// <para>A ref links header of ulong</para>
398    /// <para></para>

```

```

397     /// </returns>
398     [MethodImpl(MethodImplOptions.AggressiveInlining)]
399     protected override ref LinksHeader<ulong> GetHeaderReference() => ref *Header;
400
401     /// <summary>
402     /// <para>
403     /// Gets the link reference using the specified link.
404     /// </para>
405     /// <para></para>
406     /// </summary>
407     /// <param name="link">
408     /// <para>The link.</para>
409     /// <para></para>
410     /// </param>
411     /// <returns>
412     /// <para>A ref raw link of ulong</para>
413     /// <para></para>
414     /// </returns>
415     [MethodImpl(MethodImplOptions.AggressiveInlining)]
416     protected override ref RawLink<ulong> GetLinkReference(ulong link) => ref Links[link];
417 }
418 }

```

#### 1.101 ./csharp/Platform.Data.Doublets.Memory.United/Specific/UInt64LinksSourcesAvlBalancedTreeMethods.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.Data.Doublets.Memory.United.Specific
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the int 64 links sources avl balanced tree methods.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="UInt64LinksAvlBalancedTreeMethodsBase"/>
14     public unsafe class UInt64LinksSourcesAvlBalancedTreeMethods :
15         ↳ UInt64LinksAvlBalancedTreeMethodsBase
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="UInt64LinksSourcesAvlBalancedTreeMethods"/> instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="constants">
24         /// <para>A constants.</para>
25         /// <para></para>
26         /// </param>
27         /// <param name="links">
28         /// <para>A links.</para>
29         /// <para></para>
30         /// </param>
31         /// <param name="header">
32         /// <para>A header.</para>
33         /// <para></para>
34         /// </param>
35         public UInt64LinksSourcesAvlBalancedTreeMethods(LinksConstants<ulong> constants,
36             ↳ RawLink<ulong>* links, LinksHeader<ulong>* header) : base(constants, links, header)
37             ↳ { }
38
39         /// <summary>
40         /// <para>
41         /// Gets the left reference using the specified node.
42         /// </para>
43         /// <para></para>
44         /// </summary>
45         /// <param name="node">
46         /// <para>The node.</para>
47         /// <para></para>
48         /// </param>
49         /// <returns>
50         /// <para>The ref ulong</para>
51         /// <para></para>
52         /// </returns>
53         [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

51     protected override ref ulong GetLeftReference(ulong node) => ref
    ↪ Links[node].LeftAsSource;
52
53     /// <summary>
54     /// <para>
55     /// Gets the right reference using the specified node.
56     /// </para>
57     /// <para></para>
58     /// </summary>
59     /// <param name="node">
60     /// <para>The node.</para>
61     /// <para></para>
62     /// </param>
63     /// <returns>
64     /// <para>The ref ulong</para>
65     /// <para></para>
66     /// </returns>
67     [MethodImpl(MethodImplOptions.AggressiveInlining)]
68     protected override ref ulong GetRightReference(ulong node) => ref
    ↪ Links[node].RightAsSource;
69
70     /// <summary>
71     /// <para>
72     /// Gets the left using the specified node.
73     /// </para>
74     /// <para></para>
75     /// </summary>
76     /// <param name="node">
77     /// <para>The node.</para>
78     /// <para></para>
79     /// </param>
80     /// <returns>
81     /// <para>The ulong</para>
82     /// <para></para>
83     /// </returns>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     protected override ulong GetLeft(ulong node) => Links[node].LeftAsSource;
86
87     /// <summary>
88     /// <para>
89     /// Gets the right using the specified node.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <param name="node">
94     /// <para>The node.</para>
95     /// <para></para>
96     /// </param>
97     /// <returns>
98     /// <para>The ulong</para>
99     /// <para></para>
100    /// </returns>
101    [MethodImpl(MethodImplOptions.AggressiveInlining)]
102    protected override ulong GetRight(ulong node) => Links[node].RightAsSource;
103
104    /// <summary>
105    /// <para>
106    /// Sets the left using the specified node.
107    /// </para>
108    /// <para></para>
109    /// </summary>
110    /// <param name="node">
111    /// <para>The node.</para>
112    /// <para></para>
113    /// </param>
114    /// <param name="left">
115    /// <para>The left.</para>
116    /// <para></para>
117    /// </param>
118    [MethodImpl(MethodImplOptions.AggressiveInlining)]
119    protected override void SetLeft(ulong node, ulong left) => Links[node].LeftAsSource =
    ↪ left;
120
121    /// <summary>
122    /// <para>
123    /// Sets the right using the specified node.
124    /// </para>
125    /// <para></para>

```

```

126     /// </summary>
127     /// <param name="node">
128     /// <para>The node.</para>
129     /// <para></para>
130     /// </param>
131     /// <param name="right">
132     /// <para>The right.</para>
133     /// <para></para>
134     /// </param>
135     [MethodImpl(MethodImplOptions.AggressiveInlining)]
136     protected override void SetRight(ulong node, ulong right) => Links[node].RightAsSource =
        ↳ right;

137     /// <summary>
138     /// <para>
139     /// Gets the size using the specified node.
140     /// </para>
141     /// <para></para>
142     /// </summary>
143     /// <param name="node">
144     /// <para>The node.</para>
145     /// <para></para>
146     /// </param>
147     /// <returns>
148     /// <para>The ulong</para>
149     /// <para></para>
150     /// </returns>
151     [MethodImpl(MethodImplOptions.AggressiveInlining)]
152     protected override ulong GetSize(ulong node) => GetSizeValue(Links[node].SizeAsSource);

153     /// <summary>
154     /// <para>
155     /// Sets the size using the specified node.
156     /// </para>
157     /// <para></para>
158     /// </summary>
159     /// <param name="node">
160     /// <para>The node.</para>
161     /// <para></para>
162     /// </param>
163     /// <param name="size">
164     /// <para>The size.</para>
165     /// <para></para>
166     /// </param>
167     [MethodImpl(MethodImplOptions.AggressiveInlining)]
168     protected override void SetSize(ulong node, ulong size) => SetSizeValue(ref
        ↳ Links[node].SizeAsSource, size);

169     /// <summary>
170     /// <para>
171     /// Determines whether this instance get left is child.
172     /// </para>
173     /// <para></para>
174     /// </summary>
175     /// <param name="node">
176     /// <para>The node.</para>
177     /// <para></para>
178     /// </param>
179     /// <returns>
180     /// <para>The bool</para>
181     /// <para></para>
182     /// </returns>
183     [MethodImpl(MethodImplOptions.AggressiveInlining)]
184     protected override bool GetLeftIsChild(ulong node) =>
        ↳ GetLeftIsChildValue(Links[node].SizeAsSource);

185     ///[MethodImpl(MethodImplOptions.AggressiveInlining)]
186     ///protected override bool GetLeftIsChild(ulong node) => IsChild(node, GetLeft(node));

187     /// <summary>
188     /// <para>
189     /// Sets the left is child using the specified node.
190     /// </para>
191     /// <para></para>
192     /// </summary>
193     /// <param name="node">
194     /// <para>The node.</para>
195     /// <para></para>
196     /// </param>

```



```

201     /// </param>
202     /// <param name="value">
203     /// <para>The value.</para>
204     /// <para></para>
205     /// </param>
206     [MethodImpl(MethodImplOptions.AggressiveInlining)]
207     protected override void SetLeftIsChild(ulong node, bool value) =>
208         ↪ SetLeftIsChildValue(ref Links[node].SizeAsSource, value);
209
210     /// <summary>
211     /// <para>
212     /// Determines whether this instance get right is child.
213     /// </para>
214     /// <para></para>
215     /// </summary>
216     /// <param name="node">
217     /// <para>The node.</para>
218     /// <para></para>
219     /// </param>
220     /// <returns>
221     /// <para>The bool</para>
222     /// <para></para>
223     /// </returns>
224     [MethodImpl(MethodImplOptions.AggressiveInlining)]
225     protected override bool GetRightIsChild(ulong node) =>
226         ↪ GetRightIsChildValue(Links[node].SizeAsSource);
227
228     ///[MethodImpl(MethodImplOptions.AggressiveInlining)]
229     ///protected override bool GetRightIsChild(ulong node) => IsChild(node, GetRight(node));
230
231     /// <summary>
232     /// <para>
233     /// Sets the right is child using the specified node.
234     /// </para>
235     /// <para></para>
236     /// </summary>
237     /// <param name="node">
238     /// <para>The node.</para>
239     /// <para></para>
240     /// </param>
241     /// <param name="value">
242     /// <para>The value.</para>
243     /// <para></para>
244     /// </param>
245     [MethodImpl(MethodImplOptions.AggressiveInlining)]
246     protected override void SetRightIsChild(ulong node, bool value) =>
247         ↪ SetRightIsChildValue(ref Links[node].SizeAsSource, value);
248
249     /// <summary>
250     /// <para>
251     /// Gets the balance using the specified node.
252     /// </para>
253     /// <para></para>
254     /// </summary>
255     /// <param name="node">
256     /// <para>The node.</para>
257     /// <para></para>
258     /// </param>
259     /// <returns>
260     /// <para>The sbyte</para>
261     /// <para></para>
262     /// </returns>
263     [MethodImpl(MethodImplOptions.AggressiveInlining)]
264     protected override sbyte GetBalance(ulong node) =>
265         ↪ GetBalanceValue(Links[node].SizeAsSource);
266
267     /// <summary>
268     /// <para>
269     /// Sets the balance using the specified node.
270     /// </para>
271     /// <para></para>
272     /// </summary>
273     /// <param name="node">
274     /// <para>The node.</para>
275     /// <para></para>
276     /// </param>
277     /// <param name="value">
278     /// <para>The value.</para>
279     /// <para></para>
280     /// </param>

```

```

275     /// <para></para>
276     /// </param>
277     [MethodImpl(MethodImplOptions.AggressiveInlining)]
278     protected override void SetBalance(ulong node, sbyte value) => SetBalanceValue(ref
    ↪ Links[node].SizeAsSource, value);
279
280     /// <summary>
281     /// <para>
282     /// Gets the tree root.
283     /// </para>
284     /// <para></para>
285     /// </summary>
286     /// <returns>
287     /// <para>The ulong</para>
288     /// <para></para>
289     /// </returns>
290     [MethodImpl(MethodImplOptions.AggressiveInlining)]
291     protected override ulong GetTreeRoot() => Header->RootAsSource;
292
293     /// <summary>
294     /// <para>
295     /// Gets the base part value using the specified link.
296     /// </para>
297     /// <para></para>
298     /// </summary>
299     /// <param name="link">
300     /// <para>The link.</para>
301     /// <para></para>
302     /// </param>
303     /// <returns>
304     /// <para>The ulong</para>
305     /// <para></para>
306     /// </returns>
307     [MethodImpl(MethodImplOptions.AggressiveInlining)]
308     protected override ulong GetBasePartValue(ulong link) => Links[link].Source;
309
310     /// <summary>
311     /// <para>
312     /// Determines whether this instance first is to the left of second.
313     /// </para>
314     /// <para></para>
315     /// </summary>
316     /// <param name="firstSource">
317     /// <para>The first source.</para>
318     /// <para></para>
319     /// </param>
320     /// <param name="firstTarget">
321     /// <para>The first target.</para>
322     /// <para></para>
323     /// </param>
324     /// <param name="secondSource">
325     /// <para>The second source.</para>
326     /// <para></para>
327     /// </param>
328     /// <param name="secondTarget">
329     /// <para>The second target.</para>
330     /// <para></para>
331     /// </param>
332     /// <returns>
333     /// <para>The bool</para>
334     /// <para></para>
335     /// </returns>
336     [MethodImpl(MethodImplOptions.AggressiveInlining)]
337     protected override bool FirstIsToLeftOfSecond(ulong firstSource, ulong firstTarget,
    ↪ ulong secondSource, ulong secondTarget)
338     => firstSource < secondSource || (firstSource == secondSource && firstTarget <
    ↪ secondTarget);
339
340     /// <summary>
341     /// <para>
342     /// Determines whether this instance first is to the right of second.
343     /// </para>
344     /// <para></para>
345     /// </summary>
346     /// <param name="firstSource">
347     /// <para>The first source.</para>
348     /// <para></para>
349     /// </param>

```

```

350     /// <param name="firstTarget">
351     /// <para>The first target.</para>
352     /// <para></para>
353     /// </param>
354     /// <param name="secondSource">
355     /// <para>The second source.</para>
356     /// <para></para>
357     /// </param>
358     /// <param name="secondTarget">
359     /// <para>The second target.</para>
360     /// <para></para>
361     /// </param>
362     /// <returns>
363     /// <para>The bool</para>
364     /// <para></para>
365     /// </returns>
366     [MethodImpl(MethodImplOptions.AggressiveInlining)]
367     protected override bool FirstIsToTheRightOfSecond(ulong firstSource, ulong firstTarget,
368         ↪ ulong secondSource, ulong secondTarget)
369         => firstSource > secondSource || (firstSource == secondSource && firstTarget >
370             ↪ secondTarget);
371
372     /// <summary>
373     /// <para>
374     /// Clears the node using the specified node.
375     /// </para>
376     /// <para></para>
377     /// </summary>
378     /// <param name="node">
379     /// <para>The node.</para>
380     /// <para></para>
381     /// </param>
382     [MethodImpl(MethodImplOptions.AggressiveInlining)]
383     protected override void ClearNode(ulong node)
384     {
385         ref var link = ref Links[node];
386         link.LeftAsSource = OUL;
387         link.RightAsSource = OUL;
388         link.SizeAsSource = OUL;
389     }
390 }

```

## 1.102 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt64LinksSourcesRecursionlessSizeBalancedTreeMethods

```

1 using System.Runtime.CompilerServices;
2
3 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5 namespace Platform.Data.Doublets.Memory.United.Specific
6 {
7     /// <summary>
8     /// <para>
9     /// Represents the int 64 links sources recursionless size balanced tree methods.
10    /// </para>
11    /// <para></para>
12    /// </summary>
13    /// <seealso cref="UInt64LinksRecursionlessSizeBalancedTreeMethodsBase"/>
14    public unsafe class UInt64LinksSourcesRecursionlessSizeBalancedTreeMethods :
15        ↪ UInt64LinksRecursionlessSizeBalancedTreeMethodsBase
16    {
17        /// <summary>
18        /// <para>
19        /// Initializes a new <see
20        ↪ cref="UInt64LinksSourcesRecursionlessSizeBalancedTreeMethods"/> instance.
21        /// </para>
22        /// <para></para>
23        /// </summary>
24        /// <param name="constants">
25        /// <para>A constants.</para>
26        /// <para></para>
27        /// </param>
28        /// <param name="links">
29        /// <para>A links.</para>
30        /// <para></para>
31        /// </param>
32        /// <param name="header">
33        /// <para>A header.</para>
34        /// <para></para>
35        /// </param>

```

```

33     /// </param>
34     public UInt64LinksSourcesRecursionlessSizeBalancedTreeMethods(LinksConstants<ulong>
    ↪ constants, RawLink<ulong>* links, LinksHeader<ulong>* header) : base(constants,
    ↪ links, header) { }
35
36     /// <summary>
37     /// <para>
38     /// Gets the left reference using the specified node.
39     /// </para>
40     /// <para></para>
41     /// </summary>
42     /// <param name="node">
43     /// <para>The node.</para>
44     /// <para></para>
45     /// </param>
46     /// <returns>
47     /// <para>The ref ulong</para>
48     /// <para></para>
49     /// </returns>
50     [MethodImpl(MethodImplOptions.AggressiveInlining)]
51     protected override ref ulong GetLeftReference(ulong node) => ref
    ↪ Links[node].LeftAsSource;
52
53     /// <summary>
54     /// <para>
55     /// Gets the right reference using the specified node.
56     /// </para>
57     /// <para></para>
58     /// </summary>
59     /// <param name="node">
60     /// <para>The node.</para>
61     /// <para></para>
62     /// </param>
63     /// <returns>
64     /// <para>The ref ulong</para>
65     /// <para></para>
66     /// </returns>
67     [MethodImpl(MethodImplOptions.AggressiveInlining)]
68     protected override ref ulong GetRightReference(ulong node) => ref
    ↪ Links[node].RightAsSource;
69
70     /// <summary>
71     /// <para>
72     /// Gets the left using the specified node.
73     /// </para>
74     /// <para></para>
75     /// </summary>
76     /// <param name="node">
77     /// <para>The node.</para>
78     /// <para></para>
79     /// </param>
80     /// <returns>
81     /// <para>The ulong</para>
82     /// <para></para>
83     /// </returns>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     protected override ulong GetLeft(ulong node) => Links[node].LeftAsSource;
86
87     /// <summary>
88     /// <para>
89     /// Gets the right using the specified node.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <param name="node">
94     /// <para>The node.</para>
95     /// <para></para>
96     /// </param>
97     /// <returns>
98     /// <para>The ulong</para>
99     /// <para></para>
100    /// </returns>
101    [MethodImpl(MethodImplOptions.AggressiveInlining)]
102    protected override ulong GetRight(ulong node) => Links[node].RightAsSource;
103
104    /// <summary>
105    /// <para>
106    /// Sets the left using the specified node.

```

```

107     /// </para>
108     /// <para></para>
109     /// </summary>
110     /// <param name="node">
111     /// <para>The node.</para>
112     /// <para></para>
113     /// </param>
114     /// <param name="left">
115     /// <para>The left.</para>
116     /// <para></para>
117     /// </param>
118     [MethodImpl(MethodImplOptions.AggressiveInlining)]
119     protected override void SetLeft(ulong node, ulong left) => Links[node].LeftAsSource =
        ↳ left;
120
121     /// <summary>
122     /// <para>
123     /// Sets the right using the specified node.
124     /// </para>
125     /// <para></para>
126     /// </summary>
127     /// <param name="node">
128     /// <para>The node.</para>
129     /// <para></para>
130     /// </param>
131     /// <param name="right">
132     /// <para>The right.</para>
133     /// <para></para>
134     /// </param>
135     [MethodImpl(MethodImplOptions.AggressiveInlining)]
136     protected override void SetRight(ulong node, ulong right) => Links[node].RightAsSource =
        ↳ right;
137
138     /// <summary>
139     /// <para>
140     /// Gets the size using the specified node.
141     /// </para>
142     /// <para></para>
143     /// </summary>
144     /// <param name="node">
145     /// <para>The node.</para>
146     /// <para></para>
147     /// </param>
148     /// <returns>
149     /// <para>The ulong</para>
150     /// <para></para>
151     /// </returns>
152     [MethodImpl(MethodImplOptions.AggressiveInlining)]
153     protected override ulong GetSize(ulong node) => Links[node].SizeAsSource;
154
155     /// <summary>
156     /// <para>
157     /// Sets the size using the specified node.
158     /// </para>
159     /// <para></para>
160     /// </summary>
161     /// <param name="node">
162     /// <para>The node.</para>
163     /// <para></para>
164     /// </param>
165     /// <param name="size">
166     /// <para>The size.</para>
167     /// <para></para>
168     /// </param>
169     [MethodImpl(MethodImplOptions.AggressiveInlining)]
170     protected override void SetSize(ulong node, ulong size) => Links[node].SizeAsSource =
        ↳ size;
171
172     /// <summary>
173     /// <para>
174     /// Gets the tree root.
175     /// </para>
176     /// <para></para>
177     /// </summary>
178     /// <returns>
179     /// <para>The ulong</para>
180     /// <para></para>
181     /// </returns>

```

```

182 [MethodImpl(MethodImplOptions.AggressiveInlining)]
183 protected override ulong GetTreeRoot() => Header->RootAsSource;
184
185 /// <summary>
186 /// <para>
187 /// Gets the base part value using the specified link.
188 /// </para>
189 /// <para></para>
190 /// </summary>
191 /// <param name="link">
192 /// <para>The link.</para>
193 /// <para></para>
194 /// </param>
195 /// <returns>
196 /// <para>The ulong</para>
197 /// <para></para>
198 /// </returns>
199 [MethodImpl(MethodImplOptions.AggressiveInlining)]
200 protected override ulong GetBasePartValue(ulong link) => Links[link].Source;
201
202 /// <summary>
203 /// <para>
204 /// Determines whether this instance first is to the left of second.
205 /// </para>
206 /// <para></para>
207 /// </summary>
208 /// <param name="firstSource">
209 /// <para>The first source.</para>
210 /// <para></para>
211 /// </param>
212 /// <param name="firstTarget">
213 /// <para>The first target.</para>
214 /// <para></para>
215 /// </param>
216 /// <param name="secondSource">
217 /// <para>The second source.</para>
218 /// <para></para>
219 /// </param>
220 /// <param name="secondTarget">
221 /// <para>The second target.</para>
222 /// <para></para>
223 /// </param>
224 /// <returns>
225 /// <para>The bool</para>
226 /// <para></para>
227 /// </returns>
228 [MethodImpl(MethodImplOptions.AggressiveInlining)]
229 protected override bool FirstIsToLeftOfSecond(ulong firstSource, ulong firstTarget,
230     ↪ ulong secondSource, ulong secondTarget)
231     => firstSource < secondSource || (firstSource == secondSource && firstTarget <
232     ↪ secondTarget);
233
234 /// <summary>
235 /// <para>
236 /// Determines whether this instance first is to the right of second.
237 /// </para>
238 /// <para></para>
239 /// </summary>
240 /// <param name="firstSource">
241 /// <para>The first source.</para>
242 /// <para></para>
243 /// </param>
244 /// <param name="firstTarget">
245 /// <para>The first target.</para>
246 /// <para></para>
247 /// </param>
248 /// <param name="secondSource">
249 /// <para>The second source.</para>
250 /// <para></para>
251 /// </param>
252 /// <param name="secondTarget">
253 /// <para>The second target.</para>
254 /// <para></para>
255 /// </param>
256 /// <returns>
257 /// <para>The bool</para>
258 /// <para></para>
259 /// </returns>

```

```

258 [MethodImpl(MethodImplOptions.AggressiveInlining)]
259 protected override bool FirstIsToTheRightOfSecond(ulong firstSource, ulong firstTarget,
    ↳ ulong secondSource, ulong secondTarget)
260 => firstSource > secondSource || (firstSource == secondSource && firstTarget >
    ↳ secondTarget);
261
262 /// <summary>
263 /// <para>
264 /// Clears the node using the specified node.
265 /// </para>
266 /// <para></para>
267 /// </summary>
268 /// <param name="node">
269 /// <para>The node.</para>
270 /// <para></para>
271 /// </param>
272 [MethodImpl(MethodImplOptions.AggressiveInlining)]
273 protected override void ClearNode(ulong node)
274 {
275     ref var link = ref Links[node];
276     link.LeftAsSource = OUL;
277     link.RightAsSource = OUL;
278     link.SizeAsSource = OUL;
279 }
280 }
281 }

```

### 1.103 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt64LinksSourcesSizeBalancedTreeMethods.c

```

1 using System.Runtime.CompilerServices;
2
3 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5 namespace Platform.Data.Doublets.Memory.United.Specific
6 {
7     /// <summary>
8     /// <para>
9     /// Represents the int 64 links sources size balanced tree methods.
10    /// </para>
11    /// <para></para>
12    /// </summary>
13    /// <seealso cref="UInt64LinksSizeBalancedTreeMethodsBase"/>
14    public unsafe class UInt64LinksSourcesSizeBalancedTreeMethods :
15    ↳ UInt64LinksSizeBalancedTreeMethodsBase
16    {
17        /// <summary>
18        /// <para>
19        /// Initializes a new <see cref="UInt64LinksSourcesSizeBalancedTreeMethods"/> instance.
20        /// </para>
21        /// <para></para>
22        /// </summary>
23        /// <param name="constants">
24        /// <para>A constants.</para>
25        /// <para></para>
26        /// </param>
27        /// <param name="links">
28        /// <para>A links.</para>
29        /// <para></para>
30        /// </param>
31        /// <param name="header">
32        /// <para>A header.</para>
33        /// <para></para>
34        /// </param>
35        public UInt64LinksSourcesSizeBalancedTreeMethods(LinksConstants<ulong> constants,
36    ↳ RawLink<ulong>* links, LinksHeader<ulong>* header) : base(constants, links, header)
37    ↳ { }
38
39    /// <summary>
40    /// <para>
41    /// Gets the left reference using the specified node.
42    /// </para>
43    /// <para></para>
44    /// </summary>
45    /// <param name="node">
46    /// <para>The node.</para>
47    /// <para></para>
48    /// </param>
49    /// <returns>
50    /// <para>The ref ulong</para>

```

```

48     /// <para></para>
49     /// </returns>
50     [MethodImpl(MethodImplOptions.AggressiveInlining)]
51     protected override ref ulong GetLeftReference(ulong node) => ref
    ↪ Links[node].LeftAsSource;

52
53     /// <summary>
54     /// <para>
55     /// Gets the right reference using the specified node.
56     /// </para>
57     /// <para></para>
58     /// </summary>
59     /// <param name="node">
60     /// <para>The node.</para>
61     /// <para></para>
62     /// </param>
63     /// <returns>
64     /// <para>The ref ulong</para>
65     /// <para></para>
66     /// </returns>
67     [MethodImpl(MethodImplOptions.AggressiveInlining)]
68     protected override ref ulong GetRightReference(ulong node) => ref
    ↪ Links[node].RightAsSource;

69
70     /// <summary>
71     /// <para>
72     /// Gets the left using the specified node.
73     /// </para>
74     /// <para></para>
75     /// </summary>
76     /// <param name="node">
77     /// <para>The node.</para>
78     /// <para></para>
79     /// </param>
80     /// <returns>
81     /// <para>The ulong</para>
82     /// <para></para>
83     /// </returns>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     protected override ulong GetLeft(ulong node) => Links[node].LeftAsSource;
86
87     /// <summary>
88     /// <para>
89     /// Gets the right using the specified node.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <param name="node">
94     /// <para>The node.</para>
95     /// <para></para>
96     /// </param>
97     /// <returns>
98     /// <para>The ulong</para>
99     /// <para></para>
100    /// </returns>
101    [MethodImpl(MethodImplOptions.AggressiveInlining)]
102    protected override ulong GetRight(ulong node) => Links[node].RightAsSource;
103
104    /// <summary>
105    /// <para>
106    /// Sets the left using the specified node.
107    /// </para>
108    /// <para></para>
109    /// </summary>
110    /// <param name="node">
111    /// <para>The node.</para>
112    /// <para></para>
113    /// </param>
114    /// <param name="left">
115    /// <para>The left.</para>
116    /// <para></para>
117    /// </param>
118    [MethodImpl(MethodImplOptions.AggressiveInlining)]
119    protected override void SetLeft(ulong node, ulong left) => Links[node].LeftAsSource =
    ↪ left;

120
121    /// <summary>
122    /// <para>

```



```

123     /// Sets the right using the specified node.
124     /// </para>
125     /// <para></para>
126     /// </summary>
127     /// <param name="node">
128     /// <para>The node.</para>
129     /// <para></para>
130     /// </param>
131     /// <param name="right">
132     /// <para>The right.</para>
133     /// <para></para>
134     /// </param>
135     [MethodImpl(MethodImplOptions.AggressiveInlining)]
136     protected override void SetRight(ulong node, ulong right) => Links[node].RightAsSource =
        ↳ right;
137
138     /// <summary>
139     /// <para>
140     /// Gets the size using the specified node.
141     /// </para>
142     /// <para></para>
143     /// </summary>
144     /// <param name="node">
145     /// <para>The node.</para>
146     /// <para></para>
147     /// </param>
148     /// <returns>
149     /// <para>The ulong</para>
150     /// <para></para>
151     /// </returns>
152     [MethodImpl(MethodImplOptions.AggressiveInlining)]
153     protected override ulong GetSize(ulong node) => Links[node].SizeAsSource;
154
155     /// <summary>
156     /// <para>
157     /// Sets the size using the specified node.
158     /// </para>
159     /// <para></para>
160     /// </summary>
161     /// <param name="node">
162     /// <para>The node.</para>
163     /// <para></para>
164     /// </param>
165     /// <param name="size">
166     /// <para>The size.</para>
167     /// <para></para>
168     /// </param>
169     [MethodImpl(MethodImplOptions.AggressiveInlining)]
170     protected override void SetSize(ulong node, ulong size) => Links[node].SizeAsSource =
        ↳ size;
171
172     /// <summary>
173     /// <para>
174     /// Gets the tree root.
175     /// </para>
176     /// <para></para>
177     /// </summary>
178     /// <returns>
179     /// <para>The ulong</para>
180     /// <para></para>
181     /// </returns>
182     [MethodImpl(MethodImplOptions.AggressiveInlining)]
183     protected override ulong GetTreeRoot() => Header->RootAsSource;
184
185     /// <summary>
186     /// <para>
187     /// Gets the base part value using the specified link.
188     /// </para>
189     /// <para></para>
190     /// </summary>
191     /// <param name="link">
192     /// <para>The link.</para>
193     /// <para></para>
194     /// </param>
195     /// <returns>
196     /// <para>The ulong</para>
197     /// <para></para>
198     /// </returns>

```

```

199 [MethodImpl(MethodImplOptions.AggressiveInlining)]
200 protected override ulong GetBasePartValue(ulong link) => Links[link].Source;
201
202 /// <summary>
203 /// <para>
204 /// Determines whether this instance first is to the left of second.
205 /// </para>
206 /// <para></para>
207 /// </summary>
208 /// <param name="firstSource">
209 /// <para>The first source.</para>
210 /// <para></para>
211 /// </param>
212 /// <param name="firstTarget">
213 /// <para>The first target.</para>
214 /// <para></para>
215 /// </param>
216 /// <param name="secondSource">
217 /// <para>The second source.</para>
218 /// <para></para>
219 /// </param>
220 /// <param name="secondTarget">
221 /// <para>The second target.</para>
222 /// <para></para>
223 /// </param>
224 /// <returns>
225 /// <para>The bool</para>
226 /// <para></para>
227 /// </returns>
228 [MethodImpl(MethodImplOptions.AggressiveInlining)]
229 protected override bool FirstIsToLeftOfSecond(ulong firstSource, ulong firstTarget,
230     ↪ ulong secondSource, ulong secondTarget)
231     => firstSource < secondSource || (firstSource == secondSource && firstTarget <
232     ↪ secondTarget);
233
234 /// <summary>
235 /// <para>
236 /// Determines whether this instance first is to the right of second.
237 /// </para>
238 /// <para></para>
239 /// </summary>
240 /// <param name="firstSource">
241 /// <para>The first source.</para>
242 /// <para></para>
243 /// </param>
244 /// <param name="firstTarget">
245 /// <para>The first target.</para>
246 /// <para></para>
247 /// </param>
248 /// <param name="secondSource">
249 /// <para>The second source.</para>
250 /// <para></para>
251 /// </param>
252 /// <param name="secondTarget">
253 /// <para>The second target.</para>
254 /// <para></para>
255 /// </param>
256 /// <returns>
257 /// <para>The bool</para>
258 /// <para></para>
259 /// </returns>
260 [MethodImpl(MethodImplOptions.AggressiveInlining)]
261 protected override bool FirstIsToTheRightOfSecond(ulong firstSource, ulong firstTarget,
262     ↪ ulong secondSource, ulong secondTarget)
263     => firstSource > secondSource || (firstSource == secondSource && firstTarget >
264     ↪ secondTarget);
265
266 /// <summary>
267 /// <para>
268 /// Clears the node using the specified node.
269 /// </para>
270 /// <para></para>
271 /// </summary>
272 /// <param name="node">
273 /// <para>The node.</para>
274 /// <para></para>
275 /// </param>

```

```

272     [MethodImpl(MethodImplOptions.AggressiveInlining)]
273     protected override void ClearNode(ulong node)
274     {
275         ref var link = ref Links[node];
276         link.LeftAsSource = OUL;
277         link.RightAsSource = OUL;
278         link.SizeAsSource = OUL;
279     }
280 }
281 }

```

#### 1.104 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt64LinksTargetsAvlBalancedTreeMethods.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.Data.Doublets.Memory.United.Specific
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the int 64 links targets avl balanced tree methods.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="UInt64LinksAvlBalancedTreeMethodsBase"/>
14     public unsafe class UInt64LinksTargetsAvlBalancedTreeMethods :
15         ↳ UInt64LinksAvlBalancedTreeMethodsBase
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="UInt64LinksTargetsAvlBalancedTreeMethods"/> instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="constants">
24         /// <para>A constants.</para>
25         /// <para></para>
26         /// </param>
27         /// <param name="links">
28         /// <para>A links.</para>
29         /// <para></para>
30         /// </param>
31         /// <param name="header">
32         /// <para>A header.</para>
33         /// <para></para>
34         /// </param>
35         public UInt64LinksTargetsAvlBalancedTreeMethods(LinksConstants<ulong> constants,
36             ↳ RawLink<ulong>* links, LinksHeader<ulong>* header) : base(constants, links, header)
37             ↳ { }
38
39         /// <summary>
40         /// <para>
41         /// Gets the left reference using the specified node.
42         /// </para>
43         /// <para></para>
44         /// </summary>
45         /// <param name="node">
46         /// <para>The node.</para>
47         /// <para></para>
48         /// </param>
49         /// <returns>
50         /// <para>The ref ulong</para>
51         /// <para></para>
52         /// </returns>
53         [MethodImpl(MethodImplOptions.AggressiveInlining)]
54         protected override ref ulong GetLeftReference(ulong node) => ref
55             ↳ Links[node].LeftAsTarget;
56
57         /// <summary>
58         /// <para>
59         /// Gets the right reference using the specified node.
60         /// </para>
61         /// <para></para>
62         /// </summary>
63         /// <param name="node">
64         /// <para>The node.</para>
65         /// <para></para>
66         /// </param>

```

```

63     /// <returns>
64     /// <para>The ref ulong</para>
65     /// <para></para>
66     /// </returns>
67     [MethodImpl(MethodImplOptions.AggressiveInlining)]
68     protected override ref ulong GetRightReference(ulong node) => ref
        ↳ Links[node].RightAsTarget;
69
70     /// <summary>
71     /// <para>
72     /// Gets the left using the specified node.
73     /// </para>
74     /// <para></para>
75     /// </summary>
76     /// <param name="node">
77     /// <para>The node.</para>
78     /// <para></para>
79     /// </param>
80     /// <returns>
81     /// <para>The ulong</para>
82     /// <para></para>
83     /// </returns>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     protected override ulong GetLeft(ulong node) => Links[node].LeftAsTarget;
86
87     /// <summary>
88     /// <para>
89     /// Gets the right using the specified node.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <param name="node">
94     /// <para>The node.</para>
95     /// <para></para>
96     /// </param>
97     /// <returns>
98     /// <para>The ulong</para>
99     /// <para></para>
100    /// </returns>
101    [MethodImpl(MethodImplOptions.AggressiveInlining)]
102    protected override ulong GetRight(ulong node) => Links[node].RightAsTarget;
103
104    /// <summary>
105    /// <para>
106    /// Sets the left using the specified node.
107    /// </para>
108    /// <para></para>
109    /// </summary>
110    /// <param name="node">
111    /// <para>The node.</para>
112    /// <para></para>
113    /// </param>
114    /// <param name="left">
115    /// <para>The left.</para>
116    /// <para></para>
117    /// </param>
118    [MethodImpl(MethodImplOptions.AggressiveInlining)]
119    protected override void SetLeft(ulong node, ulong left) => Links[node].LeftAsTarget =
        ↳ left;
120
121    /// <summary>
122    /// <para>
123    /// Sets the right using the specified node.
124    /// </para>
125    /// <para></para>
126    /// </summary>
127    /// <param name="node">
128    /// <para>The node.</para>
129    /// <para></para>
130    /// </param>
131    /// <param name="right">
132    /// <para>The right.</para>
133    /// <para></para>
134    /// </param>
135    [MethodImpl(MethodImplOptions.AggressiveInlining)]
136    protected override void SetRight(ulong node, ulong right) => Links[node].RightAsTarget =
        ↳ right;
137

```

```

138     /// <summary>
139     /// <para>
140     /// Gets the size using the specified node.
141     /// </para>
142     /// <para></para>
143     /// </summary>
144     /// <param name="node">
145     /// <para>The node.</para>
146     /// <para></para>
147     /// </param>
148     /// <returns>
149     /// <para>The ulong</para>
150     /// <para></para>
151     /// </returns>
152     [MethodImpl(MethodImplOptions.AggressiveInlining)]
153     protected override ulong GetSize(ulong node) => GetSizeValue(Links[node].SizeAsTarget);
154
155     /// <summary>
156     /// <para>
157     /// Sets the size using the specified node.
158     /// </para>
159     /// <para></para>
160     /// </summary>
161     /// <param name="node">
162     /// <para>The node.</para>
163     /// <para></para>
164     /// </param>
165     /// <param name="size">
166     /// <para>The size.</para>
167     /// <para></para>
168     /// </param>
169     [MethodImpl(MethodImplOptions.AggressiveInlining)]
170     protected override void SetSize(ulong node, ulong size) => SetSizeValue(ref
    ↳ Links[node].SizeAsTarget, size);
171
172     /// <summary>
173     /// <para>
174     /// Determines whether this instance get left is child.
175     /// </para>
176     /// <para></para>
177     /// </summary>
178     /// <param name="node">
179     /// <para>The node.</para>
180     /// <para></para>
181     /// </param>
182     /// <returns>
183     /// <para>The bool</para>
184     /// <para></para>
185     /// </returns>
186     [MethodImpl(MethodImplOptions.AggressiveInlining)]
187     protected override bool GetLeftIsChild(ulong node) =>
    ↳ GetLeftIsChildValue(Links[node].SizeAsTarget);
188
189     /// <summary>
190     /// <para>
191     /// Sets the left is child using the specified node.
192     /// </para>
193     /// <para></para>
194     /// </summary>
195     /// <param name="node">
196     /// <para>The node.</para>
197     /// <para></para>
198     /// </param>
199     /// <param name="value">
200     /// <para>The value.</para>
201     /// <para></para>
202     /// </param>
203     [MethodImpl(MethodImplOptions.AggressiveInlining)]
204     protected override void SetLeftIsChild(ulong node, bool value) =>
    ↳ SetLeftIsChildValue(ref Links[node].SizeAsTarget, value);
205
206     /// <summary>
207     /// <para>
208     /// Determines whether this instance get right is child.
209     /// </para>
210     /// <para></para>
211     /// </summary>
212     /// <param name="node">

```

```

213    /// <para>The node.</para>
214    /// <para></para>
215    /// </param>
216    /// <returns>
217    /// <para>The bool</para>
218    /// <para></para>
219    /// </returns>
220    [MethodImpl(MethodImplOptions.AggressiveInlining)]
221    protected override bool GetRightIsChild(ulong node) =>
222        ↪ GetRightIsChildValue(Links[node].SizeAsTarget);
223
224    /// <summary>
225    /// <para>
226    /// Sets the right is child using the specified node.
227    /// </para>
228    /// <para></para>
229    /// </summary>
230    /// <param name="node">
231    /// <para>The node.</para>
232    /// <para></para>
233    /// </param>
234    /// <param name="value">
235    /// <para>The value.</para>
236    /// <para></para>
237    /// </param>
238    [MethodImpl(MethodImplOptions.AggressiveInlining)]
239    protected override void SetRightIsChild(ulong node, bool value) =>
240        ↪ SetRightIsChildValue(ref Links[node].SizeAsTarget, value);
241
242    /// <summary>
243    /// <para>
244    /// Gets the balance using the specified node.
245    /// </para>
246    /// <para></para>
247    /// </summary>
248    /// <param name="node">
249    /// <para>The node.</para>
250    /// <para></para>
251    /// </param>
252    /// <returns>
253    /// <para>The sbyte</para>
254    /// <para></para>
255    /// </returns>
256    [MethodImpl(MethodImplOptions.AggressiveInlining)]
257    protected override sbyte GetBalance(ulong node) =>
258        ↪ GetBalanceValue(Links[node].SizeAsTarget);
259
260    /// <summary>
261    /// <para>
262    /// Sets the balance using the specified node.
263    /// </para>
264    /// <para></para>
265    /// </summary>
266    /// <param name="node">
267    /// <para>The node.</para>
268    /// <para></para>
269    /// </param>
270    /// <param name="value">
271    /// <para>The value.</para>
272    /// <para></para>
273    /// </param>
274    [MethodImpl(MethodImplOptions.AggressiveInlining)]
275    protected override void SetBalance(ulong node, sbyte value) => SetBalanceValue(ref
276        ↪ Links[node].SizeAsTarget, value);
277
278    /// <summary>
279    /// <para>
280    /// Gets the tree root.
281    /// </para>
282    /// <para></para>
283    /// </summary>
284    /// <returns>
285    /// <para>The ulong</para>
286    /// <para></para>
287    /// </returns>
288    [MethodImpl(MethodImplOptions.AggressiveInlining)]
289    protected override ulong GetTreeRoot() => Header->RootAsTarget;

```

```

287     /// <summary>
288     /// <para>
289     /// Gets the base part value using the specified link.
290     /// </para>
291     /// <para></para>
292     /// </summary>
293     /// <param name="link">
294     /// <para>The link.</para>
295     /// <para></para>
296     /// </param>
297     /// <returns>
298     /// <para>The ulong</para>
299     /// <para></para>
300     /// </returns>
301     [MethodImpl(MethodImplOptions.AggressiveInlining)]
302     protected override ulong GetBasePartValue(ulong link) => Links[link].Target;
303
304     /// <summary>
305     /// <para>
306     /// Determines whether this instance first is to the left of second.
307     /// </para>
308     /// <para></para>
309     /// </summary>
310     /// <param name="firstSource">
311     /// <para>The first source.</para>
312     /// <para></para>
313     /// </param>
314     /// <param name="firstTarget">
315     /// <para>The first target.</para>
316     /// <para></para>
317     /// </param>
318     /// <param name="secondSource">
319     /// <para>The second source.</para>
320     /// <para></para>
321     /// </param>
322     /// <param name="secondTarget">
323     /// <para>The second target.</para>
324     /// <para></para>
325     /// </param>
326     /// <returns>
327     /// <para>The bool</para>
328     /// <para></para>
329     /// </returns>
330     [MethodImpl(MethodImplOptions.AggressiveInlining)]
331     protected override bool FirstIsToTheLeftOfSecond(ulong firstSource, ulong firstTarget,
332     ↪     ulong secondSource, ulong secondTarget)
333     ↪     => firstTarget < secondTarget || (firstTarget == secondTarget && firstSource <
334     ↪     secondSource);
335
336     /// <summary>
337     /// <para>
338     /// Determines whether this instance first is to the right of second.
339     /// </para>
340     /// <para></para>
341     /// </summary>
342     /// <param name="firstSource">
343     /// <para>The first source.</para>
344     /// <para></para>
345     /// </param>
346     /// <param name="firstTarget">
347     /// <para>The first target.</para>
348     /// <para></para>
349     /// </param>
350     /// <param name="secondSource">
351     /// <para>The second source.</para>
352     /// <para></para>
353     /// </param>
354     /// <param name="secondTarget">
355     /// <para>The second target.</para>
356     /// <para></para>
357     /// </param>
358     /// <returns>
359     /// <para>The bool</para>
360     /// <para></para>
361     /// </returns>
362     [MethodImpl(MethodImplOptions.AggressiveInlining)]
363     protected override bool FirstIsToTheRightOfSecond(ulong firstSource, ulong firstTarget,
364     ↪     ulong secondSource, ulong secondTarget)

```

```

362         => firstTarget > secondTarget || (firstTarget == secondTarget && firstSource >
363             ↪ secondSource);
364
365     /// <summary>
366     /// <para>
367     /// Clears the node using the specified node.
368     /// </para>
369     /// </summary>
370     /// <param name="node">
371     /// <para>The node.</para>
372     /// </param>
373     [MethodImpl(MethodImplOptions.AggressiveInlining)]
374     protected override void ClearNode(ulong node)
375     {
376         ref var link = ref Links[node];
377         link.LeftAsTarget = OUL;
378         link.RightAsTarget = OUL;
379         link.SizeAsTarget = OUL;
380     }
381 }
382 }
383 }

```

## 1.105 ./csharp/Platform.Data.Doublets.Memory.United/Specific/UInt64LinksTargetsRecursionlessSizeBalancedTreeMethods

```

1  using System.Runtime.CompilerServices;
2
3  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5  namespace Platform.Data.Doublets.Memory.United.Specific
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the int 64 links targets recursionless size balanced tree methods.
10     /// </para>
11     /// </summary>
12     /// <seealso cref="UInt64LinksRecursionlessSizeBalancedTreeMethodsBase"/>
13     public unsafe class UInt64LinksTargetsRecursionlessSizeBalancedTreeMethods :
14         ↪ UInt64LinksRecursionlessSizeBalancedTreeMethodsBase
15     {
16         /// <summary>
17         /// <para>
18         /// Initializes a new <see
19         ↪ cref="UInt64LinksTargetsRecursionlessSizeBalancedTreeMethods"/> instance.
20         /// </para>
21         /// </summary>
22         /// <param name="constants">
23         /// <para>A constants.</para>
24         /// </param>
25         /// <param name="links">
26         /// <para>A links.</para>
27         /// </param>
28         /// <param name="header">
29         /// <para>A header.</para>
30         /// </param>
31         public UInt64LinksTargetsRecursionlessSizeBalancedTreeMethods(LinksConstants<ulong>
32             ↪ constants, RawLink<ulong>* links, LinksHeader<ulong>* header) : base(constants,
33             ↪ links, header) { }
34
35         /// <summary>
36         /// <para>
37         /// Gets the left reference using the specified node.
38         /// </para>
39         /// </summary>
40         /// <param name="node">
41         /// <para>The node.</para>
42         /// </param>
43         /// <returns>
44         /// <para>The ref ulong</para>
45         /// </returns>
46     }
47
48     /// <summary>
49     /// <para>

```



```

50 [MethodImpl(MethodImplOptions.AggressiveInlining)]
51 protected override ref ulong GetLeftReference(ulong node) => ref
    ↳ Links[node].LeftAsTarget;

52
53 /// <summary>
54 /// <para>
55 /// Gets the right reference using the specified node.
56 /// </para>
57 /// <para></para>
58 /// </summary>
59 /// <param name="node">
60 /// <para>The node.</para>
61 /// <para></para>
62 /// </param>
63 /// <returns>
64 /// <para>The ref ulong</para>
65 /// <para></para>
66 /// </returns>
67 [MethodImpl(MethodImplOptions.AggressiveInlining)]
68 protected override ref ulong GetRightReference(ulong node) => ref
    ↳ Links[node].RightAsTarget;

69
70 /// <summary>
71 /// <para>
72 /// Gets the left using the specified node.
73 /// </para>
74 /// <para></para>
75 /// </summary>
76 /// <param name="node">
77 /// <para>The node.</para>
78 /// <para></para>
79 /// </param>
80 /// <returns>
81 /// <para>The ulong</para>
82 /// <para></para>
83 /// </returns>
84 [MethodImpl(MethodImplOptions.AggressiveInlining)]
85 protected override ulong GetLeft(ulong node) => Links[node].LeftAsTarget;
86
87 /// <summary>
88 /// <para>
89 /// Gets the right using the specified node.
90 /// </para>
91 /// <para></para>
92 /// </summary>
93 /// <param name="node">
94 /// <para>The node.</para>
95 /// <para></para>
96 /// </param>
97 /// <returns>
98 /// <para>The ulong</para>
99 /// <para></para>
100 /// </returns>
101 [MethodImpl(MethodImplOptions.AggressiveInlining)]
102 protected override ulong GetRight(ulong node) => Links[node].RightAsTarget;
103
104 /// <summary>
105 /// <para>
106 /// Sets the left using the specified node.
107 /// </para>
108 /// <para></para>
109 /// </summary>
110 /// <param name="node">
111 /// <para>The node.</para>
112 /// <para></para>
113 /// </param>
114 /// <param name="left">
115 /// <para>The left.</para>
116 /// <para></para>
117 /// </param>
118 [MethodImpl(MethodImplOptions.AggressiveInlining)]
119 protected override void SetLeft(ulong node, ulong left) => Links[node].LeftAsTarget =
    ↳ left;

120
121 /// <summary>
122 /// <para>
123 /// Sets the right using the specified node.
124 /// </para>

```

```

125     /// <para></para>
126     /// </summary>
127     /// <param name="node">
128     /// <para>The node.</para>
129     /// <para></para>
130     /// </param>
131     /// <param name="right">
132     /// <para>The right.</para>
133     /// <para></para>
134     /// </param>
135     [MethodImpl(MethodImplOptions.AggressiveInlining)]
136     protected override void SetRight(ulong node, ulong right) => Links[node].RightAsTarget =
        ↳ right;

137
138     /// <summary>
139     /// <para>
140     /// Gets the size using the specified node.
141     /// </para>
142     /// <para></para>
143     /// </summary>
144     /// <param name="node">
145     /// <para>The node.</para>
146     /// <para></para>
147     /// </param>
148     /// <returns>
149     /// <para>The ulong</para>
150     /// <para></para>
151     /// </returns>
152     [MethodImpl(MethodImplOptions.AggressiveInlining)]
153     protected override ulong GetSize(ulong node) => Links[node].SizeAsTarget;
154
155     /// <summary>
156     /// <para>
157     /// Sets the size using the specified node.
158     /// </para>
159     /// <para></para>
160     /// </summary>
161     /// <param name="node">
162     /// <para>The node.</para>
163     /// <para></para>
164     /// </param>
165     /// <param name="size">
166     /// <para>The size.</para>
167     /// <para></para>
168     /// </param>
169     [MethodImpl(MethodImplOptions.AggressiveInlining)]
170     protected override void SetSize(ulong node, ulong size) => Links[node].SizeAsTarget =
        ↳ size;

171
172     /// <summary>
173     /// <para>
174     /// Gets the tree root.
175     /// </para>
176     /// <para></para>
177     /// </summary>
178     /// <returns>
179     /// <para>The ulong</para>
180     /// <para></para>
181     /// </returns>
182     [MethodImpl(MethodImplOptions.AggressiveInlining)]
183     protected override ulong GetTreeRoot() => Header->RootAsTarget;
184
185     /// <summary>
186     /// <para>
187     /// Gets the base part value using the specified link.
188     /// </para>
189     /// <para></para>
190     /// </summary>
191     /// <param name="link">
192     /// <para>The link.</para>
193     /// <para></para>
194     /// </param>
195     /// <returns>
196     /// <para>The ulong</para>
197     /// <para></para>
198     /// </returns>
199     [MethodImpl(MethodImplOptions.AggressiveInlining)]
200     protected override ulong GetBasePartValue(ulong link) => Links[link].Target;

```

```

201
202     /// <summary>
203     /// <para>
204     /// Determines whether this instance first is to the left of second.
205     /// </para>
206     /// <para></para>
207     /// </summary>
208     /// <param name="firstSource">
209     /// <para>The first source.</para>
210     /// <para></para>
211     /// </param>
212     /// <param name="firstTarget">
213     /// <para>The first target.</para>
214     /// <para></para>
215     /// </param>
216     /// <param name="secondSource">
217     /// <para>The second source.</para>
218     /// <para></para>
219     /// </param>
220     /// <param name="secondTarget">
221     /// <para>The second target.</para>
222     /// <para></para>
223     /// </param>
224     /// <returns>
225     /// <para>The bool</para>
226     /// <para></para>
227     /// </returns>
228     [MethodImpl(MethodImplOptions.AggressiveInlining)]
229     protected override bool FirstIsToLeftOfSecond(ulong firstSource, ulong firstTarget,
230     ↪     ulong secondSource, ulong secondTarget)
231     => firstTarget < secondTarget || (firstTarget == secondTarget && firstSource <
232     ↪     secondSource);
233
234     /// <summary>
235     /// <para>
236     /// Determines whether this instance first is to the right of second.
237     /// </para>
238     /// <para></para>
239     /// </summary>
240     /// <param name="firstSource">
241     /// <para>The first source.</para>
242     /// <para></para>
243     /// </param>
244     /// <param name="firstTarget">
245     /// <para>The first target.</para>
246     /// <para></para>
247     /// </param>
248     /// <param name="secondSource">
249     /// <para>The second source.</para>
250     /// <para></para>
251     /// </param>
252     /// <param name="secondTarget">
253     /// <para>The second target.</para>
254     /// <para></para>
255     /// </param>
256     /// <returns>
257     /// <para>The bool</para>
258     /// <para></para>
259     /// </returns>
260     [MethodImpl(MethodImplOptions.AggressiveInlining)]
261     protected override bool FirstIsToTheRightOfSecond(ulong firstSource, ulong firstTarget,
262     ↪     ulong secondSource, ulong secondTarget)
263     => firstTarget > secondTarget || (firstTarget == secondTarget && firstSource >
264     ↪     secondSource);
265
266     /// <summary>
267     /// <para>
268     /// Clears the node using the specified node.
269     /// </para>
270     /// <para></para>
271     /// </summary>
272     /// <param name="node">
273     /// <para>The node.</para>
274     /// <para></para>
275     /// </param>
276     [MethodImpl(MethodImplOptions.AggressiveInlining)]
277     protected override void ClearNode(ulong node)

```

```

274     {
275         ref var link = ref Links[node];
276         link.LeftAsTarget = OUL;
277         link.RightAsTarget = OUL;
278         link.SizeAsTarget = OUL;
279     }
280 }
281 }

```

## 1.106 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt64LinksTargetsSizeBalancedTreeMethods.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.Data.Doublets.Memory.United.Specific
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the int 64 links targets size balanced tree methods.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="UInt64LinksSizeBalancedTreeMethodsBase"/>
14     public unsafe class UInt64LinksTargetsSizeBalancedTreeMethods :
15         ↳ UInt64LinksSizeBalancedTreeMethodsBase
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="UInt64LinksTargetsSizeBalancedTreeMethods"/> instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="constants">
24         /// <para>A constants.</para>
25         /// </param>
26         /// <param name="links">
27         /// <para>A links.</para>
28         /// <para></para>
29         /// </param>
30         /// <param name="header">
31         /// <para>A header.</para>
32         /// <para></para>
33         /// </param>
34         public UInt64LinksTargetsSizeBalancedTreeMethods(LinksConstants<ulong> constants,
35             ↳ RawLink<ulong>* links, LinksHeader<ulong>* header) : base(constants, links, header)
36             ↳ { }
37
38         /// <summary>
39         /// <para>
40         /// Gets the left reference using the specified node.
41         /// </para>
42         /// <para></para>
43         /// </summary>
44         /// <param name="node">
45         /// <para>The node.</para>
46         /// <para></para>
47         /// </param>
48         /// <returns>
49         /// <para>The ref ulong</para>
50         /// <para></para>
51         /// </returns>
52         [MethodImpl(MethodImplOptions.AggressiveInlining)]
53         protected override ref ulong GetLeftReference(ulong node) => ref
54             ↳ Links[node].LeftAsTarget;
55
56         /// <summary>
57         /// <para>
58         /// Gets the right reference using the specified node.
59         /// </para>
60         /// <para></para>
61         /// </summary>
62         /// <param name="node">
63         /// <para>The node.</para>
64         /// <para></para>
65         /// </param>
66         /// <returns>
67         /// <para>The ref ulong</para>
68         /// <para></para>
69         /// </returns>

```

```

65     /// <para></para>
66     /// </returns>
67     [MethodImpl(MethodImplOptions.AggressiveInlining)]
68     protected override ref ulong GetRightReference(ulong node) => ref
        ↳ Links[node].RightAsTarget;
69
70     /// <summary>
71     /// <para>
72     /// Gets the left using the specified node.
73     /// </para>
74     /// <para></para>
75     /// </summary>
76     /// <param name="node">
77     /// <para>The node.</para>
78     /// <para></para>
79     /// </param>
80     /// <returns>
81     /// <para>The ulong</para>
82     /// <para></para>
83     /// </returns>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     protected override ulong GetLeft(ulong node) => Links[node].LeftAsTarget;
86
87     /// <summary>
88     /// <para>
89     /// Gets the right using the specified node.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <param name="node">
94     /// <para>The node.</para>
95     /// <para></para>
96     /// </param>
97     /// <returns>
98     /// <para>The ulong</para>
99     /// <para></para>
100    /// </returns>
101    [MethodImpl(MethodImplOptions.AggressiveInlining)]
102    protected override ulong GetRight(ulong node) => Links[node].RightAsTarget;
103
104    /// <summary>
105    /// <para>
106    /// Sets the left using the specified node.
107    /// </para>
108    /// <para></para>
109    /// </summary>
110    /// <param name="node">
111    /// <para>The node.</para>
112    /// <para></para>
113    /// </param>
114    /// <param name="left">
115    /// <para>The left.</para>
116    /// <para></para>
117    /// </param>
118    [MethodImpl(MethodImplOptions.AggressiveInlining)]
119    protected override void SetLeft(ulong node, ulong left) => Links[node].LeftAsTarget =
        ↳ left;
120
121    /// <summary>
122    /// <para>
123    /// Sets the right using the specified node.
124    /// </para>
125    /// <para></para>
126    /// </summary>
127    /// <param name="node">
128    /// <para>The node.</para>
129    /// <para></para>
130    /// </param>
131    /// <param name="right">
132    /// <para>The right.</para>
133    /// <para></para>
134    /// </param>
135    [MethodImpl(MethodImplOptions.AggressiveInlining)]
136    protected override void SetRight(ulong node, ulong right) => Links[node].RightAsTarget =
        ↳ right;
137
138    /// <summary>
139    /// <para>

```

```

140     /// Gets the size using the specified node.
141     /// </para>
142     /// <para></para>
143     /// </summary>
144     /// <param name="node">
145     /// <para>The node.</para>
146     /// <para></para>
147     /// </param>
148     /// <returns>
149     /// <para>The ulong</para>
150     /// <para></para>
151     /// </returns>
152     [MethodImpl(MethodImplOptions.AggressiveInlining)]
153     protected override ulong GetSize(ulong node) => Links[node].SizeAsTarget;
154
155     /// <summary>
156     /// <para>
157     /// Sets the size using the specified node.
158     /// </para>
159     /// <para></para>
160     /// </summary>
161     /// <param name="node">
162     /// <para>The node.</para>
163     /// <para></para>
164     /// </param>
165     /// <param name="size">
166     /// <para>The size.</para>
167     /// <para></para>
168     /// </param>
169     [MethodImpl(MethodImplOptions.AggressiveInlining)]
170     protected override void SetSize(ulong node, ulong size) => Links[node].SizeAsTarget =
        size;
171
172     /// <summary>
173     /// <para>
174     /// Gets the tree root.
175     /// </para>
176     /// <para></para>
177     /// </summary>
178     /// <returns>
179     /// <para>The ulong</para>
180     /// <para></para>
181     /// </returns>
182     [MethodImpl(MethodImplOptions.AggressiveInlining)]
183     protected override ulong GetTreeRoot() => Header->RootAsTarget;
184
185     /// <summary>
186     /// <para>
187     /// Gets the base part value using the specified link.
188     /// </para>
189     /// <para></para>
190     /// </summary>
191     /// <param name="link">
192     /// <para>The link.</para>
193     /// <para></para>
194     /// </param>
195     /// <returns>
196     /// <para>The ulong</para>
197     /// <para></para>
198     /// </returns>
199     [MethodImpl(MethodImplOptions.AggressiveInlining)]
200     protected override ulong GetBasePartValue(ulong link) => Links[link].Target;
201
202     /// <summary>
203     /// <para>
204     /// Determines whether this instance first is to the left of second.
205     /// </para>
206     /// <para></para>
207     /// </summary>
208     /// <param name="firstSource">
209     /// <para>The first source.</para>
210     /// <para></para>
211     /// </param>
212     /// <param name="firstTarget">
213     /// <para>The first target.</para>
214     /// <para></para>
215     /// </param>
216     /// <param name="secondSource">

```

```

217     /// <para>The second source.</para>
218     /// <para></para>
219     /// </param>
220     /// <param name="secondTarget">
221     /// <para>The second target.</para>
222     /// <para></para>
223     /// </param>
224     /// <returns>
225     /// <para>The bool</para>
226     /// <para></para>
227     /// </returns>
228     [MethodImpl(MethodImplOptions.AggressiveInlining)]
229     protected override bool FirstIsToTheLeftOfSecond(ulong firstSource, ulong firstTarget,
230     ↪     ulong secondSource, ulong secondTarget)
231     => firstTarget < secondTarget || (firstTarget == secondTarget && firstSource <
232     ↪     secondSource);
233
234     /// <summary>
235     /// <para>
236     /// Determines whether this instance first is to the right of second.
237     /// </para>
238     /// <para></para>
239     /// </summary>
240     /// <param name="firstSource">
241     /// <para>The first source.</para>
242     /// <para></para>
243     /// </param>
244     /// <param name="firstTarget">
245     /// <para>The first target.</para>
246     /// <para></para>
247     /// </param>
248     /// <param name="secondSource">
249     /// <para>The second source.</para>
250     /// <para></para>
251     /// </param>
252     /// <param name="secondTarget">
253     /// <para>The second target.</para>
254     /// <para></para>
255     /// </param>
256     /// <returns>
257     /// <para>The bool</para>
258     /// <para></para>
259     /// </returns>
260     [MethodImpl(MethodImplOptions.AggressiveInlining)]
261     protected override bool FirstIsToTheRightOfSecond(ulong firstSource, ulong firstTarget,
262     ↪     ulong secondSource, ulong secondTarget)
263     => firstTarget > secondTarget || (firstTarget == secondTarget && firstSource >
264     ↪     secondSource);
265
266     /// <summary>
267     /// <para>
268     /// Clears the node using the specified node.
269     /// </para>
270     /// <para></para>
271     /// </summary>
272     /// <param name="node">
273     /// <para>The node.</para>
274     /// <para></para>
275     /// </param>
276     [MethodImpl(MethodImplOptions.AggressiveInlining)]
277     protected override void ClearNode(ulong node)
278     {
279         ref var link = ref Links[node];
280         link.LeftAsTarget = OUL;
281         link.RightAsTarget = OUL;
282         link.SizeAsTarget = OUL;
283     }
284 }
285 }

```

## 1.107 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt64UnitedMemoryLinks.cs

```

1 using System;
2 using System.Runtime.CompilerServices;
3 using Platform.Memory;
4 using Platform.Singletons;
5 using Platform.Data.Doublets.Memory.United.Generic;
6
7 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member

```

```

8
9 namespace Platform.Data.Doublets.Memory.United.Specific
10 {
11     /// <summary>
12     /// <para>Represents a low-level implementation of direct access to resizable memory, for
13     ↪ organizing the storage of links with addresses represented as <see cref="ulong"
14     ↪ >.</para>
15     /// <para>Представляет низкоуровневую реализация прямого доступа к памяти с переменным
16     ↪ размером, для организации хранения связей с адресами представленными в виде <see
17     ↪ cref="ulong"/>.</para>
18     /// </summary>
19     public unsafe class UInt64UnitedMemoryLinks : UnitedMemoryLinksBase<ulong>
20     {
21         /// <summary>
22         /// <para>
23         /// The create source tree methods.
24         /// </para>
25         /// <para></para>
26         /// </summary>
27         private readonly Func<ILinksTreeMethods<ulong>> _createSourceTreeMethods;
28         /// <summary>
29         /// <para>
30         /// The create target tree methods.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         private readonly Func<ILinksTreeMethods<ulong>> _createTargetTreeMethods;
35         /// <summary>
36         /// <para>
37         /// The header.
38         /// </para>
39         /// <para></para>
40         /// </summary>
41         private LinksHeader<ulong>* _header;
42         /// <summary>
43         /// <para>
44         /// The links.
45         /// </para>
46         /// <para></para>
47         /// </summary>
48         private RawLink<ulong>* _links;
49
50         /// <summary>
51         /// <para>
52         /// Initializes a new <see cref="UInt64UnitedMemoryLinks"/> instance.
53         /// </para>
54         /// <para></para>
55         /// </summary>
56         /// <param name="address">
57         /// <para>A address.</para>
58         /// <para></para>
59         /// </param>
60         [MethodImpl(MethodImplOptions.AggressiveInlining)]
61         public UInt64UnitedMemoryLinks(string address) : this(address, DefaultLinksSizeStep) { }
62
63         /// <summary>
64         /// Создаёт экземпляр базы данных Links в файле по указанному адресу, с указанным
65         ↪ минимальным шагом расширения базы данных.
66         /// </summary>
67         /// <param name="address">Полный путь к файлу базы данных.</param>
68         /// <param name="memoryReservationStep">Минимальный шаг расширения базы данных в
69         ↪ байтах.</param>
70         [MethodImpl(MethodImplOptions.AggressiveInlining)]
71         public UInt64UnitedMemoryLinks(string address, long memoryReservationStep) : this(new
72         ↪ FileMappedResizableDirectMemory(address, memoryReservationStep),
73         ↪ memoryReservationStep) { }
74
75         /// <summary>
76         /// <para>
77         /// Initializes a new <see cref="UInt64UnitedMemoryLinks"/> instance.
78         /// </para>
79         /// <para></para>
80         /// </summary>
81         /// <param name="memory">
82         /// <para>A memory.</para>
83         /// <para></para>
84         /// </param>
85         [MethodImpl(MethodImplOptions.AggressiveInlining)]

```



```

78 public UInt64UnitedMemoryLinks(IResizableDirectMemory memory) : this(memory,
    ↳ DefaultLinksSizeStep) { }
79
80 /// <summary>
81 /// <para>
82 /// Initializes a new <see cref="UInt64UnitedMemoryLinks"/> instance.
83 /// </para>
84 /// <para></para>
85 /// </summary>
86 /// <param name="memory">
87 /// <para>A memory.</para>
88 /// <para></para>
89 /// </param>
90 /// <param name="memoryReservationStep">
91 /// <para>A memory reservation step.</para>
92 /// <para></para>
93 /// </param>
94 [MethodImpl(MethodImplOptions.AggressiveInlining)]
95 public UInt64UnitedMemoryLinks(IResizableDirectMemory memory, long
    ↳ memoryReservationStep) : this(memory, memoryReservationStep,
    ↳ Default<LinksConstants<ulong>>.Instance, IndexTreeType.Default) { }
96
97 /// <summary>
98 /// <para>
99 /// Initializes a new <see cref="UInt64UnitedMemoryLinks"/> instance.
100 /// </para>
101 /// <para></para>
102 /// </summary>
103 /// <param name="memory">
104 /// <para>A memory.</para>
105 /// <para></para>
106 /// </param>
107 /// <param name="memoryReservationStep">
108 /// <para>A memory reservation step.</para>
109 /// <para></para>
110 /// </param>
111 /// <param name="constants">
112 /// <para>A constants.</para>
113 /// <para></para>
114 /// </param>
115 /// <param name="indexTreeType">
116 /// <para>A index tree type.</para>
117 /// <para></para>
118 /// </param>
119 [MethodImpl(MethodImplOptions.AggressiveInlining)]
120 public UInt64UnitedMemoryLinks(IResizableDirectMemory memory, long
    ↳ memoryReservationStep, LinksConstants<ulong> constants, IndexTreeType indexTreeType)
    ↳ : base(memory, memoryReservationStep, constants)
121 {
122     if (indexTreeType == IndexTreeType.SizedAndThreadedAVLBalancedTree)
123     {
124         _createSourceTreeMethods = () => new
            ↳ UInt64LinksSourcesAvlBalancedTreeMethods(Constants, _links, _header);
125         _createTargetTreeMethods = () => new
            ↳ UInt64LinksTargetsAvlBalancedTreeMethods(Constants, _links, _header);
126     }
127     else if (indexTreeType == IndexTreeType.SizeBalancedTree)
128     {
129         _createSourceTreeMethods = () => new
            ↳ UInt64LinksSourcesSizeBalancedTreeMethods(Constants, _links, _header);
130         _createTargetTreeMethods = () => new
            ↳ UInt64LinksTargetsSizeBalancedTreeMethods(Constants, _links, _header);
131     }
132     else
133     {
134         _createSourceTreeMethods = () => new
            ↳ UInt64LinksSourcesRecursionlessSizeBalancedTreeMethods(Constants, _links,
            ↳ _header);
135         _createTargetTreeMethods = () => new
            ↳ UInt64LinksTargetsRecursionlessSizeBalancedTreeMethods(Constants, _links,
            ↳ _header);
136     }
137     Init(memory, memoryReservationStep);
138 }
139
140 /// <summary>
141 /// <para>

```

```

142 /// Sets the pointers using the specified memory.
143 /// </para>
144 /// <para></para>
145 /// </summary>
146 /// <param name="memory">
147 /// <para>The memory.</para>
148 /// <para></para>
149 /// </param>
150 [MethodImpl(MethodImplOptions.AggressiveInlining)]
151 protected override void SetPointers(IResizableDirectMemory memory)
152 {
153     _header = (LinksHeader<ulong>*)memory.Pointer;
154     _links = (RawLink<ulong>*)memory.Pointer;
155     SourcesTreeMethods = _createSourceTreeMethods();
156     TargetsTreeMethods = _createTargetTreeMethods();
157     UnusedLinksListMethods = new UInt64UnusedLinksListMethods(_links, _header);
158 }
159
160 /// <summary>
161 /// <para>
162 /// Resets the pointers.
163 /// </para>
164 /// <para></para>
165 /// </summary>
166 [MethodImpl(MethodImplOptions.AggressiveInlining)]
167 protected override void ResetPointers()
168 {
169     base.ResetPointers();
170     _links = null;
171     _header = null;
172 }
173
174 /// <summary>
175 /// <para>
176 /// Gets the header reference.
177 /// </para>
178 /// <para></para>
179 /// </summary>
180 /// <returns>
181 /// <para>A ref links header of ulong</para>
182 /// <para></para>
183 /// </returns>
184 [MethodImpl(MethodImplOptions.AggressiveInlining)]
185 protected override ref LinksHeader<ulong> GetHeaderReference() => ref *_header;
186
187 /// <summary>
188 /// <para>
189 /// Gets the link reference using the specified link index.
190 /// </para>
191 /// <para></para>
192 /// </summary>
193 /// <param name="linkIndex">
194 /// <para>The link index.</para>
195 /// <para></para>
196 /// </param>
197 /// <returns>
198 /// <para>A ref raw link of ulong</para>
199 /// <para></para>
200 /// </returns>
201 [MethodImpl(MethodImplOptions.AggressiveInlining)]
202 protected override ref RawLink<ulong> GetLinkReference(ulong linkIndex) => ref
    ↪ _links[linkIndex];
203
204 /// <summary>
205 /// <para>
206 /// Determines whether this instance are equal.
207 /// </para>
208 /// <para></para>
209 /// </summary>
210 /// <param name="first">
211 /// <para>The first.</para>
212 /// <para></para>
213 /// </param>
214 /// <param name="second">
215 /// <para>The second.</para>
216 /// <para></para>
217 /// </param>
218 /// </returns>

```

```

219    /// <para>The bool</para>
220    /// <para></para>
221    /// </returns>
222    [MethodImpl(MethodImplOptions.AggressiveInlining)]
223    protected override bool AreEqual(ulong first, ulong second) => first == second;
224
225    /// <summary>
226    /// <para>
227    /// Determines whether this instance less than.
228    /// </para>
229    /// <para></para>
230    /// </summary>
231    /// <param name="first">
232    /// <para>The first.</para>
233    /// <para></para>
234    /// </param>
235    /// <param name="second">
236    /// <para>The second.</para>
237    /// <para></para>
238    /// </param>
239    /// <returns>
240    /// <para>The bool</para>
241    /// <para></para>
242    /// </returns>
243    [MethodImpl(MethodImplOptions.AggressiveInlining)]
244    protected override bool LessThan(ulong first, ulong second) => first < second;
245
246    /// <summary>
247    /// <para>
248    /// Determines whether this instance less or equal than.
249    /// </para>
250    /// <para></para>
251    /// </summary>
252    /// <param name="first">
253    /// <para>The first.</para>
254    /// <para></para>
255    /// </param>
256    /// <param name="second">
257    /// <para>The second.</para>
258    /// <para></para>
259    /// </param>
260    /// <returns>
261    /// <para>The bool</para>
262    /// <para></para>
263    /// </returns>
264    [MethodImpl(MethodImplOptions.AggressiveInlining)]
265    protected override bool LessOrEqualThan(ulong first, ulong second) => first <= second;
266
267    /// <summary>
268    /// <para>
269    /// Determines whether this instance greater than.
270    /// </para>
271    /// <para></para>
272    /// </summary>
273    /// <param name="first">
274    /// <para>The first.</para>
275    /// <para></para>
276    /// </param>
277    /// <param name="second">
278    /// <para>The second.</para>
279    /// <para></para>
280    /// </param>
281    /// <returns>
282    /// <para>The bool</para>
283    /// <para></para>
284    /// </returns>
285    [MethodImpl(MethodImplOptions.AggressiveInlining)]
286    protected override bool GreaterThan(ulong first, ulong second) => first > second;
287
288    /// <summary>
289    /// <para>
290    /// Determines whether this instance greater or equal than.
291    /// </para>
292    /// <para></para>
293    /// </summary>
294    /// <param name="first">
295    /// <para>The first.</para>
296    /// <para></para>

```

```

297     /// </param>
298     /// <param name="second">
299     /// <para>The second.</para>
300     /// <para></para>
301     /// </param>
302     /// <returns>
303     /// <para>The bool</para>
304     /// <para></para>
305     /// </returns>
306     [MethodImpl(MethodImplOptions.AggressiveInlining)]
307     protected override bool GreaterOrEqualThan(ulong first, ulong second) => first >= second;
308
309     /// <summary>
310     /// <para>
311     /// Gets the zero.
312     /// </para>
313     /// <para></para>
314     /// </summary>
315     /// <returns>
316     /// <para>The ulong</para>
317     /// <para></para>
318     /// </returns>
319     [MethodImpl(MethodImplOptions.AggressiveInlining)]
320     protected override ulong GetZero() => 0UL;
321
322     /// <summary>
323     /// <para>
324     /// Gets the one.
325     /// </para>
326     /// <para></para>
327     /// </summary>
328     /// <returns>
329     /// <para>The ulong</para>
330     /// <para></para>
331     /// </returns>
332     [MethodImpl(MethodImplOptions.AggressiveInlining)]
333     protected override ulong GetOne() => 1UL;
334
335     /// <summary>
336     /// <para>
337     /// Converts the to int 64 using the specified value.
338     /// </para>
339     /// <para></para>
340     /// </summary>
341     /// <param name="value">
342     /// <para>The value.</para>
343     /// <para></para>
344     /// </param>
345     /// <returns>
346     /// <para>The long</para>
347     /// <para></para>
348     /// </returns>
349     [MethodImpl(MethodImplOptions.AggressiveInlining)]
350     protected override long ConvertToInt64(ulong value) => (long)value;
351
352     /// <summary>
353     /// <para>
354     /// Converts the to address using the specified value.
355     /// </para>
356     /// <para></para>
357     /// </summary>
358     /// <param name="value">
359     /// <para>The value.</para>
360     /// <para></para>
361     /// </param>
362     /// <returns>
363     /// <para>The ulong</para>
364     /// <para></para>
365     /// </returns>
366     [MethodImpl(MethodImplOptions.AggressiveInlining)]
367     protected override ulong ConvertToAddress(long value) => (ulong)value;
368
369     /// <summary>
370     /// <para>
371     /// Adds the first.
372     /// </para>
373     /// <para></para>
374     /// </summary>

```

```

375     /// <param name="first">
376     /// <para>The first.</para>
377     /// <para></para>
378     /// </param>
379     /// <param name="second">
380     /// <para>The second.</para>
381     /// <para></para>
382     /// </param>
383     /// <returns>
384     /// <para>The ulong</para>
385     /// <para></para>
386     /// </returns>
387     [MethodImpl(MethodImplOptions.AggressiveInlining)]
388     protected override ulong Add(ulong first, ulong second) => first + second;
389
390     /// <summary>
391     /// <para>
392     /// Subtracts the first.
393     /// </para>
394     /// <para></para>
395     /// </summary>
396     /// <param name="first">
397     /// <para>The first.</para>
398     /// <para></para>
399     /// </param>
400     /// <param name="second">
401     /// <para>The second.</para>
402     /// <para></para>
403     /// </param>
404     /// <returns>
405     /// <para>The ulong</para>
406     /// <para></para>
407     /// </returns>
408     [MethodImpl(MethodImplOptions.AggressiveInlining)]
409     protected override ulong Subtract(ulong first, ulong second) => first - second;
410
411     /// <summary>
412     /// <para>
413     /// Increments the link.
414     /// </para>
415     /// <para></para>
416     /// </summary>
417     /// <param name="link">
418     /// <para>The link.</para>
419     /// <para></para>
420     /// </param>
421     /// <returns>
422     /// <para>The ulong</para>
423     /// <para></para>
424     /// </returns>
425     [MethodImpl(MethodImplOptions.AggressiveInlining)]
426     protected override ulong Increment(ulong link) => ++link;
427
428     /// <summary>
429     /// <para>
430     /// Decrements the link.
431     /// </para>
432     /// <para></para>
433     /// </summary>
434     /// <param name="link">
435     /// <para>The link.</para>
436     /// <para></para>
437     /// </param>
438     /// <returns>
439     /// <para>The ulong</para>
440     /// <para></para>
441     /// </returns>
442     [MethodImpl(MethodImplOptions.AggressiveInlining)]
443     protected override ulong Decrement(ulong link) => --link;
444 }
445 }

```

1.108 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt64UnusedLinksListMethods.cs

```

1 using System.Runtime.CompilerServices;
2 using Platform.Data.Doublets.Memory.United.Generic;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5

```

```

6 namespace Platform.Data.Doublets.Memory.United.Specific
7 {
8     /// <summary>
9     /// <para>
10    /// Represents the int 64 unused links list methods.
11    /// </para>
12    /// <para></para>
13    /// </summary>
14    /// <seealso cref="UnusedLinksListMethods{ulong}"/>
15    public unsafe class UInt64UnusedLinksListMethods : UnusedLinksListMethods<ulong>
16    {
17        /// <summary>
18        /// <para>
19        /// The links.
20        /// </para>
21        /// <para></para>
22        /// </summary>
23        private readonly RawLink<ulong>* _links;
24        /// <summary>
25        /// <para>
26        /// The header.
27        /// </para>
28        /// <para></para>
29        /// </summary>
30        private readonly LinksHeader<ulong>* _header;
31
32        /// <summary>
33        /// <para>
34        /// Initializes a new <see cref="UInt64UnusedLinksListMethods"/> instance.
35        /// </para>
36        /// <para></para>
37        /// </summary>
38        /// <param name="links">
39        /// <para>A links.</para>
40        /// <para></para>
41        /// </param>
42        /// <param name="header">
43        /// <para>A header.</para>
44        /// <para></para>
45        /// </param>
46        [MethodImpl(MethodImplOptions.AggressiveInlining)]
47        public UInt64UnusedLinksListMethods(RawLink<ulong>* links, LinksHeader<ulong>* header)
48            : base((byte*)links, (byte*)header)
49        {
50            _links = links;
51            _header = header;
52        }
53
54        /// <summary>
55        /// <para>
56        /// Gets the link reference using the specified link.
57        /// </para>
58        /// <para></para>
59        /// </summary>
60        /// <param name="link">
61        /// <para>The link.</para>
62        /// <para></para>
63        /// </param>
64        /// <returns>
65        /// <para>A ref raw link of ulong</para>
66        /// <para></para>
67        /// </returns>
68        [MethodImpl(MethodImplOptions.AggressiveInlining)]
69        protected override ref RawLink<ulong> GetLinkReference(ulong link) => ref _links[link];
70
71        /// <summary>
72        /// <para>
73        /// Gets the header reference.
74        /// </para>
75        /// <para></para>
76        /// </summary>
77        /// <returns>
78        /// <para>A ref links header of ulong</para>
79        /// <para></para>
80        /// </returns>
81        [MethodImpl(MethodImplOptions.AggressiveInlining)]
82        protected override ref LinksHeader<ulong> GetHeaderReference() => ref *_header;
83    }

```

84 }

### 1.109 ./csharp/Platform.Data.Doublets/PropertyOperators/PropertiesOperator.cs

```
1 using System.Collections.Generic;
2 using System.Runtime.CompilerServices;
3 using Platform.Interfaces;
4
5 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7 namespace Platform.Data.Doublets.PropertyOperators
8 {
9     /// <summary>
10    /// <para>
11    /// Represents the properties operator.
12    /// </para>
13    /// <para></para>
14    /// </summary>
15    /// <seealso cref="LinksOperatorBase{TLink}" />
16    /// <seealso cref="IProperties{TLink, TLink, TLink}" />
17    public class PropertiesOperator<TLink> : LinksOperatorBase<TLink>, IProperties<TLink, TLink,
18    ↪ TLink>
19    {
20        /// <summary>
21        /// <para>
22        /// The default.
23        /// </para>
24        /// <para></para>
25        /// </summary>
26        private static readonly EqualityComparer<TLink> _equalityComparer =
27        ↪ EqualityComparer<TLink>.Default;
28
29        /// <summary>
30        /// <para>
31        /// Initializes a new <see cref="PropertiesOperator" /> instance.
32        /// </para>
33        /// <para></para>
34        /// </summary>
35        /// <param name="links">
36        /// <para>A links.</para>
37        /// <para></para>
38        /// </param>
39        [MethodImpl(MethodImplOptions.AggressiveInlining)]
40        public PropertiesOperator(ILinks<TLink> links) : base(links) { }
41
42        /// <summary>
43        /// <para>
44        /// Gets the value using the specified object.
45        /// </para>
46        /// <para></para>
47        /// </summary>
48        /// <param name="@object">
49        /// <para>The object.</para>
50        /// <para></para>
51        /// </param>
52        /// <param name="property">
53        /// <para>The property.</para>
54        /// <para></para>
55        /// </param>
56        /// <returns>
57        /// <para>The link</para>
58        /// <para></para>
59        /// </returns>
60        [MethodImpl(MethodImplOptions.AggressiveInlining)]
61        public TLink GetValue(TLink @object, TLink property)
62        {
63            var links = _links;
64            var objectProperty = links.SearchOrDefault(@object, property);
65            if (_equalityComparer.Equals(objectProperty, default))
66            {
67                return default;
68            }
69            var constants = links.Constants;
70            var any = constants.Any;
71            var query = new Link<TLink>(any, objectProperty, any);
72            var valueLink = links.SingleOrDefault(query);
73            if (valueLink == null)
74            {
75                return default;
76            }
77        }
78    }
79 }
```

```

75         return links.GetTarget(valueLink[constants.IndexPart]);
76     }
77
78     /// <summary>
79     /// <para>
80     /// Sets the value using the specified object.
81     /// </para>
82     /// <para></para>
83     /// </summary>
84     /// <param name="@object">
85     /// <para>The object.</para>
86     /// <para></para>
87     /// </param>
88     /// <param name="property">
89     /// <para>The property.</para>
90     /// <para></para>
91     /// </param>
92     /// <param name="value">
93     /// <para>The value.</para>
94     /// <para></para>
95     /// </param>
96     [MethodImpl(MethodImplOptions.AggressiveInlining)]
97     public void SetValue(TLink @object, TLink property, TLink value)
98     {
99         var links = _links;
100         var objectProperty = links.GetOrCreate(@object, property);
101         links.DeleteMany(links.AllIndices(links.Constants.Any, objectProperty));
102         links.GetOrCreate(objectProperty, value);
103     }
104 }
105 }

```

#### 1.110 ./csharp/Platform.Data.Doublets/PropertyOperators/PropertyOperator.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3  using Platform.Interfaces;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Doublets.PropertyOperators
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the property operator.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     /// <seealso cref="LinksOperatorBase{TLink}" />
16     /// <seealso cref="IProperty{TLink, TLink}" />
17     public class PropertyOperator<TLink> : LinksOperatorBase<TLink>, IProperty<TLink, TLink>
18     {
19         /// <summary>
20         /// <para>
21         /// The default.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         private static readonly EqualityComparer<TLink> _equalityComparer =
26             ↳ EqualityComparer<TLink>.Default;
27
28         /// <summary>
29         /// <para>
30         /// The property marker.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         private readonly TLink _propertyMarker;
35
36         /// <summary>
37         /// <para>
38         /// The property value marker.
39         /// </para>
40         /// <para></para>
41         /// </summary>
42         private readonly TLink _propertyValueMarker;
43
44         /// <summary>
45         /// <para>
46         /// Initializes a new <see cref="PropertyOperator" /> instance.
47         /// </para>

```



```

46    /// <para></para>
47    /// </summary>
48    /// <param name="links">
49    /// <para>A links.</para>
50    /// <para></para>
51    /// </param>
52    /// <param name="propertyMarker">
53    /// <para>A property marker.</para>
54    /// <para></para>
55    /// </param>
56    /// <param name="propertyValueMarker">
57    /// <para>A property value marker.</para>
58    /// <para></para>
59    /// </param>
60    [MethodImpl(MethodImplOptions.AggressiveInlining)]
61    public PropertyOperator(ILinks<TLink> links, TLink propertyMarker, TLink
    ↪ propertyValueMarker) : base(links)
62    {
63        _propertyMarker = propertyMarker;
64        _propertyValueMarker = propertyValueMarker;
65    }
66
67    /// <summary>
68    /// <para>
69    /// Gets the link.
70    /// </para>
71    /// <para></para>
72    /// </summary>
73    /// <param name="link">
74    /// <para>The link.</para>
75    /// <para></para>
76    /// </param>
77    /// <returns>
78    /// <para>The link</para>
79    /// <para></para>
80    /// </returns>
81    [MethodImpl(MethodImplOptions.AggressiveInlining)]
82    public TLink Get(TLink link)
83    {
84        var property = _links.SearchOrDefault(link, _propertyMarker);
85        return GetValue(GetContainer(property));
86    }
87
88    /// <summary>
89    /// <para>
90    /// Gets the container using the specified property.
91    /// </para>
92    /// <para></para>
93    /// </summary>
94    /// <param name="property">
95    /// <para>The property.</para>
96    /// <para></para>
97    /// </param>
98    /// <returns>
99    /// <para>The value container.</para>
100    /// <para></para>
101    /// </returns>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    private TLink GetContainer(TLink property)
104    {
105        var valueContainer = default(TLink);
106        if (_equalityComparer.Equals(property, default))
107        {
108            return valueContainer;
109        }
110        var links = _links;
111        var constants = links.Constants;
112        var continueConstant = constants.Continue;
113        var breakConstant = constants.Break;
114        var anyConstant = constants.Any;
115        var query = new Link<TLink>(anyConstant, property, anyConstant);
116        links.Each(candidate =>
117        {
118            var candidateTarget = links.GetTarget(candidate);
119            var valueTarget = links.GetTarget(candidateTarget);
120            if (_equalityComparer.Equals(valueTarget, _propertyValueMarker))
121            {
122                valueContainer = links.GetIndex(candidate);

```

```

123         return breakConstant;
124     }
125     return countinueConstant;
126 }, query);
127 return valueContainer;
128 }
129
130 /// <summary>
131 /// <para>
132 /// Gets the value using the specified container.
133 /// </para>
134 /// <para></para>
135 /// </summary>
136 /// <param name="container">
137 /// <para>The container.</para>
138 /// <para></para>
139 /// </param>
140 /// <returns>
141 /// <para>The link</para>
142 /// <para></para>
143 /// </returns>
144 [MethodImpl(MethodImplOptions.AggressiveInlining)]
145 private TLink GetValue(TLink container) => _equalityComparer.Equals(container, default)
    ↪ ? default : _links.GetTarget(container);
146
147 /// <summary>
148 /// <para>
149 /// Sets the link.
150 /// </para>
151 /// <para></para>
152 /// </summary>
153 /// <param name="link">
154 /// <para>The link.</para>
155 /// <para></para>
156 /// </param>
157 /// <param name="value">
158 /// <para>The value.</para>
159 /// <para></para>
160 /// </param>
161 [MethodImpl(MethodImplOptions.AggressiveInlining)]
162 public void Set(TLink link, TLink value)
163 {
164     var links = _links;
165     var property = links.GetOrCreate(link, _propertyMarker);
166     var container = GetContainer(property);
167     if (_equalityComparer.Equals(container, default))
168     {
169         links.GetOrCreate(property, value);
170     }
171     else
172     {
173         links.Update(container, property, value);
174     }
175 }
176 }
177 }

```

### 1.111 ./csharp/Platform.Data.Doublets/Stacks/Stack.cs

```

1 using System.Collections.Generic;
2 using System.Runtime.CompilerServices;
3 using Platform.Collections.Stacks;
4
5 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7 namespace Platform.Data.Doublets.Stacks
8 {
9     /// <summary>
10    /// <para>
11    /// Represents the stack.
12    /// </para>
13    /// <para></para>
14    /// </summary>
15    /// <seealso cref="LinksOperatorBase{TLink}" />
16    /// <seealso cref="IStack{TLink}" />
17    public class Stack<TLink> : LinksOperatorBase<TLink>, IStack<TLink>
18    {
19        /// <summary>
20        /// <para>
21        /// The default.

```

```

22     /// </para>
23     /// <para></para>
24     /// </summary>
25     private static readonly EqualityComparer<TLink> _equalityComparer =
26         ↳ EqualityComparer<TLink>.Default;
27
28     /// <summary>
29     /// <para>
30     /// The stack.
31     /// </para>
32     /// <para></para>
33     /// </summary>
34     private readonly TLink _stack;
35
36     /// <summary>
37     /// <para>
38     /// Gets the is empty value.
39     /// </para>
40     /// <para></para>
41     /// </summary>
42     public bool IsEmpty
43     {
44         [MethodImpl(MethodImplOptions.AggressiveInlining)]
45         get => _equalityComparer.Equals(Peek(), _stack);
46     }
47
48     /// <summary>
49     /// <para>
50     /// Initializes a new <see cref="Stack"/> instance.
51     /// </para>
52     /// <para></para>
53     /// </summary>
54     /// <param name="links">
55     /// <para>A links.</para>
56     /// <para></para>
57     /// </param>
58     /// <param name="stack">
59     /// <para>A stack.</para>
60     /// <para></para>
61     /// </param>
62     [MethodImpl(MethodImplOptions.AggressiveInlining)]
63     public Stack(ILinks<TLink> links, TLink stack) : base(links) => _stack = stack;
64
65     /// <summary>
66     /// <para>
67     /// Gets the stack marker.
68     /// </para>
69     /// <para></para>
70     /// </summary>
71     /// <returns>
72     /// <para>The link</para>
73     /// <para></para>
74     /// </returns>
75     [MethodImpl(MethodImplOptions.AggressiveInlining)]
76     private TLink GetStackMarker() => _links.GetSource(_stack);
77
78     /// <summary>
79     /// <para>
80     /// Gets the top.
81     /// </para>
82     /// <para></para>
83     /// </summary>
84     /// <returns>
85     /// <para>The link</para>
86     /// <para></para>
87     /// </returns>
88     [MethodImpl(MethodImplOptions.AggressiveInlining)]
89     private TLink GetTop() => _links.GetTarget(_stack);
90
91     /// <summary>
92     /// <para>
93     /// Peeks this instance.
94     /// </para>
95     /// <para></para>
96     /// </summary>
97     /// <returns>
98     /// <para>The link</para>
99     /// <para></para>

```

```

99     /// </returns>
100     [MethodImpl(MethodImplOptions.AggressiveInlining)]
101     public TLink Peek() => _links.GetTarget(GetTop());
102
103     /// <summary>
104     /// <para>
105     /// Pops this instance.
106     /// </para>
107     /// <para></para>
108     /// </summary>
109     /// <returns>
110     /// <para>The element.</para>
111     /// <para></para>
112     /// </returns>
113     [MethodImpl(MethodImplOptions.AggressiveInlining)]
114     public TLink Pop()
115     {
116         var element = Peek();
117         if (!_equalityComparer.Equals(element, _stack))
118         {
119             var top = GetTop();
120             var previousTop = _links.GetSource(top);
121             _links.Update(_stack, GetStackMarker(), previousTop);
122             _links.Delete(top);
123         }
124         return element;
125     }
126
127     /// <summary>
128     /// <para>
129     /// Pushes the element.
130     /// </para>
131     /// <para></para>
132     /// </summary>
133     /// <param name="element">
134     /// <para>The element.</para>
135     /// <para></para>
136     /// </param>
137     [MethodImpl(MethodImplOptions.AggressiveInlining)]
138     public void Push(TLink element) => _links.Update(_stack, GetStackMarker(),
139         ↪ _links.GetOrCreate(GetTop(), element));
140 }

```

### 1.112 ./csharp/Platform.Data.Doublets/Stacks/StackExtensions.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.Data.Doublets.Stacks
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the stack extensions.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     public static class StackExtensions
14     {
15         /// <summary>
16         /// <para>
17         /// Creates the stack using the specified links.
18         /// </para>
19         /// <para></para>
20         /// </summary>
21         /// <typeparam name="TLink">
22         /// <para>The link.</para>
23         /// <para></para>
24         /// </typeparam>
25         /// <param name="links">
26         /// <para>The links.</para>
27         /// <para></para>
28         /// </param>
29         /// <param name="stackMarker">
30         /// <para>The stack marker.</para>
31         /// <para></para>
32         /// </param>
33         /// </returns>

```

```

34     /// <para>The stack.</para>
35     /// <para></para>
36     /// </returns>
37     [MethodImpl(MethodImplOptions.AggressiveInlining)]
38     public static TLink CreateStack<TLink>(this ILinks<TLink> links, TLink stackMarker)
39     {
40         var stackPoint = links.CreatePoint();
41         var stack = links.Update(stackPoint, stackMarker, stackPoint);
42         return stack;
43     }
44 }
45 }

```

### 1.113 ./csharp/Platform.Data.Doublets/SynchronizedLinks.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4  using Platform.Data.Doublets;
5  using Platform.Threading.Synchronization;
6
7  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
8
9  namespace Platform.Data.Doublets
10 {
11     /// <remarks>
12     /// TODO: Autogeneration of synchronized wrapper (decorator).
13     /// TODO: Try to unfold code of each method using IL generation for performance improvements.
14     /// TODO: Or even to unfold multiple layers of implementations.
15     /// </remarks>
16     public class SynchronizedLinks<TLinkAddress> : ISynchronizedLinks<TLinkAddress>
17     {
18         /// <summary>
19         /// <para>
20         /// Gets the constants value.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         public LinksConstants<TLinkAddress> Constants
25         {
26             [MethodImpl(MethodImplOptions.AggressiveInlining)]
27             get;
28         }
29
30         /// <summary>
31         /// <para>
32         /// Gets the sync root value.
33         /// </para>
34         /// <para></para>
35         /// </summary>
36         public ISynchronization SyncRoot
37         {
38             [MethodImpl(MethodImplOptions.AggressiveInlining)]
39             get;
40         }
41
42         /// <summary>
43         /// <para>
44         /// Gets the sync value.
45         /// </para>
46         /// <para></para>
47         /// </summary>
48         public ILinks<TLinkAddress> Sync
49         {
50             [MethodImpl(MethodImplOptions.AggressiveInlining)]
51             get;
52         }
53
54         /// <summary>
55         /// <para>
56         /// Gets the unsync value.
57         /// </para>
58         /// <para></para>
59         /// </summary>
60         public ILinks<TLinkAddress> Unsync
61         {
62             [MethodImpl(MethodImplOptions.AggressiveInlining)]
63             get;
64         }
65
66         /// <summary>

```

```

67     /// <para>
68     /// Initializes a new <see cref="SynchronizedLinks"/> instance.
69     /// </para>
70     /// <para></para>
71     /// </summary>
72     /// <param name="links">
73     /// <para>A links.</para>
74     /// <para></para>
75     /// </param>
76     [MethodImpl(MethodImplOptions.AggressiveInlining)]
77     public SynchronizedLinks(ILinks<TLinkAddress> links) : this(new
    ↪ ReaderWriterLockSynchronization(), links) { }
78
79     /// <summary>
80     /// <para>
81     /// Initializes a new <see cref="SynchronizedLinks"/> instance.
82     /// </para>
83     /// <para></para>
84     /// </summary>
85     /// <param name="synchronization">
86     /// <para>A synchronization.</para>
87     /// <para></para>
88     /// </param>
89     /// <param name="links">
90     /// <para>A links.</para>
91     /// <para></para>
92     /// </param>
93     [MethodImpl(MethodImplOptions.AggressiveInlining)]
94     public SynchronizedLinks(ISynchronization synchronization, ILinks<TLinkAddress> links)
95     {
96         SyncRoot = synchronization;
97         Sync = this;
98         Unsync = links;
99         Constants = links.Constants;
100    }
101
102     /// <summary>
103     /// <para>
104     /// Counts the restriction.
105     /// </para>
106     /// <para></para>
107     /// </summary>
108     /// <param name="restriction">
109     /// <para>The restriction.</para>
110     /// <para></para>
111     /// </param>
112     /// <returns>
113     /// <para>The link address</para>
114     /// <para></para>
115     /// </returns>
116     [MethodImpl(MethodImplOptions.AggressiveInlining)]
117     public TLinkAddress Count(ICollection<TLinkAddress> restriction) =>
    ↪ SyncRoot.ExecuteReadOperation(restriction, Unsync.Count);
118
119     /// <summary>
120     /// <para>
121     /// Eaches the handler.
122     /// </para>
123     /// <para></para>
124     /// </summary>
125     /// <param name="handler">
126     /// <para>The handler.</para>
127     /// <para></para>
128     /// </param>
129     /// <param name="restrictions">
130     /// <para>The restrictions.</para>
131     /// <para></para>
132     /// </param>
133     /// <returns>
134     /// <para>The link address</para>
135     /// <para></para>
136     /// </returns>
137     [MethodImpl(MethodImplOptions.AggressiveInlining)]
138     public TLinkAddress Each(Func<ICollection<TLinkAddress>, TLinkAddress> handler,
    ↪ ICollection<TLinkAddress> restrictions) => SyncRoot.ExecuteReadOperation(handler,
    ↪ restrictions, (handler1, restrictions1) => Unsync.Each(handler1, restrictions1));
139
140     /// <summary>

```

```

141     /// <para>
142     /// Creates the restrictions.
143     /// </para>
144     /// <para></para>
145     /// </summary>
146     /// <param name="restrictions">
147     /// <para>The restrictions.</para>
148     /// <para></para>
149     /// </param>
150     /// <returns>
151     /// <para>The link address</para>
152     /// <para></para>
153     /// </returns>
154     [MethodImpl(MethodImplOptions.AggressiveInlining)]
155     public TLinkAddress Create(IList<TLinkAddress> restrictions) =>
156         ↳ SyncRoot.ExecuteWriteOperation(restrictions, Unsync.Create);
157
158     /// <summary>
159     /// <para>
160     /// Updates the restrictions.
161     /// </para>
162     /// <para></para>
163     /// </summary>
164     /// <param name="restrictions">
165     /// <para>The restrictions.</para>
166     /// <para></para>
167     /// </param>
168     /// <param name="substitution">
169     /// <para>The substitution.</para>
170     /// <para></para>
171     /// </param>
172     /// <returns>
173     /// <para>The link address</para>
174     /// <para></para>
175     /// </returns>
176     [MethodImpl(MethodImplOptions.AggressiveInlining)]
177     public TLinkAddress Update(IList<TLinkAddress> restrictions, IList<TLinkAddress>
178         ↳ substitution) => SyncRoot.ExecuteWriteOperation(restrictions, substitution,
179         ↳ Unsync.Update);
180
181     /// <summary>
182     /// <para>
183     /// Deletes the restrictions.
184     /// </para>
185     /// <para></para>
186     /// </summary>
187     /// <param name="restrictions">
188     /// <para>The restrictions.</para>
189     /// <para></para>
190     /// </param>
191     [MethodImpl(MethodImplOptions.AggressiveInlining)]
192     public void Delete(IList<TLinkAddress> restrictions) =>
193         ↳ SyncRoot.ExecuteWriteOperation(restrictions, Unsync.Delete);
194
195     //public T Trigger(IList<T> restriction, Func<IList<T>, IList<T>, T> matchedHandler,
196     ↳ IList<T> substitution, Func<IList<T>, IList<T>, T> substitutedHandler)
197     //{
198     //    if (restriction != null && substitution != null &&
199     ↳ !substitution.EqualTo(restriction))
200     //        return SyncRoot.ExecuteWriteOperation(restriction, matchedHandler,
201     ↳ substitution, substitutedHandler, Unsync.Trigger);
202
203     //    return SyncRoot.ExecuteReadOperation(restriction, matchedHandler, substitution,
204     ↳ substitutedHandler, Unsync.Trigger);
205     //}
206 }
207 }

```

#### 1.114 ./csharp/Platform.Data.Doublets/UInt64LinksExtensions.cs

```

1 using System;
2 using System.Text;
3 using System.Collections.Generic;
4 using System.Runtime.CompilerServices;
5 using Platform.Singletons;
6
7 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
8
9 namespace Platform.Data.Doublets

```

```

10 {
11     /// <summary>
12     /// <para>
13     /// Represents the int 64 links extensions.
14     /// </para>
15     /// <para></para>
16     /// </summary>
17     public static class UInt64LinksExtensions
18     {
19         /// <summary>
20         /// <para>
21         /// The instance.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         public static readonly LinksConstants<ulong> Constants =
26             ↳ Default<LinksConstants<ulong>>.Instance;
27
28         /// <summary>
29         /// <para>
30         /// Determines whether any link is any.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         /// <param name="links">
35         /// <para>The links.</para>
36         /// <para></para>
37         /// </param>
38         /// <param name="sequence">
39         /// <para>The sequence.</para>
40         /// <para></para>
41         /// </param>
42         /// <returns>
43         /// <para>The bool</para>
44         /// <para></para>
45         /// </returns>
46         [MethodImpl(MethodImplOptions.AggressiveInlining)]
47         public static bool AnyLinkIsAny(this ILinks<ulong> links, params ulong[] sequence)
48         {
49             if (sequence == null)
50             {
51                 return false;
52             }
53             var constants = links.Constants;
54             for (var i = 0; i < sequence.Length; i++)
55             {
56                 if (sequence[i] == constants.Any)
57                 {
58                     return true;
59                 }
60             }
61             return false;
62         }
63
64         /// <summary>
65         /// <para>
66         /// Formats the structure using the specified links.
67         /// </para>
68         /// <para></para>
69         /// </summary>
70         /// <param name="links">
71         /// <para>The links.</para>
72         /// <para></para>
73         /// </param>
74         /// <param name="linkIndex">
75         /// <para>The link index.</para>
76         /// <para></para>
77         /// </param>
78         /// <param name="isElement">
79         /// <para>The is element.</para>
80         /// <para></para>
81         /// </param>
82         /// <param name="renderIndex">
83         /// <para>The render index.</para>
84         /// <para></para>
85         /// </param>
86         /// <param name="renderDebug">
87         /// <para>The render debug.</para>

```



```

87     /// <para></para>
88     /// </param>
89     /// <returns>
90     /// <para>The string</para>
91     /// <para></para>
92     /// </returns>
93     [MethodImpl(MethodImplOptions.AggressiveInlining)]
94     public static string FormatStructure(this ILinks<ulong> links, ulong linkIndex,
    ↪ Func<Link<ulong>, bool> isElement, bool renderIndex = false, bool renderDebug =
    ↪ false)
95     {
96         var sb = new StringBuilder();
97         var visited = new HashSet<ulong>();
98         links.AppendStructure(sb, visited, linkIndex, isElement, (innerSb, link) =>
    ↪ innerSb.Append(link.Index), renderIndex, renderDebug);
99         return sb.ToString();
100     }
101
102     /// <summary>
103     /// <para>
104     /// Formats the structure using the specified links.
105     /// </para>
106     /// <para></para>
107     /// </summary>
108     /// <param name="links">
109     /// <para>The links.</para>
110     /// <para></para>
111     /// </param>
112     /// <param name="linkIndex">
113     /// <para>The link index.</para>
114     /// <para></para>
115     /// </param>
116     /// <param name="isElement">
117     /// <para>The is element.</para>
118     /// <para></para>
119     /// </param>
120     /// <param name="appendElement">
121     /// <para>The append element.</para>
122     /// <para></para>
123     /// </param>
124     /// <param name="renderIndex">
125     /// <para>The render index.</para>
126     /// <para></para>
127     /// </param>
128     /// <param name="renderDebug">
129     /// <para>The render debug.</para>
130     /// <para></para>
131     /// </param>
132     /// <returns>
133     /// <para>The string</para>
134     /// <para></para>
135     /// </returns>
136     [MethodImpl(MethodImplOptions.AggressiveInlining)]
137     public static string FormatStructure(this ILinks<ulong> links, ulong linkIndex,
    ↪ Func<Link<ulong>, bool> isElement, Action<StringBuilder, Link<ulong>> appendElement,
    ↪ bool renderIndex = false, bool renderDebug = false)
138     {
139         var sb = new StringBuilder();
140         var visited = new HashSet<ulong>();
141         links.AppendStructure(sb, visited, linkIndex, isElement, appendElement, renderIndex,
    ↪ renderDebug);
142         return sb.ToString();
143     }
144
145     /// <summary>
146     /// <para>
147     /// Appends the structure using the specified links.
148     /// </para>
149     /// <para></para>
150     /// </summary>
151     /// <param name="links">
152     /// <para>The links.</para>
153     /// <para></para>
154     /// </param>
155     /// <param name="sb">
156     /// <para>The sb.</para>
157     /// <para></para>

```

```

158     /// </param>
159     /// <param name="visited">
160     /// <para>The visited.</para>
161     /// <para></para>
162     /// </param>
163     /// <param name="linkIndex">
164     /// <para>The link index.</para>
165     /// <para></para>
166     /// </param>
167     /// <param name="isElement">
168     /// <para>The is element.</para>
169     /// <para></para>
170     /// </param>
171     /// <param name="appendElement">
172     /// <para>The append element.</para>
173     /// <para></para>
174     /// </param>
175     /// <param name="renderIndex">
176     /// <para>The render index.</para>
177     /// <para></para>
178     /// </param>
179     /// <param name="renderDebug">
180     /// <para>The render debug.</para>
181     /// <para></para>
182     /// </param>
183     /// <exception cref="ArgumentNullException">
184     /// <para></para>
185     /// <para></para>
186     /// </exception>
187     [MethodImpl(MethodImplOptions.AggressiveInlining)]
188     public static void AppendStructure(this ILinks<ulong> links, StringBuilder sb,
    ↪ HashSet<ulong> visited, ulong linkIndex, Func<Link<ulong>, bool> isElement,
    ↪ Action<StringBuilder, Link<ulong>> appendElement, bool renderIndex = false, bool
    ↪ renderDebug = false)
189     {
190         if (sb == null)
191         {
192             throw new ArgumentNullException(nameof(sb));
193         }
194         if (linkIndex == Constants.Null || linkIndex == Constants.Any || linkIndex ==
    ↪ Constants.Itself)
195         {
196             return;
197         }
198         if (links.Exists(linkIndex))
199         {
200             if (visited.Add(linkIndex))
201             {
202                 sb.Append('(');
203                 var link = new Link<ulong>(links.GetLink(linkIndex));
204                 if (renderIndex)
205                 {
206                     sb.Append(link.Index);
207                     sb.Append(':');
208                 }
209                 if (link.Source == link.Index)
210                 {
211                     sb.Append(link.Index);
212                 }
213                 else
214                 {
215                     var source = new Link<ulong>(links.GetLink(link.Source));
216                     if (isElement(source))
217                     {
218                         appendElement(sb, source);
219                     }
220                     else
221                     {
222                         links.AppendStructure(sb, visited, source.Index, isElement,
    ↪ appendElement, renderIndex);
223                     }
224                 }
225                 sb.Append(' ');
226                 if (link.Target == link.Index)
227                 {
228                     sb.Append(link.Index);
229                 }
230                 else

```

```

231         {
232             var target = new Link<ulong>(links.GetLink(link.Target));
233             if (isElement(target))
234             {
235                 appendElement(sb, target);
236             }
237             else
238             {
239                 links.AppendStructure(sb, visited, target.Index, isElement,
240                                     ↪ appendElement, renderIndex);
241             }
242             sb.Append(' ');
243         }
244         else
245         {
246             if (renderDebug)
247             {
248                 sb.Append('*');
249             }
250             sb.Append(linkIndex);
251         }
252     }
253     else
254     {
255         if (renderDebug)
256         {
257             sb.Append('~');
258         }
259         sb.Append(linkIndex);
260     }
261 }
262 }
263 }

```

#### 1.115 ./csharp/Platform.Data.Doublets/UInt64LinksTransactionsLayer.cs

```

1  using System;
2  using System.Linq;
3  using System.Collections.Generic;
4  using System.IO;
5  using System.Runtime.CompilerServices;
6  using System.Threading;
7  using System.Threading.Tasks;
8  using Platform.Disposables;
9  using Platform.Timestamps;
10 using Platform.Unsafe;
11 using Platform.IO;
12 using Platform.Data.Doublets.Decorators;
13 using Platform.Exceptions;
14
15 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
16
17 namespace Platform.Data.Doublets
18 {
19     /// <summary>
20     /// <para>
21     /// Represents the int 64 links transactions layer.
22     /// </para>
23     /// <para></para>
24     /// </summary>
25     /// <seealso cref="LinksDisposableDecoratorBase{ulong}" />
26     public class UInt64LinksTransactionsLayer : LinksDisposableDecoratorBase<ulong> //-V3073
27     {
28         /// <remarks>
29         /// Альтернативные варианты хранения трансформации (элемента транзакции):
30         ///
31         /// private enum TransitionType
32         /// {
33         ///     Creation,
34         ///     UpdateOf,
35         ///     UpdateTo,
36         ///     Deletion
37         /// }
38         ///
39         /// private struct Transition
40         /// {
41         ///     public ulong TransactionId;
42         ///     public UniqueTimestamp Timestamp;
43         ///     public TransactionItemType Type;

```

```

44     ///     public Link Source;
45     ///     public Link Linker;
46     ///     public Link Target;
47     /// }
48     ///
49     /// Или
50     ///
51     /// public struct TransitionHeader
52     /// {
53     ///     public ulong TransactionIdCombined;
54     ///     public ulong TimestampCombined;
55     ///
56     ///     public ulong TransactionId
57     ///     {
58     ///         get
59     ///         {
60     ///             return (ulong) mask & TransactionIdCombined;
61     ///         }
62     ///     }
63     ///
64     ///     public UniqueTimestamp Timestamp
65     ///     {
66     ///         get
67     ///         {
68     ///             return (UniqueTimestamp)mask & TransactionIdCombined;
69     ///         }
70     ///     }
71     ///
72     ///     public TransactionItemType Type
73     ///     {
74     ///         get
75     ///         {
76     ///             // Использовать по одному биту из TransactionId и Timestamp,
77     ///             // для значения в 2 бита, которое представляет тип операции
78     ///             throw new NotImplementedException();
79     ///         }
80     ///     }
81     /// }
82     ///
83     /// private struct Transition
84     /// {
85     ///     public TransitionHeader Header;
86     ///     public Link Source;
87     ///     public Link Linker;
88     ///     public Link Target;
89     /// }
90     ///
91     /// </remarks>
92     public struct Transition : IEquatable<Transition>
93     {
94         /// <summary>
95         /// <para>
96         /// The size.
97         /// </para>
98         /// <para></para>
99         /// </summary>
100        public static readonly long Size = Structure<Transition>.Size;
101
102        /// <summary>
103        /// <para>
104        /// The transaction id.
105        /// </para>
106        /// <para></para>
107        /// </summary>
108        public readonly ulong TransactionId;
109        /// <summary>
110        /// <para>
111        /// The before.
112        /// </para>
113        /// <para></para>
114        /// </summary>
115        public readonly Link<ulong> Before;
116        /// <summary>
117        /// <para>
118        /// The after.
119        /// </para>
120        /// <para></para>
121        /// </summary>

```

```

122 public readonly Link<ulong> After;
123 /// <summary>
124 /// <para>
125 /// The timestamp.
126 /// </para>
127 /// <para></para>
128 /// </summary>
129 public readonly Timestamp Timestamp;
130
131 /// <summary>
132 /// <para>
133 /// Initializes a new <see cref="Transition"/> instance.
134 /// </para>
135 /// <para></para>
136 /// </summary>
137 /// <param name="uniqueTimestampFactory">
138 /// <para>A unique timestamp factory.</para>
139 /// <para></para>
140 /// </param>
141 /// <param name="transactionId">
142 /// <para>A transaction id.</para>
143 /// <para></para>
144 /// </param>
145 /// <param name="before">
146 /// <para>A before.</para>
147 /// <para></para>
148 /// </param>
149 /// <param name="after">
150 /// <para>A after.</para>
151 /// <para></para>
152 /// </param>
153 [MethodImpl(MethodImplOptions.AggressiveInlining)]
154 public Transition(UniqueTimestampFactory uniqueTimestampFactory, ulong
    ↪ transactionId, Link<ulong> before, Link<ulong> after)
155 {
156     TransactionId = transactionId;
157     Before = before;
158     After = after;
159     Timestamp = uniqueTimestampFactory.Create();
160 }
161
162 /// <summary>
163 /// <para>
164 /// Initializes a new <see cref="Transition"/> instance.
165 /// </para>
166 /// <para></para>
167 /// </summary>
168 /// <param name="uniqueTimestampFactory">
169 /// <para>A unique timestamp factory.</para>
170 /// <para></para>
171 /// </param>
172 /// <param name="transactionId">
173 /// <para>A transaction id.</para>
174 /// <para></para>
175 /// </param>
176 /// <param name="before">
177 /// <para>A before.</para>
178 /// <para></para>
179 /// </param>
180 [MethodImpl(MethodImplOptions.AggressiveInlining)]
181 public Transition(UniqueTimestampFactory uniqueTimestampFactory, ulong
    ↪ transactionId, Link<ulong> before) : this(uniqueTimestampFactory, transactionId,
    ↪ before, default) { }
182
183 /// <summary>
184 /// <para>
185 /// Initializes a new <see cref="Transition"/> instance.
186 /// </para>
187 /// <para></para>
188 /// </summary>
189 /// <param name="uniqueTimestampFactory">
190 /// <para>A unique timestamp factory.</para>
191 /// <para></para>
192 /// </param>
193 /// <param name="transactionId">
194 /// <para>A transaction id.</para>
195 /// <para></para>
196 /// </param>

```

```

197 [MethodImpl(MethodImplOptions.AggressiveInlining)]
198 public Transition(UniqueTimestampFactory uniqueTimestampFactory, ulong
    ↳ transactionId) : this(uniqueTimestampFactory, transactionId, default, default) {
    ↳ }

199
200 /// <summary>
201 /// <para>
202 /// Returns the string.
203 /// </para>
204 /// <para></para>
205 /// </summary>
206 /// <returns>
207 /// <para>The string</para>
208 /// <para></para>
209 /// </returns>
210 [MethodImpl(MethodImplOptions.AggressiveInlining)]
211 public override string ToString() => $"{Timestamp} {TransactionId}: {Before} =>
    ↳ {After}";

212
213 /// <summary>
214 /// <para>
215 /// Determines whether this instance equals.
216 /// </para>
217 /// <para></para>
218 /// </summary>
219 /// <param name="obj">
220 /// <para>The obj.</para>
221 /// <para></para>
222 /// </param>
223 /// <returns>
224 /// <para>The bool</para>
225 /// <para></para>
226 /// </returns>
227 [MethodImpl(MethodImplOptions.AggressiveInlining)]
228 public override bool Equals(object obj) => obj is Transition transition ?
    ↳ Equals(transition) : false;

229
230 /// <summary>
231 /// <para>
232 /// Gets the hash code.
233 /// </para>
234 /// <para></para>
235 /// </summary>
236 /// <returns>
237 /// <para>The int</para>
238 /// <para></para>
239 /// </returns>
240 [MethodImpl(MethodImplOptions.AggressiveInlining)]
241 public override int GetHashCode() => (TransactionId, Before, After,
    ↳ Timestamp).GetHashCode();

242
243 /// <summary>
244 /// <para>
245 /// Determines whether this instance equals.
246 /// </para>
247 /// <para></para>
248 /// </summary>
249 /// <param name="other">
250 /// <para>The other.</para>
251 /// <para></para>
252 /// </param>
253 /// <returns>
254 /// <para>The bool</para>
255 /// <para></para>
256 /// </returns>
257 [MethodImpl(MethodImplOptions.AggressiveInlining)]
258 public bool Equals(Transition other) => TransactionId == other.TransactionId &&
    ↳ Before == other.Before && After == other.After && Timestamp == other.Timestamp;

259
260 [MethodImpl(MethodImplOptions.AggressiveInlining)]
261 public static bool operator ==(Transition left, Transition right) =>
    ↳ left.Equals(right);

262
263 [MethodImpl(MethodImplOptions.AggressiveInlining)]
264 public static bool operator !=(Transition left, Transition right) => !(left ==
    ↳ right);

265 }

```

```

266 /// <remarks>
267 /// Другие варианты реализации транзакций (атомарности):
268 /// 1. Разделение хранения значения связи ((Source Target) или (Source Linker
269   → Target)) и индексов.
270 /// 2. Хранение трансформаций/операций в отдельном хранилище Links, но дополнительно
271   → потребуется решить вопрос
272   со ссылками на внешние идентификаторы, или как-то иначе решить вопрос с
273   пересечениями идентификаторов.
274 ///
275 /// Где хранить промежуточный список транзакций?
276 ///
277 /// В оперативной памяти:
278 /// Минусы:
279 /// 1. Может усложнить систему, если она будет функционировать самостоятельно,
280   так как нужно отдельно выделять память под список трансформаций.
281 /// 2. Выделенной оперативной памяти может не хватить, в том случае,
282   если транзакция использует слишком много трансформаций.
283   → Можно использовать жёсткий диск для слишком длинных транзакций.
284   → Максимальный размер списка трансформаций можно ограничить / задать
285   константой.
286 /// 3. При подтверждении транзакции (Commit) все трансформации записываются разом
287   создавая задержку.
288 ///
289 /// На жёстком диске:
290 /// Минусы:
291 /// 1. Длительный отклик, на запись каждой трансформации.
292 /// 2. Лог транзакций дополнительно наполняется отменёнными транзакциями.
293   → Это может решаться упаковкой/исключением дублирующих операций.
294   → Также это может решаться тем, что короткие транзакции вообще
295   не будут записываться в случае отката.
296 /// 3. Перед тем как выполнять отмену операций транзакции нужно дождаться пока все
297   операции (трансформации)
298   будут записаны в лог.
299 ///
300 /// </remarks>
301 public class Transaction : DisposableBase
302 {
303     /// <summary>
304     /// <para>
305     /// The transitions.
306     /// </para>
307     /// <para></para>
308     /// </summary>
309     private readonly Queue<Transition> _transitions;
310     /// <summary>
311     /// <para>
312     /// The layer.
313     /// </para>
314     /// <para></para>
315     /// </summary>
316     private readonly UInt64LinksTransactionsLayer _layer;
317     /// <summary>
318     /// <para>
319     /// Gets or sets the is committed value.
320     /// </para>
321     /// <para></para>
322     /// </summary>
323     public bool IsCommitted { get; private set; }
324     /// <summary>
325     /// <para>
326     /// Gets or sets the is reverted value.
327     /// </para>
328     /// <para></para>
329     /// </summary>
330     public bool IsReverted { get; private set; }
331     /// <summary>
332     /// <para>
333     /// Initializes a new <see cref="Transaction"/> instance.
334     /// </para>
335     /// <para></para>
336     /// </summary>
337     /// <param name="layer">
338     /// <para>A layer.</para>
339     /// <para></para>
340     /// </param>
341     /// <exception cref="NotSupportedException">

```

```

338 /// <para>Nested transactions not supported.</para>
339 /// <para></para>
340 /// </exception>
341 [MethodImpl(MethodImplOptions.AggressiveInlining)]
342 public Transaction(UInt64LinksTransactionsLayer layer)
343 {
344     _layer = layer;
345     if (_layer._currentTransactionId != 0)
346     {
347         throw new NotSupportedException("Nested transactions not supported.");
348     }
349     IsCommitted = false;
350     IsReverted = false;
351     _transitions = new Queue<Transition>();
352     SetCurrentTransaction(layer, this);
353 }
354
355 /// <summary>
356 /// <para>
357 /// Commits this instance.
358 /// </para>
359 /// <para></para>
360 /// </summary>
361 [MethodImpl(MethodImplOptions.AggressiveInlining)]
362 public void Commit()
363 {
364     EnsureTransactionAllowsWriteOperations(this);
365     while (_transitions.Count > 0)
366     {
367         var transition = _transitions.Dequeue();
368         _layer._transitions.Enqueue(transition);
369     }
370     _layer._lastCommittedTransactionId = _layer._currentTransactionId;
371     IsCommitted = true;
372 }
373
374 /// <summary>
375 /// <para>
376 /// Reverts this instance.
377 /// </para>
378 /// <para></para>
379 /// </summary>
380 [MethodImpl(MethodImplOptions.AggressiveInlining)]
381 private void Revert()
382 {
383     EnsureTransactionAllowsWriteOperations(this);
384     var transitionsToRevert = new Transition[_transitions.Count];
385     _transitions.CopyTo(transitionsToRevert, 0);
386     for (var i = transitionsToRevert.Length - 1; i >= 0; i--)
387     {
388         _layer.RevertTransition(transitionsToRevert[i]);
389     }
390     IsReverted = true;
391 }
392
393 /// <summary>
394 /// <para>
395 /// Sets the current transaction using the specified layer.
396 /// </para>
397 /// <para></para>
398 /// </summary>
399 /// <param name="layer">
400 /// <para>The layer.</para>
401 /// <para></para>
402 /// </param>
403 /// <param name="transaction">
404 /// <para>The transaction.</para>
405 /// <para></para>
406 /// </param>
407 [MethodImpl(MethodImplOptions.AggressiveInlining)]
408 public static void SetCurrentTransaction(UInt64LinksTransactionsLayer layer,
409     ↪ Transaction transaction)
410 {
411     layer._currentTransactionId = layer._lastCommittedTransactionId + 1;
412     layer._currentTransactionTransitions = transaction._transitions;
413     layer._currentTransaction = transaction;
414 }
415
416 /// <summary>

```



```

416     /// <para>
417     /// Ensures the transaction allows write operations using the specified transaction.
418     /// </para>
419     /// <para></para>
420     /// </summary>
421     /// <param name="transaction">
422     /// <para>The transaction.</para>
423     /// <para></para>
424     /// </param>
425     /// <exception cref="InvalidOperationException">
426     /// <para>Transation is committed.</para>
427     /// <para></para>
428     /// </exception>
429     /// <exception cref="InvalidOperationException">
430     /// <para>Transation is reverted.</para>
431     /// <para></para>
432     /// </exception>
433     [MethodImpl(MethodImplOptions.AggressiveInlining)]
434     public static void EnsureTransactionAllowsWriteOperations(Transaction transaction)
435     {
436         if (transaction.IsReverted)
437         {
438             throw new InvalidOperationException("Transation is reverted.");
439         }
440         if (transaction.IsCommitted)
441         {
442             throw new InvalidOperationException("Transation is committed.");
443         }
444     }
445
446     /// <summary>
447     /// <para>
448     /// Disposes the manual.
449     /// </para>
450     /// <para></para>
451     /// </summary>
452     /// <param name="manual">
453     /// <para>The manual.</para>
454     /// <para></para>
455     /// </param>
456     /// <param name="wasDisposed">
457     /// <para>The was disposed.</para>
458     /// <para></para>
459     /// </param>
460     [MethodImpl(MethodImplOptions.AggressiveInlining)]
461     protected override void Dispose(bool manual, bool wasDisposed)
462     {
463         if (!wasDisposed && _layer != null && !_layer.Disposable.IsDisposed)
464         {
465             if (!IsCommitted && !IsReverted)
466             {
467                 Revert();
468             }
469             _layer.ResetCurrentTransation();
470         }
471     }
472 }
473
474 /// <summary>
475 /// <para>
476 /// The from seconds.
477 /// </para>
478 /// <para></para>
479 /// </summary>
480 public static readonly TimeSpan DefaultPushDelay = TimeSpan.FromSeconds(0.1);
481
482 /// <summary>
483 /// <para>
484 /// The log address.
485 /// </para>
486 /// <para></para>
487 /// </summary>
488 private readonly string _logAddress;
489 /// <summary>
490 /// <para>
491 /// The log.
492 /// </para>
493 /// <para></para>

```

```

494     /// </summary>
495     private readonly FileStream _log;
496     /// <summary>
497     /// <para>
498     /// The transitions.
499     /// </para>
500     /// <para></para>
501     /// </summary>
502     private readonly Queue<Transition> _transitions;
503     /// <summary>
504     /// <para>
505     /// The unique timestamp factory.
506     /// </para>
507     /// <para></para>
508     /// </summary>
509     private readonly UniqueTimestampFactory _uniqueTimestampFactory;
510     /// <summary>
511     /// <para>
512     /// The transitions pusher.
513     /// </para>
514     /// <para></para>
515     /// </summary>
516     private Task _transitionsPusher;
517     /// <summary>
518     /// <para>
519     /// The last committed transition.
520     /// </para>
521     /// <para></para>
522     /// </summary>
523     private Transition _lastCommittedTransition;
524     /// <summary>
525     /// <para>
526     /// The current transaction id.
527     /// </para>
528     /// <para></para>
529     /// </summary>
530     private ulong _currentTransactionId;
531     /// <summary>
532     /// <para>
533     /// The current transaction transitions.
534     /// </para>
535     /// <para></para>
536     /// </summary>
537     private Queue<Transition> _currentTransactionTransitions;
538     /// <summary>
539     /// <para>
540     /// The current transaction.
541     /// </para>
542     /// <para></para>
543     /// </summary>
544     private Transaction _currentTransaction;
545     /// <summary>
546     /// <para>
547     /// The last committed transaction id.
548     /// </para>
549     /// <para></para>
550     /// </summary>
551     private ulong _lastCommittedTransactionId;
552
553     /// <summary>
554     /// <para>
555     /// Initializes a new <see cref="UInt64LinksTransactionsLayer"/> instance.
556     /// </para>
557     /// <para></para>
558     /// </summary>
559     /// <param name="links">
560     /// <para>A links.</para>
561     /// <para></para>
562     /// </param>
563     /// <param name="logAddress">
564     /// <para>A log address.</para>
565     /// <para></para>
566     /// </param>
567     /// <exception cref="ArgumentNullException">
568     /// <para></para>
569     /// <para></para>
570     /// </exception>
571     /// <exception cref="NotSupportedException">

```

```

572 /// <para>Database is damaged, autorecovery is not supported yet.</para>
573 /// <para></para>
574 /// </exception>
575 [MethodImpl(MethodImplOptions.AggressiveInlining)]
576 public UInt64LinksTransactionsLayer(ILinks<ulong> links, string logAddress)
577 : base(links)
578 {
579     if (string.IsNullOrEmpty(logAddress))
580     {
581         throw new ArgumentNullException(nameof(logAddress));
582     }
583     // В первой строке файла хранится последняя закоммиченную транзакцию.
584     // При запуске это используется для проверки удачного закрытия файла лога.
585     // In the first line of the file the last committed transaction is stored.
586     // On startup, this is used to check that the log file is successfully closed.
587     var lastCommittedTransition = FileHelpers.ReadFirstOrDefault<Transition>(logAddress);
588     var lastWrittenTransition = FileHelpers.ReadLastOrDefault<Transition>(logAddress);
589     if (!lastCommittedTransition.Equals(lastWrittenTransition))
590     {
591         Dispose();
592         throw new NotSupportedException("Database is damaged, autorecovery is not
593         ↳ supported yet.");
594     }
595     if (lastCommittedTransition == default)
596     {
597         FileHelpers.WriteFirst(logAddress, lastCommittedTransition);
598     }
599     _lastCommittedTransition = lastCommittedTransition;
600     // TODO: Think about a better way to calculate or store this value
601     var allTransitions = FileHelpers.ReadAll<Transition>(logAddress);
602     _lastCommittedTransitionId = allTransitions.Length > 0 ? allTransitions.Max(x =>
603     ↳ x.TransactionId) : 0;
604     _uniqueTimestampFactory = new UniqueTimestampFactory();
605     _logAddress = logAddress;
606     _log = FileHelpers.Append(logAddress);
607     _transitions = new Queue<Transition>();
608     _transitionsPusher = new Task(TransitionsPusher);
609     _transitionsPusher.Start();
610 }
611
612 /// <summary>
613 /// <para>
614 /// Gets the link value using the specified link.
615 /// </para>
616 /// </summary>
617 /// <param name="link">
618 /// <para>The link.</para>
619 /// </param>
620 /// <returns>
621 /// <para>A list of ulong</para>
622 /// <para></para>
623 /// </returns>
624 [MethodImpl(MethodImplOptions.AggressiveInlining)]
625 public IList<ulong> GetLinkValue(ulong link) => _links.GetLink(link);
626
627 /// <summary>
628 /// <para>
629 /// Creates the restrictions.
630 /// </para>
631 /// <para></para>
632 /// </summary>
633 /// <param name="restrictions">
634 /// <para>The restrictions.</para>
635 /// </param>
636 /// <returns>
637 /// <para>The created link index.</para>
638 /// <para></para>
639 /// </returns>
640 [MethodImpl(MethodImplOptions.AggressiveInlining)]
641 public override ulong Create(IList<ulong> restrictions)
642 {
643     var createdLinkIndex = _links.Create();
644     var createdLink = new Link<ulong>(_links.GetLink(createdLinkIndex));
645     CommitTransition(new Transition(_uniqueTimestampFactory, _currentTransactionId,
646     ↳ default, createdLink));

```

```

647         return createdLinkIndex;
648     }
649
650     /// <summary>
651     /// <para>
652     /// Updates the restrictions.
653     /// </para>
654     /// <para></para>
655     /// </summary>
656     /// <param name="restrictions">
657     /// <para>The restrictions.</para>
658     /// <para></para>
659     /// </param>
660     /// <param name="substitution">
661     /// <para>The substitution.</para>
662     /// <para></para>
663     /// </param>
664     /// <returns>
665     /// <para>The link index.</para>
666     /// <para></para>
667     /// </returns>
668     [MethodImpl(MethodImplOptions.AggressiveInlining)]
669     public override ulong Update(ICollection<ulong> restrictions, ICollection<ulong> substitution)
670     {
671         var linkIndex = restrictions[_constants.IndexPart];
672         var beforeLink = new Link<ulong>(_links.GetLink(linkIndex));
673         linkIndex = _links.Update(restrictions, substitution);
674         var afterLink = new Link<ulong>(_links.GetLink(linkIndex));
675         CommitTransition(new Transition(_uniqueTimestampFactory, _currentTransactionId,
676             ↪ beforeLink, afterLink));
677         return linkIndex;
678     }
679
680     /// <summary>
681     /// <para>
682     /// Deletes the restrictions.
683     /// </para>
684     /// <para></para>
685     /// </summary>
686     /// <param name="restrictions">
687     /// <para>The restrictions.</para>
688     /// <para></para>
689     /// </param>
690     [MethodImpl(MethodImplOptions.AggressiveInlining)]
691     public override void Delete(ICollection<ulong> restrictions)
692     {
693         var link = restrictions[_constants.IndexPart];
694         var deletedLink = new Link<ulong>(_links.GetLink(link));
695         _links.Delete(link);
696         CommitTransition(new Transition(_uniqueTimestampFactory, _currentTransactionId,
697             ↪ deletedLink, default));
698     }
699
700     /// <summary>
701     /// <para>
702     /// Gets the current transitions.
703     /// </para>
704     /// <para></para>
705     /// </summary>
706     /// <returns>
707     /// <para>A queue of transition</para>
708     /// <para></para>
709     /// </returns>
710     [MethodImpl(MethodImplOptions.AggressiveInlining)]
711     private Queue<Transition> GetCurrentTransitions() => _currentTransactionTransitions ??
712         ↪ _transitions;
713
714     /// <summary>
715     /// <para>
716     /// Commits the transition using the specified transition.
717     /// </para>
718     /// <para></para>
719     /// </summary>
720     /// <param name="transition">
721     /// <para>The transition.</para>
722     /// <para></para>
723     /// </param>
724     [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

722 private void CommitTransition(Transition transition)
723 {
724     if (_currentTransaction != null)
725     {
726         Transaction.EnsureTransactionAllowsWriteOperations(_currentTransaction);
727     }
728     var transitions = GetCurrentTransitions();
729     transitions.Enqueue(transition);
730 }
731
732 /// <summary>
733 /// <para>
734 /// Reverts the transition using the specified transition.
735 /// </para>
736 /// <para></para>
737 /// </summary>
738 /// <param name="transition">
739 /// <para>The transition.</para>
740 /// <para></para>
741 /// </param>
742 [MethodImpl(MethodImplOptions.AggressiveInlining)]
743 private void RevertTransition(Transition transition)
744 {
745     if (transition.After.IsNull()) // Revert Deletion with Creation
746     {
747         _links.Create();
748     }
749     else if (transition.Before.IsNull()) // Revert Creation with Deletion
750     {
751         _links.Delete(transition.After.Index);
752     }
753     else // Revert Update
754     {
755         _links.Update(new[] { transition.After.Index, transition.Before.Source,
756             ↪ transition.Before.Target });
757     }
758 }
759
760 /// <summary>
761 /// <para>
762 /// Resets the current transation.
763 /// </para>
764 /// <para></para>
765 /// </summary>
766 [MethodImpl(MethodImplOptions.AggressiveInlining)]
767 private void ResetCurrentTransation()
768 {
769     _currentTransactionId = 0;
770     _currentTransactionTransitions = null;
771     _currentTransaction = null;
772 }
773
774 /// <summary>
775 /// <para>
776 /// Pushes the transitions.
777 /// </para>
778 /// <para></para>
779 /// </summary>
780 [MethodImpl(MethodImplOptions.AggressiveInlining)]
781 private void PushTransitions()
782 {
783     if (_log == null || _transitions == null)
784     {
785         return;
786     }
787     for (var i = 0; i < _transitions.Count; i++)
788     {
789         var transition = _transitions.Dequeue();
790
791         _log.Write(transition);
792         _lastCommittedTransition = transition;
793     }
794 }
795
796 /// <summary>
797 /// <para>
798 /// Transitionses the pusher.
799 /// </para>

```

```

799     /// <para></para>
800     /// </summary>
801     [MethodImpl(MethodImplOptions.AggressiveInlining)]
802     private void TransitionsPusher()
803     {
804         while (!Disposable.IsDisposed && _transitionsPusher != null)
805         {
806             Thread.Sleep(DefaultPushDelay);
807             PushTransitions();
808         }
809     }
810
811     /// <summary>
812     /// <para>
813     /// Begins the transaction.
814     /// </para>
815     /// <para></para>
816     /// </summary>
817     /// <returns>
818     /// <para>The transaction</para>
819     /// <para></para>
820     /// </returns>
821     [MethodImpl(MethodImplOptions.AggressiveInlining)]
822     public Transaction BeginTransaction() => new Transaction(this);
823
824     /// <summary>
825     /// <para>
826     /// Disposes the transitions.
827     /// </para>
828     /// <para></para>
829     /// </summary>
830     [MethodImpl(MethodImplOptions.AggressiveInlining)]
831     private void DisposeTransitions()
832     {
833         try
834         {
835             var pusher = _transitionsPusher;
836             if (pusher != null)
837             {
838                 _transitionsPusher = null;
839                 pusher.Wait();
840             }
841             if (_transitions != null)
842             {
843                 PushTransitions();
844             }
845             _log.DisposeIfPossible();
846             FileHelpers.WriteFirst(_logAddress, _lastCommittedTransition);
847         }
848         catch (Exception ex)
849         {
850             ex.Ignore();
851         }
852     }
853
854     #region DisposalBase
855
856     /// <summary>
857     /// <para>
858     /// Disposes the manual.
859     /// </para>
860     /// <para></para>
861     /// </summary>
862     /// <param name="manual">
863     /// <para>The manual.</para>
864     /// <para></para>
865     /// </param>
866     /// <param name="wasDisposed">
867     /// <para>The was disposed.</para>
868     /// <para></para>
869     /// </param>
870     [MethodImpl(MethodImplOptions.AggressiveInlining)]
871     protected override void Dispose(bool manual, bool wasDisposed)
872     {
873         if (!wasDisposed)
874         {
875             DisposeTransitions();
876         }
877     }

```

```

877         base.Dispose(manual, wasDisposed);
878     }
879
880     #endregion
881 }
882 }

```

## 1.116 ./csharp/Platform.Data.Doublets.Tests/GenericLinksTests.cs

```

1  using System;
2  using Xunit;
3  using Platform.Reflection;
4  using Platform.Memory;
5  using Platform.Scopes;
6  using Platform.Data.Doublets.Memory.United.Generic;
7
8  namespace Platform.Data.Doublets.Tests
9  {
10     /// <summary>
11     /// <para>
12     /// Represents the generic links tests.
13     /// </para>
14     /// <para></para>
15     /// </summary>
16     public unsafe static class GenericLinksTests
17     {
18         /// <summary>
19         /// <para>
20         /// Tests that crud test.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         [Fact]
25         public static void CRUDTest()
26         {
27             Using<byte>(links => links.TestCRUDOperations());
28             Using<ushort>(links => links.TestCRUDOperations());
29             Using<uint>(links => links.TestCRUDOperations());
30             Using<ulong>(links => links.TestCRUDOperations());
31         }
32
33         /// <summary>
34         /// <para>
35         /// Tests that raw numbers crud test.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         [Fact]
40         public static void RawNumbersCRUDTest()
41         {
42             Using<byte>(links => links.TestRawNumbersCRUDOperations());
43             Using<ushort>(links => links.TestRawNumbersCRUDOperations());
44             Using<uint>(links => links.TestRawNumbersCRUDOperations());
45             Using<ulong>(links => links.TestRawNumbersCRUDOperations());
46         }
47
48         /// <summary>
49         /// <para>
50         /// Tests that multiple random creations and deletions test.
51         /// </para>
52         /// <para></para>
53         /// </summary>
54         [Fact]
55         public static void MultipleRandomCreationsAndDeletionsTest()
56         {
57             Using<byte>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Test
58                 ↳ MultipleRandomCreationsAndDeletions(16)); // Cannot use more because current
59                 ↳ implementation of tree cuts out 5 bits from the address space.
60             Using<ushort>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Te
61                 ↳ stMultipleRandomCreationsAndDeletions(100));
62             Using<uint>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Test
63                 ↳ MultipleRandomCreationsAndDeletions(100));
64             Using<ulong>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Tes
65                 ↳ tMultipleRandomCreationsAndDeletions(100));
66         }
67
68         /// <summary>
69         /// <para>
70         /// Usings the action.
71         /// </para>

```

```

67     /// <para></para>
68     /// </summary>
69     /// <typeparam name="TLink">
70     /// <para>The link.</para>
71     /// <para></para>
72     /// </typeparam>
73     /// <param name="action">
74     /// <para>The action.</para>
75     /// <para></para>
76     /// </param>
77     private static void Using<TLink>(Action<ILinks<TLink>> action)
78     {
79         using (var scope = new Scope<Types<HeapResizableDirectMemory,
80             ↪ UnitedMemoryLinks<TLink>>>())
81         {
82             action(scope.Use<ILinks<TLink>>());
83         }
84     }
85 }

```

### 1.117 ./csharp/Platform.Data.Doublets.Tests/ILinksBasicTests.cs

```

1  using System;
2  using Platform.Data.Doublets.Memory.United.Generic;
3  using Platform.Memory;
4  using Xunit;
5  using Xunit.Abstractions;
6
7  namespace Platform.Data.Doublets.Tests
8  {
9      public static class ILinksBasicTests
10     {
11         [Fact]
12         public static void DeleteAllUsages()
13         {
14             var mem = new HeapResizableDirectMemory();
15             var links = new UnitedMemoryLinks<uint>(mem);
16
17             var root = links.CreatePoint();
18
19             var a = links.CreatePoint();
20             var b = links.CreatePoint();
21
22             links.CreateAndUpdate(a, root);
23             links.CreateAndUpdate(b, root);
24
25             Assert.Equal(5U, links.Count());
26
27             links.DeleteAllUsages(root);
28
29             Assert.Equal(2U, links.Count());
30         }
31     }
32 }

```

### 1.118 ./csharp/Platform.Data.Doublets.Tests/LinksConstantsTests.cs

```

1  using Xunit;
2
3  namespace Platform.Data.Doublets.Tests
4  {
5      /// <summary>
6      /// <para>
7      /// Represents the links constants tests.
8      /// </para>
9      /// <para></para>
10     /// </summary>
11     public static class LinksConstantsTests
12     {
13         /// <summary>
14         /// <para>
15         /// Tests that external references test.
16         /// </para>
17         /// <para></para>
18         /// </summary>
19         [Fact]
20         public static void ExternalReferencesTest()
21         {
22             LinksConstants<ulong> constants = new LinksConstants<ulong>((1, long.MaxValue),
23                 ↪ (long.MaxValue + 1UL, ulong.MaxValue));

```



```

23         //var minimum = new Hybrid<ulong>(0, isExternal: true);
24         var minimum = new Hybrid<ulong>(1, isExternal: true);
25         var maximum = new Hybrid<ulong>(long.MaxValue, isExternal: true);
26
27         Assert.True(constants.IsExternalReference(minimum));
28         Assert.True(constants.IsExternalReference(maximum));
29     }
30 }
31 }
32 }

```

#### 1.119 ./csharp/Platform.Data.Doublets.Tests/ResizableDirectMemoryLinksTests.cs

```

1  using System.IO;
2  using Xunit;
3  using Platform.Singletons;
4  using Platform.Memory;
5  using Platform.Data.Doublets.Memory.United.Specific;
6
7  namespace Platform.Data.Doublets.Tests
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the resizable direct memory links tests.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     public static class ResizableDirectMemoryLinksTests
16     {
17         /// <summary>
18         /// <para>
19         /// The instance.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         private static readonly LinksConstants<ulong> _constants =
24             ↪ Default<LinksConstants<ulong>>.Instance;
25
26         /// <summary>
27         /// <para>
28         /// Tests that basic file mapped memory test.
29         /// </para>
30         /// <para></para>
31         /// </summary>
32         [Fact]
33         public static void BasicFileMappedMemoryTest()
34         {
35             var tempFilename = Path.GetTempFileName();
36             using (var memoryAdapter = new UInt64UnitedMemoryLinks(tempFilename))
37             {
38                 memoryAdapter.TestBasicMemoryOperations();
39             }
40             File.Delete(tempFilename);
41         }
42
43         /// <summary>
44         /// <para>
45         /// Tests that basic heap memory test.
46         /// </para>
47         /// <para></para>
48         /// </summary>
49         [Fact]
50         public static void BasicHeapMemoryTest()
51         {
52             using (var memory = new
53                 ↪ HeapResizableDirectMemory(UInt64UnitedMemoryLinks.DefaultLinksSizeStep))
54             using (var memoryAdapter = new UInt64UnitedMemoryLinks(memory,
55                 ↪ UInt64UnitedMemoryLinks.DefaultLinksSizeStep))
56             {
57                 memoryAdapter.TestBasicMemoryOperations();
58             }
59         }
60
61         /// <summary>
62         /// <para>
63         /// Tests the basic memory operations using the specified memory adapter.
64         /// </para>
65         /// <para></para>
66         /// </summary>
67         /// <param name="memoryAdapter">

```

```

65     /// <para>The memory adapter.</para>
66     /// <para></para>
67     /// </param>
68     private static void TestBasicMemoryOperations(this ILinks<ulong> memoryAdapter)
69     {
70         var link = memoryAdapter.Create();
71         memoryAdapter.Delete(link);
72     }
73
74     /// <summary>
75     /// <para>
76     /// Tests that nonexistent references heap memory test.
77     /// </para>
78     /// <para></para>
79     /// </summary>
80     [Fact]
81     public static void NonexistentReferencesHeapMemoryTest()
82     {
83         using (var memory = new
84             ↳ HeapResizableDirectMemory(UInt64UnitedMemoryLinks.DefaultLinksSizeStep))
85         using (var memoryAdapter = new UInt64UnitedMemoryLinks(memory,
86             ↳ UInt64UnitedMemoryLinks.DefaultLinksSizeStep))
87         {
88             memoryAdapter.TestNonexistentReferences();
89         }
90
91     /// <summary>
92     /// <para>
93     /// Tests the nonexistent references using the specified memory adapter.
94     /// </para>
95     /// <para></para>
96     /// </summary>
97     /// <param name="memoryAdapter">
98     /// <para>The memory adapter.</para>
99     /// <para></para>
100    /// </param>
101    private static void TestNonexistentReferences(this ILinks<ulong> memoryAdapter)
102    {
103        var link = memoryAdapter.Create();
104        memoryAdapter.Update(link, ulong.MaxValue, ulong.MaxValue);
105        var resultLink = _constants.Null;
106        memoryAdapter.Each(foundLink =>
107        {
108            resultLink = foundLink[_constants.IndexPart];
109            return _constants.Break;
110        }, _constants.Any, ulong.MaxValue, ulong.MaxValue);
111        Assert.True(resultLink == link);
112        Assert.True(memoryAdapter.Count(ulong.MaxValue) == 0);
113        memoryAdapter.Delete(link);
114    }
115 }

```

#### 1.120 ./csharp/Platform.Data.Doublets.Tests/ScopeTests.cs

```

1  using Xunit;
2  using Platform.Scopes;
3  using Platform.Memory;
4  using Platform.Data.Doublets.Decorators;
5  using Platform.Reflection;
6  using Platform.Data.Doublets.Memory.United.Generic;
7  using Platform.Data.Doublets.Memory.United.Specific;
8
9  namespace Platform.Data.Doublets.Tests
10 {
11     /// <summary>
12     /// <para>
13     /// Represents the scope tests.
14     /// </para>
15     /// <para></para>
16     /// </summary>
17     public static class ScopeTests
18     {
19         /// <summary>
20         /// <para>
21         /// Tests that single dependency test.
22         /// </para>
23         /// <para></para>
24         /// </summary>

```

```

25 [Fact]
26 public static void SingleDependencyTest()
27 {
28     using (var scope = new Scope())
29     {
30         scope.IncludeAssemblyOf<IMemory>();
31         var instance = scope.Use<IDirectMemory>();
32         Assert.IsType<HeapResizableDirectMemory>(instance);
33     }
34 }
35
36 /// <summary>
37 /// <para>
38 /// Tests that cascade dependency test.
39 /// </para>
40 /// <para></para>
41 /// </summary>
42 [Fact]
43 public static void CascadeDependencyTest()
44 {
45     using (var scope = new Scope())
46     {
47         scope.Include<TemporaryFileMappedResizableDirectMemory>();
48         scope.Include<UInt64UnitedMemoryLinks>();
49         var instance = scope.Use<ILinks<ulong>>();
50         Assert.IsType<UInt64UnitedMemoryLinks>(instance);
51     }
52 }
53
54 /// <summary>
55 /// <para>
56 /// Tests that full auto resolution test.
57 /// </para>
58 /// <para></para>
59 /// </summary>
60 [Fact(Skip = "Would be fixed later.")]
61 public static void FullAutoResolutionTest()
62 {
63     using (var scope = new Scope(autoInclude: true, autoExplore: true))
64     {
65         var instance = scope.Use<UInt64Links>();
66         Assert.IsType<UInt64Links>(instance);
67     }
68 }
69
70 /// <summary>
71 /// <para>
72 /// Tests that type parameters test.
73 /// </para>
74 /// <para></para>
75 /// </summary>
76 [Fact]
77 public static void TypeParametersTest()
78 {
79     using (var scope = new Scope<Types<HeapResizableDirectMemory,
80 ↵    UnitedMemoryLinks<ulong>>>())
81     {
82         var links = scope.Use<ILinks<ulong>>();
83         Assert.IsType<UnitedMemoryLinks<ulong>>(links);
84     }
85 }
86 }

```

#### 1.121 ./csharp/Platform.Data.Doublets.Tests/SplitMemoryGenericLinksTests.cs

```

1 using System;
2 using Xunit;
3 using Platform.Memory;
4 using Platform.Data.Doublets.Memory.Split.Generic;
5 using Platform.Data.Doublets.Memory;
6
7 namespace Platform.Data.Doublets.Tests
8 {
9     /// <summary>
10    /// <para>
11    /// Represents the split memory generic links tests.
12    /// </para>
13    /// <para></para>

```

```

14  /// </summary>
15  public unsafe static class SplitMemoryGenericLinksTests
16  {
17      /// <summary>
18      /// <para>
19      /// Tests that crud test.
20      /// </para>
21      /// <para></para>
22      /// </summary>
23      [Fact]
24      public static void CRUDTest()
25      {
26          Using<byte>(links => links.TestCRUDOperations());
27          Using<ushort>(links => links.TestCRUDOperations());
28          Using<uint>(links => links.TestCRUDOperations());
29          Using<ulong>(links => links.TestCRUDOperations());
30      }
31
32      /// <summary>
33      /// <para>
34      /// Tests that raw numbers crud test.
35      /// </para>
36      /// <para></para>
37      /// </summary>
38      [Fact]
39      public static void RawNumbersCRUDTest()
40      {
41          UsingWithExternalReferences<byte>(links => links.TestRawNumbersCRUDOperations());
42          UsingWithExternalReferences<ushort>(links => links.TestRawNumbersCRUDOperations());
43          UsingWithExternalReferences<uint>(links => links.TestRawNumbersCRUDOperations());
44          UsingWithExternalReferences<ulong>(links => links.TestRawNumbersCRUDOperations());
45      }
46
47      /// <summary>
48      /// <para>
49      /// Tests that multiple random creations and deletions test.
50      /// </para>
51      /// <para></para>
52      /// </summary>
53      [Fact]
54      public static void MultipleRandomCreationsAndDeletionsTest()
55      {
56          Using<byte>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Test
57              ↳ MultipleRandomCreationsAndDeletions(16)); // Cannot use more because current
58              ↳ implementation of tree cuts out 5 bits from the address space.
59          Using<ushort>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Te
60              ↳ stMultipleRandomCreationsAndDeletions(100));
61          Using<uint>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Test
62              ↳ MultipleRandomCreationsAndDeletions(100));
63          Using<ulong>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Tes
64              ↳ tMultipleRandomCreationsAndDeletions(100));
65      }
66
67      /// <summary>
68      /// <para>
69      /// Usings the action.
70      /// </para>
71      /// <para></para>
72      /// </summary>
73      /// <typeparam name="TLink">
74      /// <para>The link.</para>
75      /// <para></para>
76      /// </typeparam>
77      /// <param name="action">
78      /// <para>The action.</para>
79      /// <para></para>
80      /// </param>
81      private static void Using<TLink>(Action<ILinks<TLink>> action)
82      {
83          using (var dataMemory = new HeapResizableDirectMemory())
84          using (var indexMemory = new HeapResizableDirectMemory())
85          using (var memory = new SplitMemoryLinks<TLink>(dataMemory, indexMemory))
86          {
87              action(memory);
88          }
89      }
90
91      /// <summary>

```

```

87     /// <para>
88     /// Usings the with external references using the specified action.
89     /// </para>
90     /// <para></para>
91     /// </summary>
92     /// <typeparam name="TLink">
93     /// <para>The link.</para>
94     /// <para></para>
95     /// </typeparam>
96     /// <param name="action">
97     /// <para>The action.</para>
98     /// <para></para>
99     /// </param>
100 private static void UsingWithExternalReferences<TLink>(Action<ILinks<TLink>> action)
101 {
102     var contants = new LinksConstants<TLink>(enableExternalReferencesSupport: true);
103     using (var dataMemory = new HeapResizableDirectMemory())
104     using (var indexMemory = new HeapResizableDirectMemory())
105     using (var memory = new SplitMemoryLinks<TLink>(dataMemory, indexMemory,
106         ↪ SplitMemoryLinks<TLink>.DefaultLinksSizeStep, contants))
107     {
108         action(memory);
109     }
110 }
111 }

```

### 1.122 ./csharp/Platform.Data.Doublets.Tests/SplitMemoryUInt32LinksTests.cs

```

1 using System;
2 using Xunit;
3 using Platform.Memory;
4 using Platform.Data.Doublets.Memory.Split.Specific;
5 using TLink = System.UInt32;
6
7 namespace Platform.Data.Doublets.Tests
8 {
9     /// <summary>
10    /// <para>
11    /// Represents the split memory int 32 links tests.
12    /// </para>
13    /// <para></para>
14    /// </summary>
15    public unsafe static class SplitMemoryUInt32LinksTests
16    {
17        /// <summary>
18        /// <para>
19        /// Tests that crud test.
20        /// </para>
21        /// <para></para>
22        /// </summary>
23        [Fact]
24        public static void CRUDTest()
25        {
26            Using(links => links.TestCRUDOperations());
27        }
28
29        /// <summary>
30        /// <para>
31        /// Tests that raw numbers crud test.
32        /// </para>
33        /// <para></para>
34        /// </summary>
35        [Fact]
36        public static void RawNumbersCRUDTest()
37        {
38            UsingWithExternalReferences(links => links.TestRawNumbersCRUDOperations());
39        }
40
41        /// <summary>
42        /// <para>
43        /// Tests that multiple random creations and deletions test.
44        /// </para>
45        /// <para></para>
46        /// </summary>
47        [Fact]
48        public static void MultipleRandomCreationsAndDeletionsTest()
49        {
50            Using(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().TestMultip
51                ↪ leRandomCreationsAndDeletions(500));

```

```

51     }
52
53     /// <summary>
54     /// <para>
55     /// Usings the action.
56     /// </para>
57     /// <para></para>
58     /// </summary>
59     /// <param name="action">
60     /// <para>The action.</para>
61     /// <para></para>
62     /// </param>
63     private static void Using(Action<ILinks<TLink>> action)
64     {
65         using (var dataMemory = new HeapResizableDirectMemory())
66         using (var indexMemory = new HeapResizableDirectMemory())
67         using (var memory = new UInt32SplitMemoryLinks(dataMemory, indexMemory))
68         {
69             action(memory);
70         }
71     }
72
73     /// <summary>
74     /// <para>
75     /// Usings the with external references using the specified action.
76     /// </para>
77     /// <para></para>
78     /// </summary>
79     /// <param name="action">
80     /// <para>The action.</para>
81     /// <para></para>
82     /// </param>
83     private static void UsingWithExternalReferences(Action<ILinks<TLink>> action)
84     {
85         var constants = new LinksConstants<TLink>(enableExternalReferencesSupport: true);
86         using (var dataMemory = new HeapResizableDirectMemory())
87         using (var indexMemory = new HeapResizableDirectMemory())
88         using (var memory = new UInt32SplitMemoryLinks(dataMemory, indexMemory,
89             ↪ UInt32SplitMemoryLinks.DefaultLinksSizeStep, constants))
90         {
91             action(memory);
92         }
93     }
94 }

```

### 1.123 ./csharp/Platform.Data.Doublets.Tests/SplitMemoryUInt64LinksTests.cs

```

1  using System;
2  using Xunit;
3  using Platform.Memory;
4  using Platform.Data.Doublets.Memory.Split.Specific;
5  using TLink = System.UInt64;
6
7  namespace Platform.Data.Doublets.Tests
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the split memory int 64 links tests.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     public unsafe static class SplitMemoryUInt64LinksTests
16     {
17         /// <summary>
18         /// <para>
19         /// Tests that crud test.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         [Fact]
24         public static void CRUDTest()
25         {
26             Using(links => links.TestCRUDOperations());
27         }
28
29         /// <summary>
30         /// <para>
31         /// Tests that raw numbers crud test.
32         /// </para>

```

```

33     /// <para></para>
34     /// </summary>
35     [Fact]
36     public static void RawNumbersCRUDTest()
37     {
38         UsingWithExternalReferences(links => links.TestRawNumbersCRUDOperations());
39     }
40
41     /// <summary>
42     /// <para>
43     /// Tests that multiple random creations and deletions test.
44     /// </para>
45     /// <para></para>
46     /// </summary>
47     [Fact]
48     public static void MultipleRandomCreationsAndDeletionsTest()
49     {
50         Using(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().TestMultipleRandomCreationsAndDeletions(500));
51     }
52
53     /// <summary>
54     /// <para>
55     /// Usings the action.
56     /// </para>
57     /// <para></para>
58     /// </summary>
59     /// <param name="action">
60     /// <para>The action.</para>
61     /// <para></para>
62     /// </param>
63     private static void Using(Action<ILinks<TLink>> action)
64     {
65         using (var dataMemory = new HeapResizableDirectMemory())
66         using (var indexMemory = new HeapResizableDirectMemory())
67         using (var memory = new UInt64SplitMemoryLinks(dataMemory, indexMemory))
68         {
69             action(memory);
70         }
71     }
72
73     /// <summary>
74     /// <para>
75     /// Usings the with external references using the specified action.
76     /// </para>
77     /// <para></para>
78     /// </summary>
79     /// <param name="action">
80     /// <para>The action.</para>
81     /// <para></para>
82     /// </param>
83     private static void UsingWithExternalReferences(Action<ILinks<TLink>> action)
84     {
85         var constants = new LinksConstants<TLink>(enableExternalReferencesSupport: true);
86         using (var dataMemory = new HeapResizableDirectMemory())
87         using (var indexMemory = new HeapResizableDirectMemory())
88         using (var memory = new UInt64SplitMemoryLinks(dataMemory, indexMemory,
89             ↪ UInt64SplitMemoryLinks.DefaultLinksSizeStep, constants))
90         {
91             action(memory);
92         }
93     }
94 }

```

#### 1.124 ./csharp/Platform.Data.Doublets.Tests/TestExtensions.cs

```

1  using System.Collections.Generic;
2  using Xunit;
3  using Platform.Ranges;
4  using Platform.Numbers;
5  using Platform.Random;
6  using Platform.Setters;
7  using Platform.Converters;
8
9  namespace Platform.Data.Doublets.Tests
10 {
11     /// <summary>
12     /// <para>

```

```

13  /// Represents the test extensions.
14  /// </para>
15  /// <para></para>
16  /// </summary>
17  public static class TestExtensions
18  {
19      /// <summary>
20      /// <para>
21      /// Tests the crud operations using the specified links.
22      /// </para>
23      /// <para></para>
24      /// </summary>
25      /// <typeparam name="T">
26      /// <para>The .</para>
27      /// <para></para>
28      /// </typeparam>
29      /// <param name="links">
30      /// <para>The links.</para>
31      /// <para></para>
32      /// </param>
33  public static void TestCRUDOperations<T>(this ILinks<T> links)
34  {
35      var constants = links.Constants;
36
37      var equalityComparer = EqualityComparer<T>.Default;
38
39      var zero = default(T);
40      var one = Arithmetic.Increment(zero);
41
42      // Create Link
43      Assert.True(equalityComparer.Equals(links.Count(), zero));
44
45      var setter = new Setter<T>(constants.Null);
46      links.Each(constants.Any, constants.Any, setter.SetAndReturnTrue);
47
48      Assert.True(equalityComparer.Equals(setter.Result, constants.Null));
49
50      var linkAddress = links.Create();
51
52      var link = new Link<T>(links.GetLink(linkAddress));
53
54      Assert.True(link.Count == 3);
55      Assert.True(equalityComparer.Equals(link.Index, linkAddress));
56      Assert.True(equalityComparer.Equals(link.Source, constants.Null));
57      Assert.True(equalityComparer.Equals(link.Target, constants.Null));
58
59      Assert.True(equalityComparer.Equals(links.Count(), one));
60
61      // Get first link
62      setter = new Setter<T>(constants.Null);
63      links.Each(constants.Any, constants.Any, setter.SetAndReturnFalse);
64
65      Assert.True(equalityComparer.Equals(setter.Result, linkAddress));
66
67      // Update link to reference itself
68      links.Update(linkAddress, linkAddress, linkAddress);
69
70      link = new Link<T>(links.GetLink(linkAddress));
71
72      Assert.True(equalityComparer.Equals(link.Source, linkAddress));
73      Assert.True(equalityComparer.Equals(link.Target, linkAddress));
74
75      // Update link to reference null (prepare for delete)
76      var updated = links.Update(linkAddress, constants.Null, constants.Null);
77
78      Assert.True(equalityComparer.Equals(updated, linkAddress));
79
80      link = new Link<T>(links.GetLink(linkAddress));
81
82      Assert.True(equalityComparer.Equals(link.Source, constants.Null));
83      Assert.True(equalityComparer.Equals(link.Target, constants.Null));
84
85      // Delete link
86      links.Delete(linkAddress);
87
88      Assert.True(equalityComparer.Equals(links.Count(), zero));
89
90      setter = new Setter<T>(constants.Null);
91      links.Each(constants.Any, constants.Any, setter.SetAndReturnTrue);
92

```



```

93     Assert.True(equalityComparer.Equals(setter.Result, constants.Null));
94 }
95
96 /// <summary>
97 /// <para>
98 /// Tests the raw numbers crud operations using the specified links.
99 /// </para>
100 /// <para></para>
101 /// </summary>
102 /// <typeparam name="T">
103 /// <para>The .</para>
104 /// <para></para>
105 /// </typeparam>
106 /// <param name="links">
107 /// <para>The links.</para>
108 /// <para></para>
109 /// </param>
110 public static void TestRawNumbersCRUDOperations<T>(this ILinks<T> links)
111 {
112     // Constants
113     var constants = links.Constants;
114     var equalityComparer = EqualityComparer<T>.Default;
115
116     var zero = default(T);
117     var one = Arithmetic.Increment(zero);
118     var two = Arithmetic.Increment(one);
119
120     var h106E = new Hybrid<T>(106L, isExternal: true);
121     var h107E = new Hybrid<T>(-char.ConvertFromUtf32(107)[0]);
122     var h108E = new Hybrid<T>(-108L);
123
124     Assert.Equal(106L, h106E.AbsoluteValue);
125     Assert.Equal(107L, h107E.AbsoluteValue);
126     Assert.Equal(108L, h108E.AbsoluteValue);
127
128     // Create Link (External -> External)
129     var linkAddress1 = links.Create();
130
131     links.Update(linkAddress1, h106E, h108E);
132
133     var link1 = new Link<T>(links.GetLink(linkAddress1));
134
135     Assert.True(equalityComparer.Equals(link1.Source, h106E));
136     Assert.True(equalityComparer.Equals(link1.Target, h108E));
137
138     // Create Link (Internal -> External)
139     var linkAddress2 = links.Create();
140
141     links.Update(linkAddress2, linkAddress1, h108E);
142
143     var link2 = new Link<T>(links.GetLink(linkAddress2));
144
145     Assert.True(equalityComparer.Equals(link2.Source, linkAddress1));
146     Assert.True(equalityComparer.Equals(link2.Target, h108E));
147
148     // Create Link (Internal -> Internal)
149     var linkAddress3 = links.Create();
150
151     links.Update(linkAddress3, linkAddress1, linkAddress2);
152
153     var link3 = new Link<T>(links.GetLink(linkAddress3));
154
155     Assert.True(equalityComparer.Equals(link3.Source, linkAddress1));
156     Assert.True(equalityComparer.Equals(link3.Target, linkAddress2));
157
158     // Search for created link
159     var setter1 = new Setter<T>(constants.Null);
160     links.Each(h106E, h108E, setter1.SetAndReturnFalse);
161
162     Assert.True(equalityComparer.Equals(setter1.Result, linkAddress1));
163
164     // Search for nonexistent link
165     var setter2 = new Setter<T>(constants.Null);
166     links.Each(h106E, h107E, setter2.SetAndReturnFalse);
167
168     Assert.True(equalityComparer.Equals(setter2.Result, constants.Null));
169
170     // Update link to reference null (prepare for delete)
171     var updated = links.Update(linkAddress3, constants.Null, constants.Null);
172

```

```

173     Assert.True(equalityComparer.Equals(updated, linkAddress3));
174
175     link3 = new Link<T>(links.GetLink(linkAddress3));
176
177     Assert.True(equalityComparer.Equals(link3.Source, constants.Null));
178     Assert.True(equalityComparer.Equals(link3.Target, constants.Null));
179
180     // Delete link
181     links.Delete(linkAddress3);
182
183     Assert.True(equalityComparer.Equals(links.Count(), two));
184
185     var setter3 = new Setter<T>(constants.Null);
186     links.Each(constants.Any, constants.Any, setter3.SetAndReturnTrue);
187
188     Assert.True(equalityComparer.Equals(setter3.Result, linkAddress2));
189 }
190
191 /// <summary>
192 /// <para>
193 /// Tests the multiple random creations and deletions using the specified links.
194 /// </para>
195 /// <para></para>
196 /// </summary>
197 /// <typeparam name="TLink">
198 /// <para>The link.</para>
199 /// <para></para>
200 /// </typeparam>
201 /// <param name="links">
202 /// <para>The links.</para>
203 /// <para></para>
204 /// </param>
205 /// <param name="maximumOperationsPerCycle">
206 /// <para>The maximum operations per cycle.</para>
207 /// <para></para>
208 /// </param>
209 public static void TestMultipleRandomCreationsAndDeletions<TLink>(this ILinks<TLink>
    ↪ links, int maximumOperationsPerCycle)
210 {
211     var comparer = Comparer<TLink>.Default;
212     var addressToUInt64Converter = CheckedConverter<TLink, ulong>.Default;
213     var uInt64ToAddressConverter = CheckedConverter<ulong, TLink>.Default;
214     for (var N = 1; N < maximumOperationsPerCycle; N++)
215     {
216         var random = new System.Random(N);
217         var created = 0UL;
218         var deleted = 0UL;
219         for (var i = 0; i < N; i++)
220         {
221             var linksCount = addressToUInt64Converter.Convert(links.Count());
222             var createPoint = random.NextBoolean();
223             if (linksCount >= 2 && createPoint)
224             {
225                 var linksAddressRange = new Range<ulong>(1, linksCount);
226                 TLink source = uInt64ToAddressConverter.Convert(random.NextUInt64(linksA
    ↪ ddressRange));
227                 TLink target = uInt64ToAddressConverter.Convert(random.NextUInt64(linksA
    ↪ ddressRange));
228                 ↪ //-V3086
229                 var resultLink = links.GetOrCreate(source, target);
230                 if (comparer.Compare(resultLink,
    ↪ uInt64ToAddressConverter.Convert(linksCount)) > 0)
231                 {
232                     created++;
233                 }
234             }
235             else
236             {
237                 links.Create();
238                 created++;
239             }
240         }
241         Assert.True(created == addressToUInt64Converter.Convert(links.Count()));
242         for (var i = 0; i < N; i++)
243         {
244             TLink link = uInt64ToAddressConverter.Convert((ulong)i + 1UL);
245             if (links.Exists(link))
246             {

```

```

246         links.Delete(link);
247         deleted++;
248     }
249 }
250 Assert.True(addressToUInt64Converter.Convert(links.Count()) == 0L);
251 }
252 }
253 }
254 }

```

# 1.125 ./csharp/Platform.Data.Doublets.Tests/UInt64LinksExtensionsTests.cs

```

1  using Platform.Data.Doublets.Memory;
2  using Platform.Data.Doublets.Memory.United.Generic;
3  using Platform.Data.Doublets.Memory.Raw;
4  using Platform.Memory;
5  using Platform.Numbers;
6  using Xunit;
7  using Xunit.Abstractions;
8  using TLink = System.UInt64;
9
10 namespace Platform.Data.Doublets.Tests
11 {
12     /// <summary>
13     /// <para>
14     /// Represents the uint 64 links extensions tests.
15     /// </para>
16     /// <para></para>
17     /// </summary>
18     public class UInt64LinksExtensionsTests
19     {
20         /// <summary>
21         /// <para>
22         /// Creates the links.
23         /// </para>
24         /// <para></para>
25         /// </summary>
26         /// <returns>
27         /// <para>A links of t link</para>
28         /// <para></para>
29         /// </returns>
30         public static ILinks<TLink> CreateLinks() => CreateLinks<TLink>(new
            ↳ Platform.IO.TemporaryFile());
31
32         /// <summary>
33         /// <para>
34         /// Creates the links using the specified data db filename.
35         /// </para>
36         /// <para></para>
37         /// </summary>
38         /// <typeparam name="TLink">
39         /// <para>The link.</para>
40         /// <para></para>
41         /// </typeparam>
42         /// <param name="dataDBFilename">
43         /// <para>The data db filename.</para>
44         /// <para></para>
45         /// </param>
46         /// <returns>
47         /// <para>A links of t link</para>
48         /// <para></para>
49         /// </returns>
50         public static ILinks<TLink> CreateLinks<TLink>(string dataDBFilename)
51         {
52             var linksConstants = new LinksConstants<TLink>(enableExternalReferencesSupport:
                ↳ true);
53             return new UnitedMemoryLinks<TLink>(new
                ↳ FileMappedResizableDirectMemory(dataDBFilename),
                ↳ UnitedMemoryLinks<TLink>.DefaultLinksSizeStep, linksConstants,
                ↳ IndexTreeType.Default);
54         }
55         /// <summary>
56         /// <para>
57         /// Tests that format structure with external reference test.
58         /// </para>
59         /// <para></para>
60         /// </summary>
61         [Fact]
62         public void FormatStructureWithExternalReferenceTest()
63         {

```

```

64     TLink<TLink> links = CreateLinks();
65     TLink zero = default;
66     var one = Arithmetic.Increment(zero);
67     var markerIndex = one;
68     var meaningRoot = links.GetOrCreate(markerIndex, markerIndex);
69     var numberMarker = links.GetOrCreate(meaningRoot, Arithmetic.Increment(ref
    ↪ markerIndex));
70     AddressToRawNumberConverter<TLink> addressToNumberConverter = new();
71     var numberAddress = addressToNumberConverter.Convert(1);
72     var numberLink = links.GetOrCreate(numberMarker, numberAddress);
73     var linkNotation = links.FormatStructure(numberLink, link => link.IsFullPoint(),
    ↪ true);
74     Assert.Equal("(3:(2:1 2) 18446744073709551615)", linkNotation);
75 }
76 }
77 }

```

## 1.126 ./csharp/Platform.Data.Doublets.Tests/UnitedMemoryUInt32LinksTests.cs

```

1  using System;
2  using Xunit;
3  using Platform.Reflection;
4  using Platform.Memory;
5  using Platform.Scopes;
6  using Platform.Data.Doublets.Memory.United.Specific;
7  using TLink = System.UInt32;
8
9  namespace Platform.Data.Doublets.Tests
10 {
11     /// <summary>
12     /// <para>
13     /// Represents the united memory int 32 links tests.
14     /// </para>
15     /// <para></para>
16     /// </summary>
17     public unsafe static class UnitedMemoryUInt32LinksTests
18     {
19         /// <summary>
20         /// <para>
21         /// Tests that crud test.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         [Fact]
26         public static void CRUDTest()
27         {
28             Using(links => links.TestCRUDOperations());
29         }
30
31         /// <summary>
32         /// <para>
33         /// Tests that raw numbers crud test.
34         /// </para>
35         /// <para></para>
36         /// </summary>
37         [Fact]
38         public static void RawNumbersCRUDTest()
39         {
40             Using(links => links.TestRawNumbersCRUDOperations());
41         }
42
43         /// <summary>
44         /// <para>
45         /// Tests that multiple random creations and deletions test.
46         /// </para>
47         /// <para></para>
48         /// </summary>
49         [Fact]
50         public static void MultipleRandomCreationsAndDeletionsTest()
51         {
52             Using(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().TestMultip
    ↪ leRandomCreationsAndDeletions(100));
53         }
54
55         /// <summary>
56         /// <para>
57         /// Usings the action.
58         /// </para>
59         /// <para></para>
60         /// </summary>

```

```

61     /// <param name="action">
62     /// <para>The action.</para>
63     /// <para></para>
64     /// </param>
65     private static void Using(Action<ILinks<TLink>> action)
66     {
67         using (var scope = new Scope<Types<HeapResizableDirectMemory,
68             ↳ UInt32UnitedMemoryLinks>>())
69         {
70             action(scope.Use<ILinks<TLink>>());
71         }
72     }
73 }

```

#### 1.127 ./csharp/Platform.Data.Doublets.Tests/UnitedMemoryUInt64LinksTests.cs

```

1  using System;
2  using Xunit;
3  using Platform.Reflection;
4  using Platform.Memory;
5  using Platform.Scopes;
6  using Platform.Data.Doublets.Memory.United.Specific;
7  using TLink = System.UInt64;
8
9  namespace Platform.Data.Doublets.Tests
10 {
11     /// <summary>
12     /// <para>
13     /// Represents the united memory int 64 links tests.
14     /// </para>
15     /// <para></para>
16     /// </summary>
17     public unsafe static class UnitedMemoryUInt64LinksTests
18     {
19         /// <summary>
20         /// <para>
21         /// Tests that crud test.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         [Fact]
26         public static void CRUDTest()
27         {
28             Using(links => links.TestCRUDOperations());
29         }
30
31         /// <summary>
32         /// <para>
33         /// Tests that raw numbers crud test.
34         /// </para>
35         /// <para></para>
36         /// </summary>
37         [Fact]
38         public static void RawNumbersCRUDTest()
39         {
40             Using(links => links.TestRawNumbersCRUDOperations());
41         }
42
43         /// <summary>
44         /// <para>
45         /// Tests that multiple random creations and deletions test.
46         /// </para>
47         /// <para></para>
48         /// </summary>
49         [Fact]
50         public static void MultipleRandomCreationsAndDeletionsTest()
51         {
52             Using(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().TestMultipleRandomCreationsAndDeletions(100));
53         }
54
55         /// <summary>
56         /// <para>
57         /// Usings the action.
58         /// </para>
59         /// <para></para>
60         /// </summary>
61         /// <param name="action">
62         /// <para>The action.</para>

```

```
63     /// <para></para>
64     /// </param>
65     private static void Using(Action<ILinks<TLink>> action)
66     {
67         using (var scope = new Scope<Types<HeapResizableDirectMemory,
68             ↪ UInt64UnitedMemoryLinks>>())
69         {
70             action(scope.Use<ILinks<TLink>>());
71         }
72     }
73 }
```

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