

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        private static readonly EqualityComparer<TLink> _equalityComparer =
20            ↪ EqualityComparer<TLink>.Default;
21        private readonly TLink _targetToMatch;
22
23        /// <summary>
24        /// <para>
25        /// Initializes a new <see cref="TargetMatcher"/> instance.
26        /// </para>
27        /// <para></para>
28        /// </summary>
29        /// <param name="links">
30        /// <para>A links.</para>
31        /// </param>
32        /// <param name="targetToMatch">
33        /// <para>A target to match.</para>
34        /// </param>
35        /// </summary>
36        [MethodImpl(MethodImplOptions.AggressiveInlining)]
37        public TargetMatcher(ILinks<TLink> links, TLink targetToMatch) : base(links) =>
38            ↪ _targetToMatch = targetToMatch;
39
40        /// <summary>
41        /// <para>
42        /// Determines whether this instance is matched.
43        /// </para>
44        /// <para></para>
45        /// </summary>
46        /// <param name="link">
47        /// <para>The link.</para>
48        /// </param>
49        /// <returns>
50        /// <para>The bool</para>
51        /// </returns>
52        [MethodImpl(MethodImplOptions.AggressiveInlining)]
53        public bool IsMatched(TLink link) => _equalityComparer.Equals(_links.GetTarget(link),
54            ↪ _targetToMatch);
55    }
56 }
```

1.2 ./csharp/Platform.Data.Doublets/Decorators/LinksCascadeUniquenessAndUsagesResolver.cs

```
1 using System;
2 using System.Collections.Generic;
3 using System.Runtime.CompilerServices;
4 using Platform.Delegates;
5
6 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
7
8 namespace Platform.Data.Doublets.Decorators
9 {
10    /// <summary>
11    /// <para>
12    /// Represents the links cascade uniqueness and usages resolver.
13    /// </para>
14    /// <para></para>
15    /// </summary>
16    /// <seealso cref="LinksUniquenessResolver{TLink}"/>
```

```

17 public class LinksCascadeUniquenessAndUsagesResolver<TLink> : LinksUniquenessResolver<TLink>
18 {
19     /// <summary>
20     /// <para>
21     /// Initializes a new <see cref="LinksCascadeUniquenessAndUsagesResolver"/> instance.
22     /// </para>
23     /// <para></para>
24     /// </summary>
25     /// <param name="links">
26     /// <para>A links.</para>
27     /// <para></para>
28     /// </param>
29     [MethodImpl(MethodImplOptions.AggressiveInlining)]
30     public LinksCascadeUniquenessAndUsagesResolver(ILinks<TLink> links) : base(links) { }
31
32     /// <summary>
33     /// <para>
34     /// Resolves the address change conflict using the specified old link address.
35     /// </para>
36     /// <para></para>
37     /// </summary>
38     /// <param name="oldLinkAddress">
39     /// <para>The old link address.</para>
40     /// <para></para>
41     /// </param>
42     /// <param name="newLinkAddress">
43     /// <para>The new link address.</para>
44     /// <para></para>
45     /// </param>
46     /// <returns>
47     /// <para>The link</para>
48     /// <para></para>
49     /// </returns>
50     [MethodImpl(MethodImplOptions.AggressiveInlining)]
51     protected override TLink ResolveAddressChangeConflict(TLink oldLinkAddress, TLink
52     ↪ newLinkAddress, WriteHandler<TLink> handler)
53     {
54         var constants = _links.Constants;
55         WriteHandlerState<TLink> handlerState = new(constants.Continue, constants.Break,
56         ↪ handler);
57         // Use Facade (the last decorator) to ensure recursion working correctly
58         handlerState.Apply(_facade.MergeUsages(oldLinkAddress, newLinkAddress,
59         ↪ handlerState.Handler));
60         handlerState.Apply(base.ResolveAddressChangeConflict(oldLinkAddress, newLinkAddress,
61         ↪ handlerState.Handler));
62         return handlerState.Result;
63     }
64 }
65 }

```

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

```

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

```

```

28
29     /// <summary>
30     /// <para>
31     /// Deletes the restriction.
32     /// </para>
33     /// <para></para>
34     /// </summary>
35     /// <param name="restriction">
36     /// <para>The restriction.</para>
37     /// <para></para>
38     /// </param>
39     [MethodImpl(MethodImplOptions.AggressiveInlining)]
40     public override TLink Delete(ICollection<TLink> restriction, WriteHandler<TLink> handler)
41     {
42         var constants = _links.Constants;
43         WriteHandlerState<TLink> handlerState = new(constants.Continue, constants.Break,
44             ↪ handler);
45         var linkIndex = restriction[_constants.IndexPart];
46         // Use Facade (the last decorator) to ensure recursion working correctly
47         handlerState.Apply(_facade.DeleteAllUsages(linkIndex, handlerState.Handler));
48         handlerState.Apply(_links.Delete(restriction, handlerState.Handler));
49         return handlerState.Result;
50     }
51 }

```

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

```

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

```

```

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

```

```

130     /// <param name="restriction">
131     /// <para>The restriction.</para>
132     /// <para></para>
133     /// </param>
134     /// <returns>
135     /// <para>The link</para>
136     /// <para></para>
137     /// </returns>
138     [MethodImpl(MethodImplOptions.AggressiveInlining)]
139     public virtual TLink Create(IList<TLink> substitution, WriteHandler<TLink> handler) =>
140         ↪ _links.Create(substitution, handler);
141
142     /// <summary>
143     /// <para>
144     /// Updates the restriction.
145     /// </para>
146     /// <para></para>
147     /// </summary>
148     /// <param name="restriction">
149     /// <para>The restriction.</para>
150     /// <para></para>
151     /// </param>
152     /// <param name="substitution">
153     /// <para>The substitution.</para>
154     /// <para></para>
155     /// </param>
156     /// <returns>
157     /// <para>The link</para>
158     /// <para></para>
159     /// </returns>
160     [MethodImpl(MethodImplOptions.AggressiveInlining)]
161     public virtual TLink Update(IList<TLink> restriction, IList<TLink> substitution,
162         ↪ WriteHandler<TLink> handler) => _links.Update(restriction, substitution, handler);
163
164     /// <summary>
165     /// <para>
166     /// Deletes the restriction.
167     /// </para>
168     /// <para></para>
169     /// </summary>
170     /// <param name="restriction">
171     /// <para>The restriction.</para>
172     /// <para></para>
173     /// </param>
174     [MethodImpl(MethodImplOptions.AggressiveInlining)]
175     public virtual TLink Delete(IList<TLink> restriction, WriteHandler<TLink> handler) =>
176         ↪ _links.Delete(restriction, handler);
177 }
178 }

```

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" />

```

```

27 protected class DisposableWithMultipleCallsAllowed : Disposable
28 {
29     /// <summary>
30     /// <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)

```

```

104     {
105         if (!wasDisposed)
106         {
107             _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  using Platform.Delegates;
5
6  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
7
8  namespace Platform.Data.Doublets.Decorators
9  {
10     // TODO: Make LinksExternalReferenceValidator. A layer that checks each link to exist or to
11     // ↳ be external (hybrid link's raw number).
12     /// <summary>
13     /// <para>
14     /// Represents the links inner reference existence validator.
15     /// </para>
16     /// <para></para>
17     /// </summary>
18     /// <seealso cref="LinksDecoratorBase{TLink}" />
19     public class LinksInnerReferenceExistenceValidator<TLink> : LinksDecoratorBase<TLink>
20     {
21         /// <summary>
22         /// <para>
23         /// Initializes a new <see cref="LinksInnerReferenceExistenceValidator" /> instance.
24         /// </para>
25         /// <para></para>
26         /// </summary>
27         /// <param name="links">
28         /// <para>A links.</para>
29         /// <para></para>
30         /// </param>
31         [MethodImpl(MethodImplOptions.AggressiveInlining)]
32         public LinksInnerReferenceExistenceValidator(ILinks<TLink> links) : base(links) { }
33
34         /// <summary>
35         /// <para>
36         /// Eaches the handler.
37         /// </para>
38         /// <para></para>
39         /// </summary>
40         /// <param name="handler">
41         /// <para>The handler.</para>
42         /// <para></para>
43         /// </param>
44         /// <param name="restriction">
45         /// <para>The restriction.</para>
46         /// <para></para>
47         /// </param>
48         /// <returns>
49         /// <para>The link</para>
50         /// <para></para>
51         /// </returns>
52         [MethodImpl(MethodImplOptions.AggressiveInlining)]
53         public override TLink Each(IList<TLink> restriction, ReadHandler<TLink> handler)
54         {
55             var links = _links;
56             links.EnsureInnerReferenceExists(restriction, nameof(restriction));
57             return links.Each(restriction, handler);
58         }
59
60         /// <summary>
61         /// <para>
62         /// Updates the restriction.
63         /// </para>
64         /// <para></para>
65         /// </summary>
66         /// <param name="restriction">
67         /// <para>The restriction.</para>
68         /// <para></para>
69         /// </param>

```

```

69     /// <param name="substitution">
70     /// <para>The substitution.</para>
71     /// <para></para>
72     /// </param>
73     /// <returns>
74     /// <para>The link</para>
75     /// <para></para>
76     /// </returns>
77     [MethodImpl(MethodImplOptions.AggressiveInlining)]
78     public override TLink Update(IList<TLink> restriction, IList<TLink> substitution,
    ↪ WriteHandler<TLink> handler)
79     {
80         // TODO: Possible values: null, ExistentLink or NonExistentHybrid(ExternalReference)
81         var links = _links;
82         links.EnsureInnerReferenceExists(restriction, nameof(restriction));
83         links.EnsureInnerReferenceExists(substitution, nameof(substitution));
84         return links.Update(restriction, substitution, handler);
85     }
86
87     /// <summary>
88     /// <para>
89     /// Deletes the restriction.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <param name="restriction">
94     /// <para>The restriction.</para>
95     /// <para></para>
96     /// </param>
97     [MethodImpl(MethodImplOptions.AggressiveInlining)]
98     public override TLink Delete(IList<TLink> restriction, WriteHandler<TLink> handler)
99     {
100         var link = restriction[_constants.IndexPart];
101         var links = _links;
102         links.EnsureLinkExists(link, nameof(link));
103         return links.Delete(restriction, handler);
104     }
105 }
106 }

```

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

```

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

```



```

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

```

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

```

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

```

```

23     /// <param name="links">
24     /// <para>A links.</para>
25     /// <para></para>
26     /// </param>
27     [MethodImpl(MethodImplOptions.AggressiveInlining)]
28     public LinksNonExistentDependenciesCreator(ILinks<TLink> links) : base(links) { }
29
30     /// <summary>
31     /// <para>
32     /// Updates the restriction.
33     /// </para>
34     /// <para></para>
35     /// </summary>
36     /// <param name="restriction">
37     /// <para>The restriction.</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> restriction, IList<TLink> substitution,
50         ↳ WriteHandler<TLink> handler)
51     {
52         var constants = _constants;
53         var links = _links;
54         links.EnsureCreated(substitution[constants.SourcePart],
55             ↳ substitution[constants.TargetPart]);
56         return links.Update(restriction, substitution, handler);
57     }
58 }

```

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

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4  using Platform.Delegates;
5
6  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
7
8  namespace Platform.Data.Doublets.Decorators
9  {
10     /// <summary>
11     /// <para>
12     /// Represents the links null constant to self reference resolver.
13     /// </para>
14     /// <para></para>
15     /// </summary>
16     /// <seealso cref="LinksDecoratorBase{TLink}" />
17     public class LinksNullConstantToSelfReferenceResolver<TLink> : LinksDecoratorBase<TLink>
18     {
19         /// <summary>
20         /// <para>
21         /// Initializes a new <see cref="LinksNullConstantToSelfReferenceResolver" /> instance.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         /// <param name="links">
26         /// <para>A links.</para>
27         /// <para></para>
28         /// </param>
29         [MethodImpl(MethodImplOptions.AggressiveInlining)]
30         public LinksNullConstantToSelfReferenceResolver(ILinks<TLink> links) : base(links) { }
31
32         /// <summary>
33         /// <para>
34         /// Creates the substitution.
35         /// </para>
36         /// <para></para>
37         /// </summary>
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 Create(IList<TLink> substitution, WriteHandler<TLink> handler)
48     {
49         return _links.CreatePoint(handler);
50     }
51
52     /// <summary>
53     /// <para>
54     /// Updates the substitution.
55     /// </para>
56     /// <para></para>
57     /// </summary>
58     /// <param name="restriction">
59     /// <para>The substitution.</para>
60     /// <para></para>
61     /// </param>
62     /// <param name="substitution">
63     /// <para>The substitution.</para>
64     /// <para></para>
65     /// </param>
66     /// <returns>
67     /// <para>The link</para>
68     /// <para></para>
69     /// </returns>
70     [MethodImpl(MethodImplOptions.AggressiveInlining)]
71     public override TLink Update(IList<TLink> restriction, IList<TLink> substitution,
72         WriteHandler<TLink> handler) => _links.Update(restriction,
73         _links.ResolveConstantAsSelfReference(_constants.Null, restriction, substitution),
74         handler);
75 }

```

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

```

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

```

```

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

```

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

```

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

```

```

19     /// <summary>
20     /// <para>
21     /// Initializes a new <see cref="LinksUniquenessValidator"/> instance.
22     /// </para>
23     /// <para></para>
24     /// </summary>
25     /// <param name="links">
26     /// <para>A links.</para>
27     /// <para></para>
28     /// </param>
29     [MethodImpl(MethodImplOptions.AggressiveInlining)]
30     public LinksUniquenessValidator(ILinks<TLink> links) : base(links) { }
31
32     /// <summary>
33     /// <para>
34     /// Updates the restriction.
35     /// </para>
36     /// <para></para>
37     /// </summary>
38     /// <param name="restriction">
39     /// <para>The restriction.</para>
40     /// <para></para>
41     /// </param>
42     /// <param name="substitution">
43     /// <para>The substitution.</para>
44     /// <para></para>
45     /// </param>
46     /// <returns>
47     /// <para>The link</para>
48     /// <para></para>
49     /// </returns>
50     [MethodImpl(MethodImplOptions.AggressiveInlining)]
51     public override TLink Update(IList<TLink> restriction, IList<TLink> substitution,
52     ↪ WriteHandler<TLink> handler)
53     {
54         var links = _links;
55         var constants = _constants;
56         links.EnsureDoesNotExists(substitution[constants.SourcePart],
57         ↪ substitution[constants.TargetPart]);
58         return links.Update(restriction, substitution, handler);
59     }

```

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

```

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

```

```

35     /// </para>
36     /// <para></para>
37     /// </summary>
38     /// <param name="restriction">
39     /// <para>The restriction.</para>
40     /// <para></para>
41     /// </param>
42     /// <param name="substitution">
43     /// <para>The substitution.</para>
44     /// <para></para>
45     /// </param>
46     /// <returns>
47     /// <para>The link</para>
48     /// <para></para>
49     /// </returns>
50     [MethodImpl(MethodImplOptions.AggressiveInlining)]
51     public override TLink Update(ICollection<TLink> restriction, ICollection<TLink> substitution,
    ↪ WriteHandler<TLink> handler)
52     {
53         var links = _links;
54         links.EnsureNoUsages(restriction[_constants.IndexPart]);
55         return links.Update(restriction, substitution, handler);
56     }
57
58     /// <summary>
59     /// <para>
60     /// Deletes the restriction.
61     /// </para>
62     /// <para></para>
63     /// </summary>
64     /// <param name="restriction">
65     /// <para>The restriction.</para>
66     /// <para></para>
67     /// </param>
68     [MethodImpl(MethodImplOptions.AggressiveInlining)]
69     public override TLink Delete(ICollection<TLink> restriction, WriteHandler<TLink> handler)
70     {
71         var link = restriction[_constants.IndexPart];
72         var links = _links;
73         links.EnsureNoUsages(link);
74         return links.Delete(restriction, handler);
75     }
76 }
77 }

```

1.13 ./csharp/Platform.Data.Doublets/Decorators/LoggingDecorator.cs

```

1  using System.Collections.Generic;
2  using System.IO;
3  using Platform.Delegates;
4
5  namespace Platform.Data.Doublets.Decorators
6  {
7      public class LoggingDecorator<TLink> : LinksDecoratorBase<TLink>
8      {
9          private readonly Stream _logStream;
10         private readonly StreamWriter _logStreamWriter;
11         public LoggingDecorator(ICollection<TLink> links, Stream logStream) : base(links)
12         {
13             _logStream = logStream;
14             _logStreamWriter = new StreamWriter(_logStream);
15             _logStreamWriter.AutoFlush = true;
16         }
17
18         public override TLink Create(ICollection<TLink> substitution, WriteHandler<TLink> handler)
19         {
20             WriteHandlerState<TLink> handlerState = new(_constants.Continue, _constants.Break,
    ↪ handler);
21             return base.Create(substitution, (before, after) =>
22             {
23                 if (handlerState.Handler != null)
24                 {
25                     handlerState.Apply(handlerState.Handler(before, after));
26                 }
27                 _logStreamWriter.WriteLine($"Create. Before: {new Link<TLink>(before)}. After:
    ↪ {new Link<TLink>(after)}");
28                 return _constants.Continue;
29             });
30         }
31     }

```

```

32     public override TLink Update(IList<TLink> restriction, IList<TLink> substitution,
    ↪ WriteHandler<TLink> handler)
33     {
34         WriteHandlerState<TLink> handlerState = new(_constants.Continue, _constants.Break,
    ↪ handler);
35         return base.Update(restriction, substitution, (before, after) =>
36         {
37             if (handlerState.Handler != null)
38             {
39                 handlerState.Apply(handlerState.Handler(before, after));
40             }
41             _logStreamWriter.WriteLine($"Update. Before: {new Link<TLink>(before)}. After:
    ↪ {new Link<TLink>(after)}");
42             return _constants.Continue;
43         });
44     }
45
46     public override TLink Delete(IList<TLink> restriction, WriteHandler<TLink> handler)
47     {
48         WriteHandlerState<TLink> handlerState = new(_constants.Continue, _constants.Break,
    ↪ handler);
49         return base.Delete(restriction, (before, after) =>
50         {
51             if (handlerState.Handler != null)
52             {
53                 handlerState.Apply(handlerState.Handler(before, after));
54             }
55             _logStreamWriter.WriteLine($"Delete. Before: {new Link<TLink>(before)}. After:
    ↪ {new Link<TLink>(after)}");
56             return _constants.Continue;
57         });
58     }
59 }
60 }

```

1.14 ./csharp/Platform.Data.Doublets/Decorators/NonNullContentsLinkDeletionResolver.cs

```

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

```

```

43     public override TLink Delete(IList<TLink> restriction, WriteHandler<TLink> handler)
44     {
45         var linkIndex = restriction[_constants.IndexPart];
46         var constants = _links.Constants;
47         WriteHandlerState<TLink> handlerResult = new(constants.Continue, constants.Break,
48             ↪ handler);
49         handlerResult.Apply(_links.EnforceResetValues(linkIndex, handlerResult.Handler));
50         handlerResult.Apply(_links.Delete(restriction, handlerResult.Handler));
51         return handlerResult.Result;
52     }
53 }

```

1.15 ./csharp/Platform.Data.Doublets/Decorators/UInt32Links.cs

```

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

```



```

65     /// <para>The link</para>
66     /// <para></para>
67     /// </returns>
68     [MethodImpl(MethodImplOptions.AggressiveInlining)]
69     public override TLink Update(ICollection<TLink> restriction, ICollection<TLink> substitution,
70     ↪ WriteHandler<TLink> handler)
71     {
72         var constants = _constants;
73         var indexPartConstant = constants.IndexPart;
74         var sourcePartConstant = constants.SourcePart;
75         var targetPartConstant = constants.TargetPart;
76         var nullConstant = constants.Null;
77         var itselfConstant = constants.Itself;
78         var existedLink = nullConstant;
79         var updatedLink = restriction[indexPartConstant];
80         var newSource = substitution[sourcePartConstant];
81         var newTarget = substitution[targetPartConstant];
82         var links = _links;
83         if (newSource != itselfConstant && newTarget != itselfConstant)
84         {
85             existedLink = links.SearchOrDefault(newSource, newTarget);
86         }
87         if (existedLink == nullConstant)
88         {
89             var before = links.GetLink(updatedLink);
90             if (before[sourcePartConstant] != newSource || before[targetPartConstant] !=
91             ↪ newTarget)
92             {
93                 var source = newSource == itselfConstant ? updatedLink : newSource;
94                 var target = newTarget == itselfConstant ? updatedLink : newTarget;
95                 return links.Update(new Link<TLink>(updatedLink, source, target), handler);
96             }
97             return _links.Constants.Continue;
98         }
99         else
100         {
101             return _facade.MergeAndDelete(updatedLink, existedLink, handler);
102         }
103     }
104     /// <summary>
105     /// <para>
106     /// Deletes the substitution.
107     /// </para>
108     /// </summary>
109     /// <param name="restriction">
110     /// <para>The restriction.</para>
111     /// </param>
112     /// </summary>
113     [MethodImpl(MethodImplOptions.AggressiveInlining)]
114     public override TLink Delete(ICollection<TLink> restriction, WriteHandler<TLink> handler)
115     {
116         var linkIndex = restriction[_constants.IndexPart];
117         var constants = _links.Constants;
118         WriteHandlerState<TLink> handlerState = new(constants.Continue, constants.Break,
119         ↪ handler);
120         handlerState.Apply(_links.EnforceResetValues(linkIndex, handlerState.Handler));
121         handlerState.Apply(_facade.DeleteAllUsages(linkIndex, handlerState.Handler));
122         handlerState.Apply(_links.Delete(restriction, handlerState.Handler));
123         return handlerState.Result;
124     }
125 }

```

1.16 ./csharp/Platform.Data.Doublets/Decorators/UInt64Links.cs

```

1  using System.Collections.Generic;
2  using System.Net.Security;
3  using System.Runtime.CompilerServices;
4  using Platform.Delegates;
5  using TLink = System.UInt64;
6
7  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
8
9  namespace Platform.Data.Doublets.Decorators
10 {
11     /// <summary>
12     /// <para>Represents a combined decorator that implements the basic logic for interacting
13     ↪ with the links storage for links with addresses represented as <see cref="System.UInt64"
14     ↪ />.</para>

```

```

13  /// <para>Представляет комбинированный декоратор, реализующий основную логику по
    ↳ взаимодействию с хранилищем связей, для связей с адресами представленными в виде <see
    ↳ cref="System.UInt64"/>.</para>
14  /// </summary>
15  /// <remarks>
16  /// Возможные оптимизации:
17  /// Объединение в одном поле Source и Target с уменьшением до 32 бит.
18  /// + меньше объём БД
19  /// - меньше производительность
20  /// - больше ограничение на количество связей в БД)
21  /// Ленивое хранение размеров поддеревьев (расчитываемое по мере использования БД)
22  /// + меньше объём БД
23  /// - больше сложность
24  ///
25  /// 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
26  /// Желательно реализовать поддержку переключения между деревьями и битовыми индексами
    ↳ (битовыми строками) - вариант матрицы (выстраиваемой лениво).
27  ///
28  /// Решить отключать ли проверки при компиляции под Release. Т.е. исключения будут
    ↳ выбрасываться только при #if DEBUG
29  /// </remarks>
30  public class UInt64Links : LinksDisposableDecoratorBase<TLink>
31  {
32      /// <summary>
33      /// <para>
34      /// Initializes a new <see cref="UInt64Links"/> instance.
35      /// </para>
36      /// <para></para>
37      /// </summary>
38      /// <param name="links">
39      /// <para>A links.</para>
40      /// <para></para>
41      /// </param>
42      [MethodImpl(MethodImplOptions.AggressiveInlining)]
43      public UInt64Links(ILinks<TLink> links) : base(links) { }
44
45      /// <summary>
46      /// <para>
47      /// Creates the substitution.
48      /// </para>
49      /// <para></para>
50      /// </summary>
51      /// <param name="substitution">
52      /// <para>The substitution.</para>
53      /// <para></para>
54      /// </param>
55      /// <returns>
56      /// <para>The TLink</para>
57      /// <para></para>
58      /// </returns>
59      [MethodImpl(MethodImplOptions.AggressiveInlining)]
60      public override TLink Create(IList<TLink> substitution, WriteHandler<TLink> handler) =>
        ↳ _links.CreatePoint(handler);
61
62      /// <summary>
63      /// <para>
64      /// Updates the substitution.
65      /// </para>
66      /// <para></para>
67      /// </summary>
68      /// <param name="restriction">
69      /// <para>The substitution.</para>
70      /// <para></para>
71      /// </param>
72      /// <param name="substitution">
73      /// <para>The substitution.</para>
74      /// <para></para>
75      /// </param>
76      /// <returns>
77      /// <para>The TLink</para>
78      /// <para></para>
79      /// </returns>
80      [MethodImpl(MethodImplOptions.AggressiveInlining)]
81      public override TLink Update(IList<TLink> restriction, IList<TLink> substitution,
        ↳ WriteHandler<TLink> handler)

```

```

82     {
83         var constants = _constants;
84         var indexPartConstant = constants.IndexPart;
85         var sourcePartConstant = constants.SourcePart;
86         var targetPartConstant = constants.TargetPart;
87         var nullConstant = constants.Null;
88         var itselfConstant = constants.Itself;
89         var existedLink = nullConstant;
90         var updatedLink = restriction[indexPartConstant];
91         var newSource = substitution[sourcePartConstant];
92         var newTarget = substitution[targetPartConstant];
93         var links = _links;
94         if (newSource != itselfConstant && newTarget != itselfConstant)
95         {
96             existedLink = links.SearchOrDefault(newSource, newTarget);
97         }
98         if (existedLink == nullConstant)
99         {
100             var before = links.GetLink(updatedLink);
101             if (before[sourcePartConstant] != newSource || before[targetPartConstant] !=
102                 ↪ newTarget)
103             {
104                 var source = newSource == itselfConstant ? updatedLink : newSource;
105                 var target = newTarget == itselfConstant ? updatedLink : newTarget;
106                 return links.Update(new Link<TLink>(updatedLink, source, target), handler);
107             }
108             return _links.Constants.Continue;
109         }
110         else
111         {
112             return _facade.MergeAndDelete(updatedLink, existedLink, handler);
113         }
114     }
115     /// <summary>
116     /// <para>
117     /// Deletes the substitution.
118     /// </para>
119     /// <para></para>
120     /// </summary>
121     /// <param name="restriction">
122     /// <para>The substitution.</para>
123     /// <para></para>
124     /// </param>
125     [MethodImpl(MethodImplOptions.AggressiveInlining)]
126     public override TLink Delete(IList<TLink> restriction, WriteHandler<TLink> handler)
127     {
128         var linkIndex = restriction[_constants.IndexPart];
129         var constants = _links.Constants;
130         WriteHandlerState<TLink> handlerState = new(constants.Continue, constants.Break,
131             ↪ handler);
132         handlerState.Apply(_links.EnforceResetValues(linkIndex, handlerState.Handler));
133         handlerState.Apply(_facade.DeleteAllUsages(linkIndex, handlerState.Handler));
134         handlerState.Apply(_links.Delete(restriction, handlerState.Handler));
135         return handlerState.Result;
136     }
137 }

```

1.17 ./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  using Platform.Delegates;
8
9  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
10
11 namespace Platform.Data.Doublets.Decorators
12 {
13     /// <remarks>
14     /// What does empty pattern (for condition or substitution) mean? Nothing or Everything?
15     /// Now we go with nothing. And nothing is something one, but empty, and cannot be changed
16     ↪ by itself. But can cause creation (update from nothing) or deletion (update to nothing).
17     ///
18     /// TODO: Decide to change to IDoubletLinks or not to change. (Better to create
19     ↪ DefaultUniLinksBase, that contains logic itself and can be implemented using both
20     ↪ IDoubletLinks and ILinks.)

```

```

18  /// </remarks>
19  internal class UniLinks<TLink> : LinksDecoratorBase<TLink>, IUniLinks<TLink>
20  {
21      private static readonly EqualityComparer<TLink> _equalityComparer =
22          ↳ EqualityComparer<TLink>.Default;
23
24      /// <summary>
25      /// <para>
26      /// Initializes a new <see cref="UniLinks"/> instance.
27      /// </para>
28      /// </summary>
29      /// <param name="links">
30      /// <para>A links.</para>
31      /// </param>
32      public UniLinks(ILinks<TLink> links) : base(links) { }
33      private struct Transition
34      {
35          /// <summary>
36          /// <para>
37          /// The before.
38          /// </para>
39          /// </summary>
40          public IList<TLink> Before;
41          /// <summary>
42          /// <para>
43          /// The after.
44          /// </para>
45          /// </summary>
46          public IList<TLink> After;
47
48          /// <summary>
49          /// <para>
50          /// Initializes a new <see cref="Transition"/> instance.
51          /// </para>
52          /// </summary>
53          /// <param name="before">
54          /// <para>A before.</para>
55          /// </param>
56          /// <param name="after">
57          /// <para>A after.</para>
58          /// </param>
59          public Transition(IList<TLink> before, IList<TLink> after)
60          {
61              Before = before;
62              After = after;
63          }
64      }
65
66      //public static readonly TLink NullConstant = Use<LinksConstants<TLink>>.Single.Null;
67      //public static readonly IReadOnlyList<TLink> NullLink = new
68      ↳ ReadOnlyCollection<TLink>(new List<TLink> { NullConstant, NullConstant, NullConstant
69      ↳ });
70
71      // TODO: Подумать о том, как реализовать древовидный Restriction и Substitution
72      ↳ (Links-Expression)
73      /// <summary>
74      /// <para>
75      /// Triggers the restriction.
76      /// </para>
77      /// </summary>
78      /// <param name="restriction">
79      /// <para>The restriction.</para>
80      /// </param>
81      /// <param name="matchedHandler">
82      /// <para>The matched handler.</para>
83      /// </param>
84      /// <param name="substitution">
85      /// <para>The substitution.</para>

```

```

92  /// <para></para>
93  /// </param>
94  /// <param name="substitutedHandler">
95  /// <para>The substituted handler.</para>
96  /// <para></para>
97  /// </param>
98  /// <returns>
99  /// <para>The link</para>
100 /// <para></para>
101 /// </returns>
102 public TLink Trigger(IList<TLink> restriction, WriteHandler<TLink> matchedHandler,
    ↳ IList<TLink> substitution, WriteHandler<TLink> substitutedHandler)
103 {
104     ///List<Transition> transitions = null;
105     ///if (!restriction.IsNullOrEmpty())
106     ///{
107     ///    // Есть причина делать проход (чтение)
108     ///    if (matchedHandler != null)
109     ///    {
110     ///        if (!substitution.IsNullOrEmpty())
111     ///        {
112     ///            // restriction => { 0, 0, 0 } | { 0 } // Create
113     ///            // substitution => { itself, 0, 0 } | { itself, itself, itself } //
    ↳ Create / Update
114     ///            // substitution => { 0, 0, 0 } | { 0 } // Delete
115     ///            transitions = new List<Transition>();
116     ///            if (Equals(substitution[Constants.IndexPart], Constants.Null))
117     ///            {
118     ///                // If index is Null, that means we always ignore every other
    ↳ value (they are also Null by definition)
119     ///                var matchDecision = matchedHandler(, NullLink);
120     ///                if (Equals(matchDecision, Constants.Break))
121     ///                    return false;
122     ///                if (!Equals(matchDecision, Constants.Skip))
123     ///                    transitions.Add(new Transition(matchedLink, newValue));
124     ///            }
125     ///            else
126     ///            {
127     ///                Func<T, bool> handler;
128     ///                handler = link =>
129     ///                {
130     ///                    var matchedLink = Memory.GetLinkValue(link);
131     ///                    var newValue = Memory.GetLinkValue(link);
132     ///                    newValue[Constants.IndexPart] = Constants.Itself;
133     ///                    newValue[Constants.SourcePart] =
    ↳ Equals(substitution[Constants.SourcePart], Constants.Itself) ?
    ↳ matchedLink[Constants.IndexPart] : substitution[Constants.SourcePart];
134     ///                    newValue[Constants.TargetPart] =
    ↳ Equals(substitution[Constants.TargetPart], Constants.Itself) ?
    ↳ matchedLink[Constants.IndexPart] : substitution[Constants.TargetPart];
135     ///                    var matchDecision = matchedHandler(matchedLink, newValue);
136     ///                    if (Equals(matchDecision, Constants.Break))
137     ///                        return false;
138     ///                    if (!Equals(matchDecision, Constants.Skip))
139     ///                        transitions.Add(new Transition(matchedLink, newValue));
140     ///                    return true;
141     ///                };
142     ///                if (!Memory.Each(handler, restriction))
143     ///                    return Constants.Break;
144     ///            }
145     ///        }
146     ///    }
147     ///    else
148     ///    {
149     ///        Func<T, bool> handler = link =>
150     ///        {
151     ///            var matchedLink = Memory.GetLinkValue(link);
152     ///            var matchDecision = matchedHandler(matchedLink, matchedLink);
153     ///            return !Equals(matchDecision, Constants.Break);
154     ///        };
155     ///        if (!Memory.Each(handler, restriction))
156     ///            return Constants.Break;
157     ///    }
158     ///    else
159     ///    {
160     ///        if (substitution != null)
161     ///        {

```

```

162         transitions = new List<IList<T>>>();
163         Func<T, bool> handler = link =>
164         {
165             var matchedLink = Memory.GetLinkValue(link);
166             transitions.Add(matchedLink);
167             return true;
168         };
169         if (!Memory.Each(handler, restriction))
170             return Constants.Break;
171     }
172     else
173     {
174         return Constants.Continue;
175     }
176 }
177 }
178 }
179 if (substitution != null)
180 {
181     // Есть причина делать замену (запись)
182     if (substitutedHandler != null)
183     {
184     }
185     else
186     {
187     }
188 }
189 return Constants.Continue;
190
191 //if (restriction.IsNullOrEmpty()) // Create
192 //{
193     substitution[Constants.IndexPart] = Memory.AllocateLink();
194     Memory.SetLinkValue(substitution);
195 //}
196 //else if (substitution.IsNullOrEmpty()) // Delete
197 //{
198     Memory.FreeLink(restriction[Constants.IndexPart]);
199 //}
200 //else if (restriction.EqualTo(substitution)) // Read or ("repeat" the state) // Each
201 //{
202     // No need to collect links to list
203     // Skip == Continue
204     // No need to check substitutedHandler
205     if (!Memory.Each(link => !Equals(matchedHandler(Memory.GetLinkValue(link)),
206         ↪ Constants.Break), restriction))
207         return Constants.Break;
208 //}
209 //else // Update
210 //{
211     //List<IList<T>> matchedLinks = null;
212     if (matchedHandler != null)
213     {
214         matchedLinks = new List<IList<T>>>();
215         Func<T, bool> handler = link =>
216         {
217             var matchedLink = Memory.GetLinkValue(link);
218             var matchDecision = matchedHandler(matchedLink);
219             if (Equals(matchDecision, Constants.Break))
220                 return false;
221             if (!Equals(matchDecision, Constants.Skip))
222                 matchedLinks.Add(matchedLink);
223             return true;
224         };
225         if (!Memory.Each(handler, restriction))
226             return Constants.Break;
227     }
228     if (!matchedLinks.IsNullOrEmpty())
229     {
230         var totalMatchedLinks = matchedLinks.Count;
231         for (var i = 0; i < totalMatchedLinks; i++)
232         {
233             var matchedLink = matchedLinks[i];
234             if (substitutedHandler != null)
235             {
236                 var newValue = new List<T>(); // TODO: Prepare value to update here
237                 // TODO: Decide is it actually needed to use Before and After
238                 ↪ substitution handling.
239                 var substitutedDecision = substitutedHandler(matchedLink,
240                 ↪ newValue);

```

```

237         //         if (Equals(substitutedDecision, Constants.Break))
238         //             return Constants.Break;
239         //         if (Equals(substitutedDecision, Constants.Continue))
240         //         {
241         //             // Actual update here
242         //             Memory.SetLinkValue(newValue);
243         //         }
244         //         if (Equals(substitutedDecision, Constants.Skip))
245         //         {
246         //             // Cancel the update. TODO: decide use separate Cancel
247         //             ↪ constant or Skip is enough?
248         //         }
249         //     }
250     }
251 }
252 return _constants.Continue;
253 }
254
255 /// <summary>
256 /// <para>
257 /// Triggers the pattern or condition.
258 /// </para>
259 /// <para></para>
260 /// </summary>
261 /// <param name="patternOrCondition">
262 /// <para>The pattern or condition.</para>
263 /// <para></para>
264 /// </param>
265 /// <param name="matchHandler">
266 /// <para>The match handler.</para>
267 /// <para></para>
268 /// </param>
269 /// <param name="substitution">
270 /// <para>The substitution.</para>
271 /// <para></para>
272 /// </param>
273 /// <param name="substitutionHandler">
274 /// <para>The substitution handler.</para>
275 /// <para></para>
276 /// </param>
277 /// <exception cref="NotImplementedException">
278 /// <para></para>
279 /// <para></para>
280 /// </exception>
281 /// <exception cref="NotSupportedException">
282 /// <para></para>
283 /// <para></para>
284 /// </exception>
285 /// <exception cref="NotSupportedException">
286 /// <para></para>
287 /// <para></para>
288 /// </exception>
289 /// <exception cref="NotSupportedException">
290 /// <para></para>
291 /// <para></para>
292 /// </exception>
293 /// <exception cref="NotSupportedException">
294 /// <para></para>
295 /// <para></para>
296 /// </exception>
297 /// <returns>
298 /// <para>The link</para>
299 /// <para></para>
300 /// </returns>
301 public TLink Trigger(IList<TLink> patternOrCondition, ReadHandler<TLink> matchHandler,
302     ↪ IList<TLink> substitution, WriteHandler<TLink> substitutionHandler)
303 {
304     var constants = _constants;
305     if (patternOrCondition.IsNullOrEmpty() && substitution.IsNullOrEmpty())
306     {
307         return constants.Continue;
308     }
309     else if (patternOrCondition.EqualTo(substitution)) // Should be Each here TODO:
310     ↪ Check if it is a correct condition
311     {
312         // Or it only applies to trigger without matchHandler.
313         throw new NotImplementedException();

```

```

312 }
313 else if (!substitution.IsNullOrEmpty()) // Creation
314 {
315     var before = Array.Empty<TLink>();
316     // Что должно означать False здесь? Остановиться (перестать идти) или пропустить
317     ↪ (пройти мимо) или пустить (взять)?
318     if (matchHandler != null && _equalityComparer.Equals(matchHandler(before),
319     ↪ constants.Break))
320     {
321         return constants.Break;
322     }
323     var after = (IList<TLink>)substitution.ToArray();
324     if (_equalityComparer.Equals(after[0], default))
325     {
326         var newLink = _links.Create();
327         after[0] = newLink;
328     }
329     if (substitution.Count == 1)
330     {
331         after = _links.GetLink(substitution[0]);
332     }
333     else if (substitution.Count == 3)
334     {
335         //Links.Create(after);
336     }
337     else
338     {
339         throw new NotSupportedException();
340     }
341     return matchHandler != null ? substitutionHandler(before, after) :
342     ↪ constants.Continue;
343 }
344 else if (!patternOrCondition.IsNullOrEmpty()) // Deletion
345 {
346     if (patternOrCondition.Count == 1)
347     {
348         var linkToDelete = patternOrCondition[0];
349         var before = _links.GetLink(linkToDelete);
350         if (matchHandler != null && _equalityComparer.Equals(matchHandler(before),
351         ↪ constants.Break))
352         {
353             return constants.Break;
354         }
355         var after = Array.Empty<TLink>();
356         _links.Update(linkToDelete, constants.Null, constants.Null);
357         _links.Delete(linkToDelete);
358         return matchHandler != null ? substitutionHandler(before, after) :
359         ↪ constants.Continue;
360     }
361     else
362     {
363         throw new NotSupportedException();
364     }
365 }
366 else // Replace / Update
367 {
368     if (patternOrCondition.Count == 1) //-V3125
369     {
370         var linkToUpdate = patternOrCondition[0];
371         var before = _links.GetLink(linkToUpdate);
372         if (matchHandler != null && _equalityComparer.Equals(matchHandler(before),
373         ↪ constants.Break))
374         {
375             return constants.Break;
376         }
377         var after = (IList<TLink>)substitution.ToArray(); //-V3125
378         if (_equalityComparer.Equals(after[0], default))
379         {
380             after[0] = linkToUpdate;
381         }
382         if (substitution.Count == 1)
383         {
384             if (!_equalityComparer.Equals(substitution[0], linkToUpdate))
385             {
386                 after = _links.GetLink(substitution[0]);
387                 _links.Update(linkToUpdate, constants.Null, constants.Null);
388                 _links.Delete(linkToUpdate);
389             }
390         }
391     }
392 }

```



```

384     }
385     else if (substitution.Count == 3)
386     {
387         //Links.Update(after);
388     }
389     else
390     {
391         throw new NotSupportedException();
392     }
393     return matchHandler != null ? substitutionHandler(before, after) :
        ↪ constants.Continue;
394 }
395 else
396 {
397     throw new NotSupportedException();
398 }
399 }
400 }
401
402 /// <remarks>
403 /// IList[IList[IList[T]]]
404 /// | | | | |
405 /// | | | | |
406 /// | | | | |
407 /// | | | | |
408 /// | | | | |
409 /// | | | | |
410 /// | | | | |
411 /// | | | | |
412 public IList<IList<IList<TLink>>> Trigger(IList<TLink> condition, IList<TLink>
    ↪ substitution)
413 {
414     var changes = new List<IList<IList<TLink>>>();
415     var @continue = _constants.Continue;
416     Trigger(condition, AlwaysContinue, substitution, (before, after) =>
417     {
418         var change = new[] { before, after };
419         changes.Add(change);
420         return @continue;
421     });
422     return changes;
423 }
424 private TLink AlwaysContinue(IList<TLink> linkToMatch) => _constants.Continue;
425 }
426 }

```

1.18 ./csharp/Platform.Data.Doublets/Doublet.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
8 {
9
10     /// <summary>
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         private static readonly EqualityComparer<T> _equalityComparer =
            ↪ EqualityComparer<T>.Default;
21
22         /// <summary>
23         /// <para>.</para>
24         /// <para>.</para>
25         /// </summary>
26         /// <typeparam name="T">
27         /// <para>.</para>
28         /// <para>.</para>
29         /// </typeparam>
30         public readonly T Source;
31

```

```

32    /// <summury>
33    /// <para>.</para>
34    /// <para>.</para>
35    /// </summury>
36    /// <typeparam name="T">
37    /// <para>.</para>
38    /// <para>.</para>
39    /// </typeparam>
40    public readonly T Target;
41
42    /// <summury>
43    /// <para>.</para>
44    /// <para>.</para>
45    /// </summury>
46    /// <typeparam name="T">
47    /// <para>.</para>
48    /// <para>.</para>
49    /// </typeparam>
50    /// <param name="source">
51    /// <para>.</para>
52    /// <para>.</para>
53    /// </param>
54    /// <param name="target">
55    /// <para>.</para>
56    /// <para>.</para>
57    /// </param>
58    [MethodImpl(MethodImplOptions.AggressiveInlining)]
59    public Doublet(T source, T target)
60    {
61        Source = source;
62        Target = target;
63    }
64
65    /// <summury>
66    /// <para>.</para>
67    /// <para>.</para>
68    /// </summury>
69    /// <returns>
70    /// <para>.</para>
71    /// <para>.</para>
72    /// </returns>
73    [MethodImpl(MethodImplOptions.AggressiveInlining)]
74    public override string ToString() => $"{Source}->{Target}";
75
76    /// <summury>
77    /// <para>.</para>
78    /// <para>.</para>
79    /// </summury>
80    /// <typeparam>
81    /// <para>.</para>
82    /// <para>.</para>
83    /// </typeparam>
84    /// <param name="other">
85    /// <para>.</para>
86    /// <para>.</para>
87    /// </param>
88    /// <returns>
89    /// <para>.</para>
90    /// <para>.</para>
91    /// </returns>
92    [MethodImpl(MethodImplOptions.AggressiveInlining)]
93    public bool Equals(Doublet<T> other) => _equalityComparer.Equals(Source, other.Source)
94    ↪ && _equalityComparer.Equals(Target, other.Target);
95
96    /// <summury>
97    /// <para>.</para>
98    /// <para>.</para>
99    /// </summury>
100    /// <typeparam>
101    /// <para>.</para>
102    /// <para>.</para>
103    /// </typeparam>
104    /// <param name="obj">
105    /// <para>.</para>
106    /// <para>.</para>
107    /// </param>
108    /// <returns>
109    /// <para>.</para>

```

```

109     /// <para>.</para>
110     /// </returns>
111     [MethodImpl(MethodImplOptions.AggressiveInlining)]
112     public override bool Equals(object obj) => obj is Doublet<T> doublet ?
        ↳ base.Equals(doublet) : false;
113
114     /// <summary>
115     /// <para>.</para>
116     /// <para>.</para>
117     /// </summary>
118     /// <returns>
119     /// <para>.</para>
120     /// <para>.</para>
121     /// </returns>
122     [MethodImpl(MethodImplOptions.AggressiveInlining)]
123     public override int GetHashCode() => (Source, Target).GetHashCode();
124
125     /// <summary>
126     /// <para>.</para>
127     /// <para>.</para>
128     /// </summary>
129     /// <param name="left">
130     /// <para>.</para>
131     /// <para>.</para>
132     /// </param>
133     /// <param name="right">
134     /// <para>.</para>
135     /// <para>.</para>
136     /// </param>
137     /// <returns>
138     /// <para>.</para>
139     /// <para>.</para>
140     /// </returns>
141     [MethodImpl(MethodImplOptions.AggressiveInlining)]
142     public static bool operator ==(Doublet<T> left, Doublet<T> right) => left.Equals(right);
143
144     /// <summary>
145     /// <para>.</para>
146     /// <para>.</para>
147     /// </summary>
148     /// <param name="left">
149     /// <para>.</para>
150     /// <para>.</para>
151     /// </param>
152     /// <param name="right">
153     /// <para>.</para>
154     /// <para>.</para>
155     /// </param>
156     /// <returns>
157     /// <para>.</para>
158     /// <para>.</para>
159     /// </returns>
160     [MethodImpl(MethodImplOptions.AggressiveInlining)]
161     public static bool operator !=(Doublet<T> left, Doublet<T> right) => !(left == right);
162 }
163 }

```

1.19 ./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 }

```

1.20 ./csharp/Platform.Data.Doublets/FFI/UnitedMemoryLinks.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Linq;
4  using System.Runtime.InteropServices;
5  using Platform.Converters;
6  using Platform.Delegates;
7  using Platform.Disposables;
8
9  namespace Platform.Data.Doublets.FFI
10 {
11     struct FfiLink_UInt8
12     {
13         public Byte Index;
14         public Byte Source;
15         public Byte Target;
16     }
17
18     struct FfiLink_UInt16
19     {
20         public UInt16 Index;
21         public UInt16 Source;
22         public UInt16 Target;
23     }
24
25     struct FfiLink_UInt32
26     {
27         public UInt32 Index;
28         public UInt32 Source;
29         public UInt32 Target;
30     }
31
32     struct FfiLink_UInt64
33     {
34         public UInt64 Index;
35         public UInt64 Source;
36         public UInt64 Target;
37     }
38

```

```

39 unsafe static class Methods
40 {
41     private const string DllName = "Platform.Doublers";
42
43     public delegate Byte EachCallback_UInt8(FfiLink_UInt8 link);
44
45     public delegate UInt16 EachCallback_UInt16(FfiLink_UInt16 link);
46
47     public delegate UInt32 EachCallback_UInt32(FfiLink_UInt32 link);
48
49     public delegate UInt64 EachCallback_UInt64(FfiLink_UInt64 link);
50
51     public delegate Byte CreateCallback_UInt8(FfiLink_UInt8 before, FfiLink_UInt8 after);
52
53     public delegate UInt16 CreateCallback_UInt16(FfiLink_UInt16 before, FfiLink_UInt16
54         ↪ after);
55
56     public delegate UInt32 CreateCallback_UInt32(FfiLink_UInt32 before, FfiLink_UInt32
57         ↪ after);
58
59     public delegate UInt64 CreateCallback_UInt64(FfiLink_UInt64 before, FfiLink_UInt64
60         ↪ after);
61
62     public delegate Byte UpdateCallback_UInt8(FfiLink_UInt8 before, FfiLink_UInt8 after);
63
64     public delegate UInt16 UpdateCallback_UInt16(FfiLink_UInt16 before, FfiLink_UInt16
65         ↪ after);
66
67     public delegate UInt32 UpdateCallback_UInt32(FfiLink_UInt32 before, FfiLink_UInt32
68         ↪ after);
69
70     public delegate UInt64 UpdateCallback_UInt64(FfiLink_UInt64 before, FfiLink_UInt64
71         ↪ after);
72
73     public delegate Byte DeleteCallback_UInt8(FfiLink_UInt8 before, FfiLink_UInt8 after);
74
75     public delegate UInt16 DeleteCallback_UInt16(FfiLink_UInt16 before, FfiLink_UInt16
76         ↪ after);
77
78     public delegate UInt32 DeleteCallback_UInt32(FfiLink_UInt32 before, FfiLink_UInt32
79         ↪ after);
80
81     public delegate UInt64 DeleteCallback_UInt64(FfiLink_UInt64 before, FfiLink_UInt64
82         ↪ after);
83
84     [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
85     public static extern void* ByteUnitedMemoryLinks_New(string path);
86
87     [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
88     public static extern void* UInt16UnitedMemoryLinks_New(string path);
89
90     [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
91     public static extern void* UInt32UnitedMemoryLinks_New(string path);
92
93     [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
94     public static extern void* UInt64UnitedMemoryLinks_New(string path);
95
96     [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
97     public static extern void ByteUnitedMemoryLinks_Drop(void* self);
98
99     [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
100    public static extern void UInt16UnitedMemoryLinks_Drop(void* self);
101
102    [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
103    public static extern void UInt32UnitedMemoryLinks_Drop(void* self);
104
105    [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
106    public static extern void UInt64UnitedMemoryLinks_Drop(void* self);
107
108    [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
109    public static extern byte ByteUnitedMemoryLinks_Create(void* self, byte* substitution,
110        ↪ nuint substitutionLength, CreateCallback_UInt8 callback);
111
112    [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
113    public static extern ushort UInt16UnitedMemoryLinks_Create(void* self, ushort*
114        ↪ substitution, nuint substitutionLength, CreateCallback_UInt16 callback);
115
116    [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]

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```

106 public static extern uint UInt32UnitedMemoryLinks_Create(void* self, uint* substitution,
107     ↳ nuint substitutionLength, CreateCallback_UInt32 callback);
108
109 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
110 public static extern ulong UInt64UnitedMemoryLinks_Create(void* self, ulong*
111     ↳ substitution, nuint substitutionLength, CreateCallback_UInt64 callback);
112
113 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
114 public static extern byte ByteUnitedMemoryLinks_Count(void* self, byte* restriction,
115     ↳ nuint len);
116
117 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
118 public static extern ushort UInt16UnitedMemoryLinks_Count(void* self, ushort*
119     ↳ restriction, nuint len);
120
121 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
122 public static extern uint UInt32UnitedMemoryLinks_Count(void* self, uint* restriction,
123     ↳ nuint len);
124
125 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
126 public static extern ulong UInt64UnitedMemoryLinks_Count(void* self, ulong* restriction,
127     ↳ nuint len);
128
129 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
130 public static extern byte ByteUnitedMemoryLinks_Each(void* self, byte* restriction,
131     ↳ nuint len, EachCallback_UInt8 callback);
132
133 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
134 public static extern ushort UInt16UnitedMemoryLinks_Each(void* self, ushort*
135     ↳ restriction, nuint len, EachCallback_UInt16 callback);
136
137 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
138 public static extern uint UInt32UnitedMemoryLinks_Each(void* self, uint* restriction,
139     ↳ nuint len, EachCallback_UInt32 callback);
140
141 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
142 public static extern ulong UInt64UnitedMemoryLinks_Each(void* self, ulong* restriction,
143     ↳ nuint len, EachCallback_UInt64 callback);
144
145 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
146 public static extern byte ByteUnitedMemoryLinks_Update(void* self, byte* restriction,
147     ↳ nuint restrictionLength, byte* substitution, nuint substitutionLength,
148     ↳ UpdateCallback_UInt8 callback);
149
150 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
151 public static extern ushort UInt16UnitedMemoryLinks_Update(void* self, ushort*
152     ↳ restriction, nuint restrictionLength, ushort* substitution, nuint
153     ↳ substitutionLength, UpdateCallback_UInt16 callback);
154
155 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
156 public static extern uint UInt32UnitedMemoryLinks_Update(void* self, uint* restriction,
157     ↳ nuint restrictionLength, uint* substitution, nuint substitutionLength,
158     ↳ UpdateCallback_UInt32 callback);
159
160 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
161 public static extern ulong UInt64UnitedMemoryLinks_Update(void* self, ulong*
    ↳ restriction, nuint restrictionLength, ulong* substitution, nuint
    ↳ substitutionLength, UpdateCallback_UInt64 callback);
162
163 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
164 public static extern byte ByteUnitedMemoryLinks_Delete(void* self, byte* restriction,
165     ↳ nuint restrictionLength, DeleteCallback_UInt8 callback);
166
167 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
168 public static extern ushort UInt16UnitedMemoryLinks_Delete(void* self, ushort*
169     ↳ restriction, nuint len, DeleteCallback_UInt16 callback);
170
171 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
172 public static extern uint UInt32UnitedMemoryLinks_Delete(void* self, uint* restriction,
173     ↳ nuint len, DeleteCallback_UInt32 callback);
174
175 [DllImport(DllName, CallingConvention = CallingConvention.Cdecl)]
176 public static extern ulong UInt64UnitedMemoryLinks_Delete(void* self, ulong*
    ↳ restriction, nuint len, DeleteCallback_UInt64 callback);
177
178 }
179
180 public class UnitedMemoryLinks<TLink> : DisposableBase, ILinks<TLink>
181 {

```

```

162 private static readonly UncheckedConverter<byte, TLink> from_u8 =
163     ↳ UncheckedConverter<byte, TLink>.Default;
164 private static readonly UncheckedConverter<ushort, TLink> from_u16 =
165     ↳ UncheckedConverter<ushort, TLink>.Default;
166 private static readonly UncheckedConverter<uint, TLink> from_u32 =
167     ↳ UncheckedConverter<uint, TLink>.Default;
168 private static readonly UncheckedConverter<ulong, TLink> from_u64 =
169     ↳ UncheckedConverter<ulong, TLink>.Default;
170 private static readonly UncheckedConverter<TLink, ulong> from_t =
171     ↳ UncheckedConverter<TLink, ulong>.Default;
172
173 public LinksConstants<TLink> Constants { get; }
174
175 private readonly unsafe void* _ptr;
176
177 public UnitedMemoryLinks(string path)
178 {
179     TLink t = default;
180     unsafe
181     {
182         _ptr = t switch
183         {
184             byte => Methods.ByteUnitedMemoryLinks_New(path),
185             ushort => Methods.UInt16UnitedMemoryLinks_New(path),
186             uint => Methods.UInt32UnitedMemoryLinks_New(path),
187             ulong => Methods.UInt64UnitedMemoryLinks_New(path),
188             _ => throw new NotImplementedException()
189         };
190
191         // TODO: Update api
192         Constants = new LinksConstants<TLink>(enableExternalReferencesSupport: true);
193     }
194 }
195
196 public TLink Count(IList<TLink> restriction)
197 {
198     unsafe
199     {
200         TLink t = default;
201         switch (t)
202         {
203             case byte:
204             {
205                 var array = stackalloc byte[restriction.Count];
206                 for (var i = 0; i < restriction.Count; i++)
207                 {
208                     array[i] = (byte)from_t.Convert(restriction[i]);
209                 }
210                 return from_u8.Convert(Methods.ByteUnitedMemoryLinks_Count(_ptr, array,
211                     ↳ (nuint)(restriction?.Count ?? 0)));
212             }
213             case ushort:
214             {
215                 var array = stackalloc ushort[restriction.Count];
216                 for (var i = 0; i < restriction.Count; i++)
217                 {
218                     array[i] = (ushort)from_t.Convert(restriction[i]);
219                 }
220                 return from_u16.Convert(Methods.UInt16UnitedMemoryLinks_Count(_ptr,
221                     ↳ array, (nuint)(restriction?.Count ?? 0)));
222             }
223             case uint:
224             {
225                 var array = stackalloc uint[restriction.Count];
226                 for (var i = 0; i < restriction.Count; i++)
227                 {
228                     array[i] = (uint)from_t.Convert(restriction[i]);
229                 }
230                 return from_u32.Convert(Methods.UInt32UnitedMemoryLinks_Count(_ptr,
231                     ↳ array, (nuint)(restriction?.Count ?? 0)));
232             }
233             case ulong:
234             {
235                 {
236                     var array = stackalloc UInt64[restriction.Count];
237                     for (var i = 0; i < restriction.Count; i++)
238                     {
239                         array[i] = from_t.Convert(restriction[i]);
240                     }
241                 }
242             }
243         }
244     }
245 }

```

```

233         return from_u64.Convert(Methods.UInt64UnitedMemoryLinks_Count(_ptr,
234             ↳ array, (nuint)(restriction?.Count ?? 0)));
235     }
236     default:
237     {
238         throw new NotImplementedException();
239     }
240 }
241 }
242 }
243
244 public TLink Each(IList<TLink> restriction, ReadHandler<TLink> handler)
245 {
246     unsafe
247     {
248         TLink t = default;
249         switch (t)
250         {
251             case byte:
252             {
253                 Methods.EachCallback_UInt8 callback = (link) =>
254                     ↳ (byte)from_t.Convert(handler != null? handler(new
255                     ↳ Link<TLink>(from_u8.Convert(link.Index),
256                     ↳ from_u8.Convert(link.Source), from_u8.Convert(link.Target))) :
257                     ↳ Constants.Continue);
258                 var array = stackalloc byte[restriction.Count];
259                 for (var i = 0; i < restriction.Count; i++)
260                 {
261                     array[i] = (byte)from_t.Convert(restriction[i]);
262                 }
263                 return from_u8.Convert(Methods.ByteUnitedMemoryLinks_Each(_ptr, array,
264                     ↳ (nuint)(restriction?.Count ?? 0), callback));
265             }
266             case ushort:
267             {
268                 Methods.EachCallback_UInt16 callback = (link) =>
269                     ↳ (ushort)from_t.Convert(handler != null? handler(new
270                     ↳ Link<TLink>(from_u16.Convert(link.Index),
271                     ↳ from_u16.Convert(link.Source), from_u16.Convert(link.Target))) :
272                     ↳ Constants.Continue);
273                 var array = stackalloc ushort[restriction.Count];
274                 for (var i = 0; i < restriction.Count; i++)
275                 {
276                     array[i] = (ushort)from_t.Convert(restriction[i]);
277                 }
278                 return from_u16.Convert(Methods.UInt16UnitedMemoryLinks_Each(_ptr,
279                     ↳ array, (nuint)(restriction?.Count ?? 0), callback));
280             }
281             case uint:
282             {
283                 Methods.EachCallback_UInt32 callback = (link) =>
284                     ↳ (uint)from_t.Convert(handler != null? handler(new
285                     ↳ Link<TLink>(from_u32.Convert(link.Index),
286                     ↳ from_u32.Convert(link.Source), from_u32.Convert(link.Target))) :
287                     ↳ Constants.Continue);
288                 var array = stackalloc uint[restriction.Count];
289                 for (var i = 0; i < restriction.Count; i++)
290                 {
291                     array[i] = (uint)from_t.Convert(restriction[i]);
292                 }
293                 return from_u32.Convert(Methods.UInt32UnitedMemoryLinks_Each(_ptr,
294                     ↳ array, (nuint)(restriction?.Count ?? 0), callback));
295             }
296             case ulong:
297             {
298                 {
299                     Methods.EachCallback_UInt64 callback = (link) =>
300                         ↳ from_t.Convert(handler != null? handler(new
301                         ↳ Link<TLink>(from_u64.Convert(link.Index),
302                         ↳ from_u64.Convert(link.Source), from_u64.Convert(link.Target))) :
303                         ↳ Constants.Continue);
304                     var array = stackalloc UInt64[restriction.Count];
305                     for (var i = 0; i < restriction.Count; i++)
306                     {
307                         array[i] = from_t.Convert(restriction[i]);
308                     }
309                 }

```



```

290         return from_u64.Convert(Methods.UInt64UnitedMemoryLinks_Each(_ptr,
291             ↳ array, (nuint)(restriction?.Count ?? 0), callback));
292     }
293     default:
294     {
295         throw new NotImplementedException();
296     }
297 }
298 }
299 }
300
301 public TLink Create(IList<TLink> substitution, WriteHandler<TLink> handler)
302 {
303     unsafe
304     {
305         TLink t = default;
306         switch (t)
307         {
308             case byte:
309             {
310                 Methods.CreateCallback_UInt8 callback = (before, after) =>
311                     ↳ (byte)from_t.Convert(handler != null? handler(new
312                     ↳ Link<TLink>(from_u8.Convert(before.Index),
313                     ↳ from_u8.Convert(before.Source), from_u8.Convert(before.Target)), new
314                     ↳ Link<TLink>(from_u8.Convert(after.Index),
315                     ↳ from_u8.Convert(after.Source), from_u8.Convert(after.Target))) :
316                     ↳ Constants.Continue);
317                 fixed (byte* substitutionPtr = (byte[])(object)substitution)
318                 {
319                     return from_u8.Convert(Methods.ByteUnitedMemoryLinks_Create(_ptr,
320                         ↳ substitutionPtr, (nuint)(substitution?.Count ?? 0), callback));
321                 }
322             }
323             case ushort:
324             {
325                 Methods.CreateCallback_UInt16 callback = (before, after) =>
326                     ↳ (byte)from_t.Convert(handler != null? handler(new
327                     ↳ Link<TLink>(from_u16.Convert(before.Index),
328                     ↳ from_u16.Convert(before.Source), from_u16.Convert(before.Target)),
329                     ↳ new Link<TLink>(from_u16.Convert(after.Index),
330                     ↳ from_u16.Convert(after.Source), from_u16.Convert(after.Target))) :
331                     ↳ Constants.Continue);
332                 fixed (ushort* substitutionPtr = (ushort[])(object)substitution)
333                 {
334                     return from_u16.Convert(Methods.UInt16UnitedMemoryLinks_Create(_ptr,
335                         ↳ substitutionPtr, (nuint)(substitution?.Count ?? 0), callback));
336                 }
337             }
338             case uint:
339             {
340                 Methods.CreateCallback_UInt32 callback = (before, after) =>
341                     ↳ (byte)from_t.Convert(handler != null? handler(new
342                     ↳ Link<TLink>(from_u32.Convert(before.Index),
343                     ↳ from_u32.Convert(before.Source), from_u32.Convert(before.Target)),
344                     ↳ new Link<TLink>(from_u32.Convert(after.Index),
345                     ↳ from_u32.Convert(after.Source), from_u32.Convert(after.Target))) :
346                     ↳ Constants.Continue);
347                 fixed (uint* substitutionPtr = (uint[])(object)substitution)
348                 {
349                     return from_u32.Convert(Methods.UInt32UnitedMemoryLinks_Create(_ptr,
350                         ↳ substitutionPtr, (nuint)(substitution?.Count ?? 0), callback));
351                 }
352             }
353             case ulong:
354             {
355                 Methods.CreateCallback_UInt64 callback = (before, after) =>
356                     ↳ (byte)from_t.Convert(handler != null? handler(new
357                     ↳ Link<TLink>(from_u64.Convert(before.Index),
358                     ↳ from_u64.Convert(before.Source), from_u64.Convert(before.Target)),
359                     ↳ new Link<TLink>(from_u64.Convert(after.Index),
360                     ↳ from_u64.Convert(after.Source), from_u64.Convert(after.Target))) :
361                     ↳ Constants.Continue);
362                 fixed (ulong* substitutionPtr = (ulong[])(object)substitution)
363                 {
364                     return from_u64.Convert(Methods.UInt64UnitedMemoryLinks_Create(_ptr,
365                         ↳ substitutionPtr, (nuint)(substitution?.Count ?? 0), callback));

```

```

338     }
339     }
340     default:
341     {
342         throw new NotImplementedException();
343     }
344     };
345 }
346 }
347
348 public TLink Update(IList<TLink> restriction, IList<TLink> substitution,
349     ↪ WriteHandler<TLink> handler)
350 {
351     unsafe
352     {
353         TLink t = default;
354         switch (t)
355         {
356             case byte:
357             {
358                 var restrictionArray = restriction.ToArray();
359                 var substitutionArray = substitution.ToArray();
360                 Methods.UpdateCallback_UInt8 callback = (before, after) =>
361                     ↪ (byte)from_t.Convert(handler != null? handler(new
362                     ↪ Link<TLink>(from_u8.Convert(before.Index),
363                     ↪ from_u8.Convert(before.Source), from_u8.Convert(before.Target)), new
364                     ↪ Link<TLink>(from_u8.Convert(after.Index),
365                     ↪ from_u8.Convert(after.Source), from_u8.Convert(after.Target))) :
366                     ↪ Constants.Continue);
367                 fixed (byte* restrictionPointer = (byte[])(object)restrictionArray,
368                     ↪ substitutionPointer = (byte[])(object)substitutionArray)
369                 {
370                     return from_u8.Convert(Methods.ByteUnitedMemoryLinks_Update(_ptr,
371                     ↪ restrictionPointer, (nuint)(restrictionArray?.Length ?? 0),
372                     ↪ substitutionPointer, (nuint)(substitutionArray?.Length ?? 0),
373                     ↪ callback));
374                 }
375             }
376             case ushort:
377             {
378                 var restrictionArray = restriction.ToArray();
379                 var substitutionArray = substitution.ToArray();
380                 Methods.UpdateCallback_UInt16 callback = (before, after) =>
381                     ↪ (ushort)from_t.Convert(handler != null? handler(new
382                     ↪ Link<TLink>(from_u16.Convert(before.Index),
383                     ↪ from_u16.Convert(before.Source), from_u16.Convert(before.Target)),
384                     ↪ new Link<TLink>(from_u16.Convert(after.Index),
385                     ↪ from_u16.Convert(after.Source), from_u16.Convert(after.Target))) :
386                     ↪ Constants.Continue);
387                 fixed (ushort* restrictionPointer = (ushort[])(object)restrictionArray,
388                     ↪ substitutionPointer = (ushort[])(object)substitutionArray)
389                 {
390                     return from_u16.Convert(Methods.UInt16UnitedMemoryLinks_Update(_ptr,
391                     ↪ restrictionPointer, (nuint)(restrictionArray?.Length ?? 0),
392                     ↪ substitutionPointer, (nuint)(substitutionArray?.Length ?? 0),
393                     ↪ callback));
394                 }
395             }
396             case uint:
397             {
398                 var restrictionArray = restriction.ToArray();
399                 var substitutionArray = substitution.ToArray();
400                 Methods.UpdateCallback_UInt32 callback = (before, after) =>
401                 {
402                     var handlerState = Constants.Continue;
403                     if (handler != null)
404                     {
405                         handlerState = handler != null? handler(new
406                         ↪ Link<TLink>(from_u32.Convert(before.Index),
407                         ↪ from_u32.Convert(before.Source),
408                         ↪ from_u32.Convert(before.Target)), new
409                         ↪ Link<TLink>(from_u32.Convert(after.Index),
410                         ↪ from_u32.Convert(after.Source),
411                         ↪ from_u32.Convert(after.Target))) : Constants.Continue;
412                     }
413                     return (uint)from_t.Convert(handlerState);
414                 }
415             }
416         }
417     }
418 }

```

```

388         fixed (uint* restrictionPointer = (uint[])(object)restrictionArray,
389             ↪ substitutionPointer = (uint[])(object)substitutionArray)
390     {
391         return from_u32.Convert(Methods.UInt32UnitedMemoryLinks_Update(_ptr,
392             ↪ restrictionPointer, (nuint)(restrictionArray?.Length ?? 0),
393             ↪ substitutionPointer, (nuint)(substitutionArray?.Length ?? 0),
394             ↪ callback));
395     }
396 }
397 case ulong:
398 {
399     Methods.UpdateCallback_UInt64 callback = (before, after) =>
400     (ulong)from_t.Convert(handler != null? handler(new
401         ↪ Link<TLink>(from_u64.Convert(before.Index),
402         ↪ from_u64.Convert(before.Source), from_u64.Convert(before.Target)),
403         ↪ new Link<TLink>(from_u64.Convert(after.Index),
404         ↪ from_u64.Convert(after.Source), from_u64.Convert(after.Target))) :
405         ↪ Constants.Continue);
406     var restrictionArray = restriction.ToArray();
407     var substitutionArray = substitution.ToArray();
408     fixed (ulong* restrictionPointer = (ulong[])(object)restrictionArray,
409         ↪ substitutionPointer = (ulong[])(object)substitutionArray)
410     {
411         return from_u64.Convert(Methods.UInt64UnitedMemoryLinks_Update(_ptr,
412             ↪ restrictionPointer, (nuint)(restrictionArray?.Length ?? 0),
413             ↪ substitutionPointer, (nuint)(substitutionArray?.Length ?? 0),
414             ↪ callback));
415     }
416 }
417 default:
418 {
419     throw new NotImplementedException();
420 }
421 }
422 }
423 }
424 }
425 }
426 }
427 }
428 }
429 }
430 }
431 }
432 }
433 }
434 }

public TLink Delete(IList<TLink> restriction, WriteHandler<TLink> handler)
{
    unsafe
    {
        TLink t = default;
        switch (t)
        {
            case byte:
            {
                var restrictionArray = restriction.ToArray();
                Methods.DeleteCallback_UInt8 callback = (before, after) =>
                (byte)from_t.Convert(handler != null? handler(new
                ↪ Link<TLink>(from_u8.Convert(before.Index),
                ↪ from_u8.Convert(before.Source), from_u8.Convert(before.Target)), new
                ↪ Link<TLink>(from_u8.Convert(after.Index),
                ↪ from_u8.Convert(after.Source), from_u8.Convert(after.Target))) :
                ↪ Constants.Continue);
                fixed (byte* restrictionPointer = (byte[])(object)restrictionArray)
                {
                    return (TLink)(object)Methods.ByteUnitedMemoryLinks_Delete(_ptr,
                    ↪ restrictionPointer, (nuint)(restrictionArray?.Length ?? 0),
                    ↪ callback);
                }
            }
            case ushort:
            {
                var restrictionArray = restriction.ToArray();
                Methods.DeleteCallback_UInt16 callback = (before, after) =>
                (ushort)from_t.Convert(handler != null? handler(new
                ↪ Link<TLink>(from_u16.Convert(before.Index),
                ↪ from_u16.Convert(before.Source), from_u16.Convert(before.Target)),
                ↪ new Link<TLink>(from_u16.Convert(after.Index),
                ↪ from_u16.Convert(after.Source), from_u16.Convert(after.Target))) :
                ↪ Constants.Continue);
                fixed (ushort* restrictionPointer = (ushort[])(object)restrictionArray)
                {
                    return (TLink)(object)Methods.UInt16UnitedMemoryLinks_Delete(_ptr,
                    ↪ restrictionPointer, (nuint)(restrictionArray?.Length ?? 0),
                    ↪ callback);
                }
            }
        }
    }
}

```

```

435     }
436     case uint:
437     {
438         var restrictionArray = restriction.ToArray();
439         Methods.DeleteCallback_UInt32 callback = (before, after) =>
440             (uint)from_t.Convert(handler != null? handler(new
441                 ↪ Link<TLink>(from_u32.Convert(before.Index),
442                 ↪ from_u32.Convert(before.Source), from_u32.Convert(before.Target)),
443                 ↪ new Link<TLink>(from_u32.Convert(after.Index),
444                 ↪ from_u32.Convert(after.Source), from_u32.Convert(after.Target))) :
445                 ↪ Constants.Continue);
446         fixed (uint* restrictionPointer = (uint[])(object)restrictionArray)
447         {
448             return (TLink)(object)Methods.UInt32UnitedMemoryLinks_Delete(_ptr,
449                 ↪ restrictionPointer, (nuint)(restrictionArray?.Length ?? 0),
450                 ↪ callback);
451         }
452     }
453 }
454 case ulong:
455 {
456     var restrictionArray = restriction.ToArray();
457     Methods.DeleteCallback_UInt64 callback = (before, after) =>
458         (ulong)from_t.Convert(handler != null? handler(new
459             ↪ Link<TLink>(from_u64.Convert(before.Index),
460             ↪ from_u64.Convert(before.Source), from_u64.Convert(before.Target)),
461             ↪ new Link<TLink>(from_u64.Convert(after.Index),
462             ↪ from_u64.Convert(after.Source), from_u64.Convert(after.Target))) :
463             ↪ Constants.Continue);
464     fixed (ulong* restrictionPointer = (ulong[])(object)restrictionArray)
465     {
466         return (TLink)(object)Methods.UInt64UnitedMemoryLinks_Delete(_ptr,
467             ↪ restrictionPointer, (nuint)(restrictionArray?.Length ?? 0),
468             ↪ callback);
469     }
470 }
471 default:
472 {
473     throw new NotImplementedException();
474 }
475 }
476 }
477 }
478 }
479 }
480 }
481 }
482 }
483 }
484 }
485 }
486 }
487 }
488 }
489 }
490 }
491 }

```

```

protected override void Dispose(bool manual, bool wasDisposed)
{
    unsafe
    {
        if (wasDisposed && _ptr != null)
        {
            return;
        }
        TLink t = default;
        switch (t)
        {
            case byte:
                Methods.ByteUnitedMemoryLinks_Drop(_ptr);
                break;
            case ushort:
                Methods.UInt16UnitedMemoryLinks_Drop(_ptr);
                break;
            case uint:
                Methods.UInt32UnitedMemoryLinks_Drop(_ptr);
                break;
            case ulong:
                Methods.UInt64UnitedMemoryLinks_Drop(_ptr);
                break;
            default:
                throw new NotImplementedException();
        }
    }
}

```

1.21 ./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 }

```

1.22 ./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.Lists;
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 using Platform.Delegates;
15
16 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
17
18 namespace Platform.Data.Doublets
19 {
20     /// <summary>
21     /// <para>
22     /// Represents the links extensions.
23     /// </para>
24     /// <para></para>
25     /// </summary>
26     public static class ILinksExtensions
27     {
28         /// <summary>
29         /// <para>
30         /// Runs the random creations using the specified links.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         /// <typeparam name="TLink">
35         /// <para>The link.</para>
36         /// <para></para>
37         /// </typeparam>
38         /// <param name="links">
39         /// <para>The links.</para>
40         /// <para></para>
41         /// </param>
42         /// <param name="amountOfCreations">
43         /// <para>The amount of creations.</para>
44         /// <para></para>
45         /// </param>
46         [MethodImpl(MethodImplOptions.AggressiveInlining)]
47         public static void RunRandomCreations<TLink>(this ILinks<TLink> links, ulong
48             ↳ amountOfCreations)
49         {
50             var random = RandomHelpers.Default;
51             var addressToUInt64Converter = UncheckedConverter<TLink, ulong>.Default;
52             var uInt64ToAddressConverter = UncheckedConverter<ulong, TLink>.Default;
53             for (var i = 0UL; i < amountOfCreations; i++)
54             {
55                 var linksAddressRange = new Range<ulong>(0,
56                     ↳ addressToUInt64Converter.Convert(links.Count()));
57                 var source =
58                     ↳ uInt64ToAddressConverter.Convert(random.NextUInt64(linksAddressRange));
59                 var target =
60                     ↳ uInt64ToAddressConverter.Convert(random.NextUInt64(linksAddressRange));
61                 links.GetOrCreate(source, target);
62             }
63         }
64     }
65 }

```

```

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

```

```

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

```

```

209 public static TLink First<TLink>(this ILinks<TLink> links)
210 {
211     TLink firstLink = default;
212     var equalityComparer = EqualityComparer<TLink>.Default;
213     if (equalityComparer.Equals(links.Count(), default))
214     {
215         throw new InvalidOperationException("В хранилище нет связей.");
216     }
217     links.Each(links.Constants.Any, links.Constants.Any, link =>
218     {
219         firstLink = link[links.Constants.IndexPart];
220         return links.Constants.Break;
221     });
222     if (equalityComparer.Equals(firstLink, default))
223     {
224         throw new InvalidOperationException("В процессе поиска по хранилищу не было
225             ↳ найдено связей.");
226     }
227     return firstLink;
228 }
229
230 /// <summary>
231 /// <para>
232 /// Singles the or default using the specified links.
233 /// </para>
234 /// <para></para>
235 /// </summary>
236 /// <typeparam name="TLink">
237 /// <para>The link.</para>
238 /// <para></para>
239 /// </typeparam>
240 /// <param name="links">
241 /// <para>The links.</para>
242 /// <para></para>
243 /// </param>
244 /// <param name="query">
245 /// <para>The query.</para>
246 /// <para></para>
247 /// </param>
248 /// <returns>
249 /// <para>The result.</para>
250 /// <para></para>
251 /// </returns>
252 [MethodImpl(MethodImplOptions.AggressiveInlining)]
253 public static IList<TLink> SingleOrDefault<TLink>(this ILinks<TLink> links, IList<TLink>
254     ↳ query)
255 {
256     IList<TLink> result = null;
257     var count = 0;
258     var constants = links.Constants;
259     var @continue = constants.Continue;
260     var @break = constants.Break;
261     links.Each(query, linkHandler);
262     return result;
263
264     TLink linkHandler(IList<TLink> link)
265     {
266         if (count == 0)
267         {
268             result = link;
269             count++;
270             return @continue;
271         }
272         else
273         {
274             result = null;
275             return @break;
276         }
277     }
278 }
279
280 #region Paths
281
282 /// <remarks>
283 /// TODO: Как так? Как то что ниже может быть корректно?
284 /// Скорее всего практически не применимо
285 /// Предполагалось, что можно было конвертировать формируемый в проходе через
286     ↳ SequenceWalker
287 /// Stack в конкретный путь из Source, Target до связи, но это не всегда так.

```



```

285 /// TODO: Возможно нужен метод, который именно выбрасывает исключения (EnsurePathExists)
286 /// </remarks>
287 [MethodImpl(MethodImplOptions.AggressiveInlining)]
288 public static bool CheckPathExistence<TLink>(this ILinks<TLink> links, params TLink[]
    ↪ path)
289 {
290     var current = path[0];
291     //EnsureLinkExists(current, "path");
292     if (!links.Exists(current))
293     {
294         return false;
295     }
296     var equalityComparer = EqualityComparer<TLink>.Default;
297     var constants = links.Constants;
298     for (var i = 1; i < path.Length; i++)
299     {
300         var next = path[i];
301         var values = links.GetLink(current);
302         var source = values[constants.SourcePart];
303         var target = values[constants.TargetPart];
304         if (equalityComparer.Equals(source, target) && equalityComparer.Equals(source,
    ↪ next))
305         {
306             //throw new InvalidOperationException(string.Format("Невозможно выбрать
    ↪ путь, так как и Source и Target совпадают с элементом пути {0}.", next));
307             return false;
308         }
309         if (!equalityComparer.Equals(next, source) && !equalityComparer.Equals(next,
    ↪ target))
310         {
311             //throw new InvalidOperationException(string.Format("Невозможно продолжить
    ↪ путь через элемент пути {0}", next));
312             return false;
313         }
314         current = next;
315     }
316     return true;
317 }
318
319 /// <remarks>
320 /// Может потребовать дополнительного стека для PathElement's при использовании
    ↪ SequenceWalker.
321 /// </remarks>
322 [MethodImpl(MethodImplOptions.AggressiveInlining)]
323 public static TLink GetByKeyes<TLink>(this ILinks<TLink> links, TLink root, params int[]
    ↪ path)
324 {
325     links.EnsureLinkExists(root, "root");
326     var currentLink = root;
327     for (var i = 0; i < path.Length; i++)
328     {
329         currentLink = links.GetLink(currentLink)[path[i]];
330     }
331     return currentLink;
332 }
333
334 /// <summary>
335 /// <para>
336 /// Gets the square matrix sequence element by index using the specified links.
337 /// </para>
338 /// <para></para>
339 /// </summary>
340 /// <typeparam name="TLink">
341 /// <para>The link.</para>
342 /// <para></para>
343 /// </typeparam>
344 /// <param name="links">
345 /// <para>The links.</para>
346 /// <para></para>
347 /// </param>
348 /// <param name="root">
349 /// <para>The root.</para>
350 /// <para></para>
351 /// </param>
352 /// <param name="size">
353 /// <para>The size.</para>
354 /// <para></para>
355 /// </param>

```

```

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

```

```

426
427 /// <summary>
428 /// Возвращает индекс конечной (Target) связи для указанной связи.
429 /// </summary>
430 /// <param name="links">Хранилище связей.</param>
431 /// <param name="link">Связь представленная списком, состоящим из её адреса и
    ↳ 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) =>
    ↳ link[links.Constants.TargetPart];
435
436 /// <summary>
437 /// Выполняет проход по всем связям, соответствующим шаблону, вызывая обработчик
    ↳ (handler) для каждой подходящей связи.
438 /// </summary>
439 /// <param name="links">Хранилище связей.</param>
440 /// <param name="handler">Обработчик каждой подходящей связи.</param>
441 /// <param name="restriction">Ограничения на содержимое связей. Каждое ограничение может
    ↳ иметь значения: Constants.Null - 0-я связь, обозначающая ссылку на пустоту, Any -
    ↳ отсутствие ограничения, 1..∞ конкретный адрес связи.</param>
442 /// <returns>True, в случае если проход по связям не был прерван и False в обратном
    ↳ случае.</returns>
443 [MethodImpl(MethodImplOptions.AggressiveInlining)]
444 public static bool Each<TLink>(this ILinks<TLink> links, ReadHandler<TLink> handler,
    ↳ params TLink[] restriction)
445 => EqualityComparer<TLink>.Default.Equals(links.Each(restriction, handler),
    ↳ links.Constants.Continue);
446
447 public static bool Each<TLink>(this ILinks<TLink> links, Func<TLink, bool> handler,
    ↳ TLink source, TLink target) => links.Each(source, target, handler);
448
449
450 /// <summary>
451 /// Выполняет проход по всем связям, соответствующим шаблону, вызывая обработчик
    ↳ (handler) для каждой подходящей связи.
452 /// </summary>
453 /// <param name="links">Хранилище связей.</param>
454 /// <param name="source">Значение, определяющее соответствующие шаблону связи.
    ↳ (Constants.Null - 0-я связь, обозначающая ссылку на пустоту в качестве начала,
    ↳ Constants.Any - любое начало, 1..∞ конкретное начало)</param>
455 /// <param name="target">Значение, определяющее соответствующие шаблону связи.
    ↳ (Constants.Null - 0-я связь, обозначающая ссылку на пустоту в качестве конца,
    ↳ Constants.Any - любой конец, 1..∞ конкретный конец)</param>
456 /// <param name="handler">Обработчик каждой подходящей связи.</param>
457 /// <returns>True, в случае если проход по связям не был прерван и False в обратном
    ↳ случае.</returns>
458 [MethodImpl(MethodImplOptions.AggressiveInlining)]
459 public static bool Each<TLink>(this ILinks<TLink> links, TLink source, TLink target,
    ↳ Func<TLink, bool> handler)
460 {
461     var constants = links.Constants;
462     return links.Each(link => handler(link[constants.IndexPart]) ? constants.Continue :
    ↳ constants.Break, constants.Any, source, target);
463 }
464
465 public static bool Each<TLink>(this ILinks<TLink> links, ReadHandler<TLink> handler,
    ↳ TLink source, TLink target) => links.Each(source, target, handler);
466
467
468 /// <summary>
469 /// Выполняет проход по всем связям, соответствующим шаблону, вызывая обработчик
    ↳ (handler) для каждой подходящей связи.
470 /// </summary>
471 /// <param name="links">Хранилище связей.</param>
472 /// <param name="source">Значение, определяющее соответствующие шаблону связи.
    ↳ (Constants.Null - 0-я связь, обозначающая ссылку на пустоту в качестве начала,
    ↳ Constants.Any - любое начало, 1..∞ конкретное начало)</param>
473 /// <param name="target">Значение, определяющее соответствующие шаблону связи.
    ↳ (Constants.Null - 0-я связь, обозначающая ссылку на пустоту в качестве конца,
    ↳ Constants.Any - любой конец, 1..∞ конкретный конец)</param>
474 /// <param name="handler">Обработчик каждой подходящей связи.</param>
475 /// <returns>True, в случае если проход по связям не был прерван и False в обратном
    ↳ случае.</returns>
476 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

477 public static bool Each<TLink>(this ILinks<TLink> links, TLink source, TLink target,
478     ↳ ReadHandler<TLink> handler) => links.Each(handler, links.Constants.Any, source,
479     ↳ target);
480
481 /// <summary>
482 /// <para>
483 /// Alls the links.
484 /// </para>
485 /// <para></para>
486 /// </summary>
487 /// <typeparam name="TLink">
488 /// <para>The link.</para>
489 /// <para></para>
490 /// </typeparam>
491 /// <param name="links">
492 /// <para>The links.</para>
493 /// <para></para>
494 /// </param>
495 /// <param name="restriction">
496 /// <para>The restriction.</para>
497 /// <para></para>
498 /// </param>
499 /// <returns>
500 /// <para>A list of i list t link</para>
501 /// <para></para>
502 /// </returns>
503 [MethodImpl(MethodImplOptions.AggressiveInlining)]
504 public static IList<IList<TLink>> All<TLink>(this ILinks<TLink> links, params TLink[]
505     ↳ restriction)
506 {
507     var allLinks = new List<IList<TLink>>();
508     var filler = new ListFiller<IList<TLink>, TLink>(allLinks, links.Constants.Continue);
509     links.Each(filler.AddAndReturnConstant, restriction);
510     return allLinks;
511 }
512
513 /// <summary>
514 /// <para>
515 /// Alls the indices using the specified links.
516 /// </para>
517 /// <para></para>
518 /// </summary>
519 /// <typeparam name="TLink">
520 /// <para>The link.</para>
521 /// <para></para>
522 /// </typeparam>
523 /// <param name="links">
524 /// <para>The links.</para>
525 /// <para></para>
526 /// </param>
527 /// <param name="restriction">
528 /// <para>The restriction.</para>
529 /// <para></para>
530 /// </param>
531 /// <returns>
532 /// <para>A list of t link</para>
533 /// <para></para>
534 /// </returns>
535 [MethodImpl(MethodImplOptions.AggressiveInlining)]
536 public static IList<TLink> AllIndices<TLink>(this ILinks<TLink> links, params TLink[]
537     ↳ restriction)
538 {
539     var allIndices = new List<TLink>();
540     var filler = new ListFiller<TLink, TLink>(allIndices, links.Constants.Continue);
541     links.Each(filler.AddFirstAndReturnConstant, restriction);
542     return allIndices;
543 }
544
545 /// <summary>
546 /// Возвращает значение, определяющее существует ли связь с указанными началом и концом
547     ↳ в хранилище связей.
548 /// </summary>
549 /// <param name="links">Хранилище связей.</param>
550 /// <param name="source">Начало связи.</param>
551 /// <param name="target">Конец связи.</param>
552 /// <returns>Значение, определяющее существует ли связь.</returns>
553 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

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;

#region Ensure
// TODO: May be move to EnsureExtensions or make it both there and here

/// <summary>
/// <para>
/// Ensures the link exists using the specified links.
/// </para>
/// <para></para>
/// </summary>
/// <typeparam name="TLink">
/// <para>The link.</para>
/// <para></para>
/// </typeparam>
/// <param name="links">
/// <para>The links.</para>
/// <para></para>
/// </param>
/// <param name="restriction">
/// <para>The restriction.</para>
/// <para></para>
/// </param>
/// <exception cref="ArgumentLinkDoesNotExistsException{TLink}">
/// <para>sequence[{i}]</para>
/// <para></para>
/// </exception>
[MethodImpl(MethodImplOptions.AggressiveInlining)]
public static void EnsureLinkExists<TLink>(this ILinks<TLink> links, IList<TLink>
    => restriction)
{
    for (var i = 0; i < restriction.Count; i++)
    {
        if (!links.Exists(restriction[i]))
        {
            throw new ArgumentLinkDoesNotExistsException<TLink>(restriction[i],
                => $"sequence[{i}]");
        }
    }
}

/// <summary>
/// <para>
/// Ensures the inner reference exists using the specified links.
/// </para>
/// <para></para>
/// </summary>
/// <typeparam name="TLink">
/// <para>The link.</para>
/// <para></para>
/// </typeparam>
/// <param name="links">
/// <para>The links.</para>
/// <para></para>
/// </param>
/// <param name="reference">
/// <para>The reference.</para>
/// <para></para>
/// </param>
/// <param name="argumentName">
/// <para>The argument name.</para>
/// <para></para>
/// </param>
/// <exception cref="ArgumentLinkDoesNotExistsException{TLink}">
/// <para></para>
/// <para></para>
/// </exception>
[MethodImpl(MethodImplOptions.AggressiveInlining)]
public static void EnsureInnerReferenceExists<TLink>(this ILinks<TLink> links, TLink
    => reference, string argumentName)
{
    if (links.Constants.IsInternalReference(reference) && !links.Exists(reference))
    {
        throw new ArgumentLinkDoesNotExistsException<TLink>(reference, argumentName);
    }
}

```

```

621 }
622
623 /// <summary>
624 /// <para>
625 /// Ensures the inner reference exists using the specified links.
626 /// </para>
627 /// <para></para>
628 /// </summary>
629 /// <typeparam name="TLink">
630 /// <para>The link.</para>
631 /// <para></para>
632 /// </typeparam>
633 /// <param name="links">
634 /// <para>The links.</para>
635 /// <para></para>
636 /// </param>
637 /// <param name="restriction">
638 /// <para>The restriction.</para>
639 /// <para></para>
640 /// </param>
641 /// <param name="argumentName">
642 /// <para>The argument name.</para>
643 /// <para></para>
644 /// </param>
645 [MethodImpl(MethodImplOptions.AggressiveInlining)]
646 public static void EnsureInnerReferenceExists<TLink>(this ILinks<TLink> links,
647 ↪ IList<TLink> restriction, string argumentName)
648 {
649     for (int i = 0; i < restriction.Count; i++)
650     {
651         links.EnsureInnerReferenceExists(restriction[i], argumentName);
652     }
653 }
654
655 /// <summary>
656 /// <para>
657 /// Ensures the link is any or exists using the specified links.
658 /// </para>
659 /// <para></para>
660 /// </summary>
661 /// <typeparam name="TLink">
662 /// <para>The link.</para>
663 /// <para></para>
664 /// </typeparam>
665 /// <param name="links">
666 /// <para>The links.</para>
667 /// <para></para>
668 /// </param>
669 /// <param name="restriction">
670 /// <para>The restriction.</para>
671 /// <para></para>
672 /// </param>
673 /// <exception cref="ArgumentLinkDoesNotExistsException{TLink}">
674 /// <para>sequence[{i}]</para>
675 /// <para></para>
676 /// </exception>
677 [MethodImpl(MethodImplOptions.AggressiveInlining)]
678 public static void EnsureLinkIsAnyOrExists<TLink>(this ILinks<TLink> links, IList<TLink>
679 ↪ restriction)
680 {
681     var equalityComparer = EqualityComparer<TLink>.Default;
682     var any = links.Constants.Any;
683     for (var i = 0; i < restriction.Count; i++)
684     {
685         if (!equalityComparer.Equals(restriction[i], any) &&
686             ↪ !links.Exists(restriction[i]))
687         {
688             throw new ArgumentLinkDoesNotExistsException<TLink>(restriction[i],
689                 ↪ $"sequence[{i}]");
690         }
691     }
692 }
693
694 /// <summary>
695 /// <para>
696 /// Ensures the link is any or exists using the specified links.
697 /// </para>
698 /// <para></para>

```

```

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

```

```

770 }
771
772 /// <param name="links">Хранилище связей.</param>
773 [MethodImpl(MethodImplOptions.AggressiveInlining)]
774 public static void EnsureNoUsages<TLink>(this ILinks<TLink> links, TLink link)
775 {
776     if (links.HasUsages(link))
777     {
778         throw new ArgumentLinkHasDependenciesException<TLink>(link);
779     }
780 }
781
782 /// <param name="links">Хранилище связей.</param>
783 [MethodImpl(MethodImplOptions.AggressiveInlining)]
784 public static void EnsureCreated<TLink>(this ILinks<TLink> links, params TLink[]
    ↪ addresses) => links.EnsureCreated(links.Create, addresses);
785
786 /// <param name="links">Хранилище связей.</param>
787 [MethodImpl(MethodImplOptions.AggressiveInlining)]
788 public static void EnsurePointsCreated<TLink>(this ILinks<TLink> links, params TLink[]
    ↪ addresses) => links.EnsureCreated(links.CreatePoint, addresses);
789
790 /// <param name="links">Хранилище связей.</param>
791 [MethodImpl(MethodImplOptions.AggressiveInlining)]
792 public static void EnsureCreated<TLink>(this ILinks<TLink> links, Func<TLink> creator,
    ↪ params TLink[] addresses)
793 {
794     var addressToUInt64Converter = CheckedConverter<TLink, ulong>.Default;
795     var uInt64ToAddressConverter = CheckedConverter<ulong, TLink>.Default;
796     var nonExistentAddresses = new HashSet<TLink>(addresses.Where(x =>
    ↪ !links.Exists(x)));
797     if (nonExistentAddresses.Count > 0)
798     {
799         var max = nonExistentAddresses.Max();
800         max = uInt64ToAddressConverter.Convert(System.Math.Min(addressToUInt64Converter.
    ↪ Convert(max),
    ↪ addressToUInt64Converter.Convert(links.Constants.InternalReferencesRange.Max
    ↪ imum)));
801         var createdLinks = new List<TLink>();
802         var equalityComparer = EqualityComparer<TLink>.Default;
803         TLink createdLink = creator();
804         while (!equalityComparer.Equals(createdLink, max))
805         {
806             createdLinks.Add(createdLink);
807         }
808         for (var i = 0; i < createdLinks.Count; i++)
809         {
810             if (!nonExistentAddresses.Contains(createdLinks[i]))
811             {
812                 links.Delete(createdLinks[i]);
813             }
814         }
815     }
816 }
817
818 #endregion
819
820 /// <param name="links">Хранилище связей.</param>
821 [MethodImpl(MethodImplOptions.AggressiveInlining)]
822 public static TLink CountUsages<TLink>(this ILinks<TLink> links, TLink link)
823 {
824     var constants = links.Constants;
825     var values = links.GetLink(link);
826     TLink usagesAsSource = links.Count(new Link<TLink>(constants.Any, link,
    ↪ constants.Any));
827     var equalityComparer = EqualityComparer<TLink>.Default;
828     if (equalityComparer.Equals(values[constants.SourcePart], link))
829     {
830         usagesAsSource = Arithmetic<TLink>.Decrement(usagesAsSource);
831     }
832     TLink usagesAsTarget = links.Count(new Link<TLink>(constants.Any, constants.Any,
    ↪ link));
833     if (equalityComparer.Equals(values[constants.TargetPart], link))
834     {
835         usagesAsTarget = Arithmetic<TLink>.Decrement(usagesAsTarget);
836     }
837     return Arithmetic<TLink>.Add(usagesAsSource, usagesAsTarget);
838 }

```



```

839
840 /// <param name="links">Хранилище связей.</param>
841 [MethodImpl(MethodImplOptions.AggressiveInlining)]
842 public static bool HasUsages<TLink>(this ILinks<TLink> links, TLink link) =>
843     ⇨ Comparer<TLink>.Default.Compare(links.CountUsages(link), default) > 0;
844
845 /// <param name="links">Хранилище связей.</param>
846 [MethodImpl(MethodImplOptions.AggressiveInlining)]
847 public static bool Equals<TLink>(this ILinks<TLink> links, TLink link, TLink source,
848     ⇨ TLink target)
849 {
850     var constants = links.Constants;
851     var values = links.GetLink(link);
852     var equalityComparer = EqualityComparer<TLink>.Default;
853     return equalityComparer.Equals(values[constants.SourcePart], source) &&
854         ⇨ equalityComparer.Equals(values[constants.TargetPart], target);
855 }
856
857 /// <summary>
858 /// Выполняет поиск связи с указанными Source (началом) и Target (концом).
859 /// </summary>
860 /// <param name="links">Хранилище связей.</param>
861 /// <param name="source">Индекс связи, которая является началом для искомой
862     ⇨ связи.</param>
863 /// <param name="target">Индекс связи, которая является концом для искомой связи.</param>
864 /// <returns>Индекс искомой связи с указанными Source (началом) и Target
865     ⇨ (концом).</returns>
866 [MethodImpl(MethodImplOptions.AggressiveInlining)]
867 public static TLink SearchOrDefault<TLink>(this ILinks<TLink> links, TLink source, TLink
868     ⇨ target)
869 {
870     var constants = links.Constants;
871     var setter = new Setter<TLink, TLink>(constants.Continue, constants.Break, default);
872     links.Each(setter.SetFirstAndReturnFalse, constants.Any, source, target);
873     return setter.Result;
874 }
875
876 public static TLink CreatePoint<TLink>(this ILinks<TLink> links)
877 {
878     var constants = links.Constants;
879     var setter = new Setter<TLink, TLink>(constants.Continue, constants.Break);
880     links.CreatePoint(setter.SetFirstFromSecondListAndReturnTrue);
881     return setter.Result;
882 }
883
884 /// <param name="links">Хранилище связей.</param>
885 [MethodImpl(MethodImplOptions.AggressiveInlining)]
886 public static TLink CreatePoint<TLink>(this ILinks<TLink> links, WriteHandler<TLink>
887     ⇨ handler)
888 {
889     var constants = links.Constants;
890     WriteHandlerState<TLink> handlerState = new(constants.Continue, constants.Break,
891         ⇨ handler);
892     TLink link = default;
893     TLink HandlerWrapper(IList<TLink> before, IList<TLink> after)
894     {
895         link = after[constants.IndexPart];
896         return handlerState.Handler != null ? handlerState.Handler(before, after) :
897             ⇨ constants.Continue;
898     }
899     handlerState.Apply(links.Create(null, HandlerWrapper));
900     handlerState.Apply(links.Update(link, link, link, HandlerWrapper));
901     return handlerState.Result;
902 }
903
904 public static TLink CreateAndUpdate<TLink>(this ILinks<TLink> links, TLink source, TLink
905     ⇨ target)
906 {
907     var constants = links.Constants;
908     var setter = new Setter<TLink, TLink>(constants.Continue, constants.Break);
909     links.CreateAndUpdate(source, target, setter.SetFirstFromSecondListAndReturnTrue);
910     return setter.Result;
911 }
912
913 /// <param name="links">Хранилище связей.</param>
914 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

906 public static TLink CreateAndUpdate<TLink>(this ILinks<TLink> links, TLink source, TLink
    ↳ target, WriteHandler<TLink> handler)
907 {
908     var constants = links.Constants;
909     TLink createdLink = default;
910     WriteHandlerState<TLink> handlerState = new(constants.Continue, constants.Break,
    ↳ handler);
911     handlerState.Apply(links.Create(null, (before, after) =>
912     {
913         createdLink = links.GetIndex(after);
914         return handlerState.Handler != null ? handlerState.Handler(before, after) :
    ↳ constants.Continue;
915     }));
916     handlerState.Apply(links.Update(createdLink, source, target, handler));
917     return handlerState.Result;
918 }
919
920 /// <summary>
921 /// Обновляет связь с указанными началом (Source) и концом (Target)
922 /// на связь с указанными началом (NewSource) и концом (NewTarget).
923 /// </summary>
924 /// <param name="links">Хранилище связей.</param>
925 /// <param name="link">Индекс обновляемой связи.</param>
926 /// <param name="newSource">Индекс связи, которая является началом связи, на которую
    ↳ выполняется обновление.</param>
927 /// <param name="newTarget">Индекс связи, которая является концом связи, на которую
    ↳ выполняется обновление.</param>
928 /// <returns>Индекс обновлённой связи.</returns>
929 [MethodImpl(MethodImplOptions.AggressiveInlining)]
930 public static TLink Update<TLink>(this ILinks<TLink> links, TLink link, TLink newSource,
    ↳ TLink newTarget) => links.Update(new LinkAddress<TLink>(link), new Link<TLink>(link,
    ↳ newSource, newTarget));
931
932 public static TLink Update<TLink>(this ILinks<TLink> links, params TLink[] restriction)
    ↳ => links.Update(restriction, null);
933
934 public static TLink Update<TLink>(this ILinks<TLink> links, WriteHandler<TLink> handler,
    ↳ params TLink[] restriction) => links.Update(restriction, handler);
935
936 public static TLink Update<TLink>(this ILinks<TLink> links, IList<TLink> restriction)
937 {
938     var constants = links.Constants;
939     var setter = new Setter<TLink, TLink>(constants.Continue, constants.Break);
940     links.Update(restriction, setter.SetFirstFromSecondListAndReturnTrue);
941     return setter.Result;
942 }
943
944
945 /// <summary>
946 /// Обновляет связь с указанными началом (Source) и концом (Target)
947 /// на связь с указанными началом (NewSource) и концом (NewTarget).
948 /// </summary>
949 /// <param name="links">Хранилище связей.</param>
950 /// <param name="restriction">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.. $\infty$  конкретный адрес другой связи.</param>
951 /// <returns>Индекс обновлённой связи.</returns>
952 [MethodImpl(MethodImplOptions.AggressiveInlining)]
953 public static TLink Update<TLink>(this ILinks<TLink> links, IList<TLink> restriction,
    ↳ WriteHandler<TLink> handler)
954 {
955     return restriction.Count switch
956     {
957         2 => links.MergeAndDelete(restriction[0], restriction[1], handler),
958         4 => links.UpdateOrCreateOrGet(restriction[0], restriction[1], restriction[2],
    ↳ restriction[3], handler),
959         _ => links.Update(restriction[0], restriction[1], restriction[2], handler)
960     };
961 }
962
963 public static TLink Update<TLink>(this ILinks<TLink> links, TLink link, TLink newSource,
    ↳ TLink newTarget, WriteHandler<TLink> handler) => links.Update(new
    ↳ LinkAddress<TLink>(link), new Link<TLink>(link, newSource, newTarget), handler);
964
965 /// <summary>
966 /// <para>
967 /// Resolves the constant as self reference using the specified links.
968 /// </para>

```

```

969    /// <para></para>
970    /// </summary>
971    /// <typeparam name="TLink">
972    /// <para>The link.</para>
973    /// <para></para>
974    /// </typeparam>
975    /// <param name="links">
976    /// <para>The links.</para>
977    /// <para></para>
978    /// </param>
979    /// <param name="constant">
980    /// <para>The constant.</para>
981    /// <para></para>
982    /// </param>
983    /// <param name="restriction">
984    /// <para>The restriction.</para>
985    /// <para></para>
986    /// </param>
987    /// <param name="substitution">
988    /// <para>The substitution.</para>
989    /// <para></para>
990    /// </param>
991    /// <returns>
992    /// <para>A list of t link</para>
993    /// <para></para>
994    /// </returns>
995    [MethodImpl(MethodImplOptions.AggressiveInlining)]
996    public static IList<TLink> ResolveConstantAsSelfReference<TLink>(this ILinks<TLink>
    ↳ links, TLink constant, IList<TLink> restriction, IList<TLink> substitution)
997    {
998        var equalityComparer = EqualityComparer<TLink>.Default;
999        var constants = links.Constants;
1000        var restrictionIndex = restriction[constants.IndexPart];
1001        var substitutionIndex = substitution[constants.IndexPart];
1002        if (equalityComparer.Equals(substitutionIndex, default))
1003        {
1004            substitutionIndex = restrictionIndex;
1005        }
1006        var source = substitution[constants.SourcePart];
1007        var target = substitution[constants.TargetPart];
1008        source = equalityComparer.Equals(source, constant) ? substitutionIndex : source;
1009        target = equalityComparer.Equals(target, constant) ? substitutionIndex : target;
1010        return new Link<TLink>(substitutionIndex, source, target);
1011    }
1012
1013    /// <summary>
1014    /// Создаёт связь (если она не существовала), либо возвращает индекс существующей связи
    ↳ с указанными Source (началом) и Target (концом).
1015    /// </summary>
1016    /// <param name="links">Хранилище связей.</param>
1017    /// <param name="source">Индекс связи, которая является началом на создаваемой
    ↳ связи.</param>
1018    /// <param name="target">Индекс связи, которая является концом для создаваемой
    ↳ связи.</param>
1019    /// <returns>Индекс связи, с указанным Source (началом) и Target (концом)</returns>
1020    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1021    public static TLink GetOrCreate<TLink>(this ILinks<TLink> links, TLink source, TLink
    ↳ target)
1022    {
1023        var link = links.SearchOrDefault(source, target);
1024        if (EqualityComparer<TLink>.Default.Equals(link, default))
1025        {
1026            link = links.CreateAndUpdate(source, target);
1027        }
1028        return link;
1029    }
1030
1031    public static TLink UpdateOrCreateOrGet<TLink>(this ILinks<TLink> links, TLink source,
    ↳ TLink target, TLink newSource, TLink newTarget)
1032    {
1033        var constants = links.Constants;
1034        var setter = new Setter<TLink, TLink>(constants.Continue, constants.Break);
1035        links.UpdateOrCreateOrGet(source, target, newSource, newTarget,
    ↳ setter.SetFirstFromSecondListAndReturnTrue);
1036        return setter.Result;
1037    }
1038
1039    /// <summary>

```

```

1040 /// Обновляет связь с указанными началом (Source) и концом (Target)
1041 /// на связь с указанными началом (NewSource) и концом (NewTarget).
1042 /// </summary>
1043 /// <param name="links">Хранилище связей.</param>
1044 /// <param name="source">Индекс связи, которая является началом обновляемой
    ↳ связи.</param>
1045 /// <param name="target">Индекс связи, которая является концом обновляемой связи.</param>
1046 /// <param name="newSource">Индекс связи, которая является началом связи, на которую
    ↳ выполняется обновление.</param>
1047 /// <param name="newTarget">Индекс связи, которая является концом связи, на которую
    ↳ выполняется обновление.</param>
1048 /// <returns>Индекс обновлённой связи.</returns>
1049 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1050 public static TLink UpdateOrCreateOrGet<TLink>(this ILinks<TLink> links, TLink source,
    ↳ TLink target, TLink newSource, TLink newTarget, WriteHandler<TLink> handler)
1051 {
1052     var equalityComparer = EqualityComparer<TLink>.Default;
1053     var link = links.SearchOrDefault(source, target);
1054     if (equalityComparer.Equals(link, default))
1055     {
1056         return links.CreateAndUpdate(newSource, newTarget, handler);
1057     }
1058     if (equalityComparer.Equals(newSource, source) && equalityComparer.Equals(newTarget,
    ↳ target))
1059     {
1060         var linkStruct = new Link<TLink>(link, source, target);
1061         return link;
1062     }
1063     return links.Update(link, newSource, newTarget, handler);
1064 }
1065
1066 /// <summary>Удаляет связь с указанными началом (Source) и концом (Target).</summary>
1067 /// <param name="links">Хранилище связей.</param>
1068 /// <param name="source">Индекс связи, которая является началом удаляемой связи.</param>
1069 /// <param name="target">Индекс связи, которая является концом удаляемой связи.</param>
1070 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1071 public static TLink DeleteIfExists<TLink>(this ILinks<TLink> links, TLink source, TLink
    ↳ target)
1072 {
1073     var link = links.SearchOrDefault(source, target);
1074     if (!EqualityComparer<TLink>.Default.Equals(link, default))
1075     {
1076         links.Delete(link);
1077         return link;
1078     }
1079     return default;
1080 }
1081
1082 /// <summary>Удаляет несколько связей.</summary>
1083 /// <param name="links">Хранилище связей.</param>
1084 /// <param name="deletedLinks">Список адресов связей к удалению.</param>
1085 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1086 public static void DeleteMany<TLink>(this ILinks<TLink> links, IList<TLink> deletedLinks)
1087 {
1088     for (int i = 0; i < deletedLinks.Count; i++)
1089     {
1090         links.Delete(deletedLinks[i]);
1091     }
1092 }
1093
1094 public static void DeleteAllUsages<TLink>(this ILinks<TLink> links, TLink linkIndex) =>
    ↳ links.DeleteAllUsages(linkIndex, null);
1095
1096 /// <remarks>Before execution of this method ensure that deleted link is detached (all
    ↳ values - source and target are reset to null) or it might enter into infinite
    ↳ recursion.</remarks>
1097 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1098 public static TLink DeleteAllUsages<TLink>(this ILinks<TLink> links, TLink linkIndex,
    ↳ WriteHandler<TLink> handler)
1099 {
1100     var constants = links.Constants;
1101     var any = constants.Any;
1102     var equalityComparer = EqualityComparer<TLink>.Default;
1103     var usagesAsSourceQuery = new Link<TLink>(any, linkIndex, any);
1104     var usagesAsTargetQuery = new Link<TLink>(any, any, linkIndex);
1105     var usages = new List<IList<TLink>>();
1106     var usagesFiller = new ListFiller<IList<TLink>, TLink>(usages, constants.Continue);
1107     links.Each(usagesFiller.AddAndReturnConstant, usagesAsSourceQuery);

```

```

1108     links.Each(usagesFiller.AddAndReturnConstant, usagesAsTargetQuery);
1109     WriteHandlerState<TLink> handlerState = new(constants.Continue, constants.Break,
1110         ↪ handler);
1111     foreach (var usage in usages)
1112     {
1113         if (equalityComparer.Equals(links.GetIndex(usage), linkIndex) ||
1114             ↪ !links.Exists(links.GetIndex(usage)))
1115         {
1116             continue;
1117         }
1118         handlerState.Apply(links.Delete(links.GetIndex(usage), handlerState.Handler));
1119     }
1120     return handlerState.Result;
1121 }
1122
1123 /// <summary>
1124 /// <para>
1125 /// Deletes the by query using the specified links.
1126 /// </para>
1127 /// <para></para>
1128 /// </summary>
1129 /// <typeparam name="TLink">
1130 /// <para>The link.</para>
1131 /// <para></para>
1132 /// </typeparam>
1133 /// <param name="links">
1134 /// <para>The links.</para>
1135 /// <para></para>
1136 /// </param>
1137 /// <param name="query">
1138 /// <para>The query.</para>
1139 /// <para></para>
1140 /// </param>
1141 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1142 public static void DeleteByQuery<TLink>(this ILinks<TLink> links, Link<TLink> query)
1143 {
1144     var queryResult = new List<TLink>();
1145     var queryResultFiller = new ListFiller<TLink, TLink>(queryResult,
1146         ↪ links.Constants.Continue);
1147     links.Each(queryResultFiller.AddFirstAndReturnConstant, query);
1148     foreach (var link in queryResult)
1149     {
1150         links.Delete(link);
1151     }
1152 }
1153
1154 // TODO: Move to Platform.Data
1155 /// <summary>
1156 /// <para>
1157 /// Determines whether are values reset.
1158 /// </para>
1159 /// <para></para>
1160 /// </summary>
1161 /// <typeparam name="TLink">
1162 /// <para>The link.</para>
1163 /// <para></para>
1164 /// </typeparam>
1165 /// <param name="links">
1166 /// <para>The links.</para>
1167 /// <para></para>
1168 /// </param>
1169 /// <param name="linkIndex">
1170 /// <para>The link index.</para>
1171 /// <para></para>
1172 /// </param>
1173 /// <returns>
1174 /// <para>The bool</para>
1175 /// <para></para>
1176 /// </returns>
1177 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1178 public static bool AreValuesReset<TLink>(this ILinks<TLink> links, TLink linkIndex)
1179 {
1180     var nullConstant = links.Constants.Null;
1181     var equalityComparer = EqualityComparer<TLink>.Default;
1182     var link = links.GetLink(linkIndex);
1183     for (int i = 1; i < link.Count; i++)
1184     {
1185         if (!equalityComparer.Equals(link[i], nullConstant))

```

```

1183         {
1184             return false;
1185         }
1186     }
1187     return true;
1188 }
1189
1190 public static void ResetValues<TLink>(this ILinks<TLink> links, TLink linkIndex) =>
1191     ↪ links.ResetValues(linkIndex, null);
1192
1193 // TODO: Create a universal version of this method in Platform.Data (with using of for
1194     ↪ loop)
1195 /// <summary>
1196 /// <para>
1197 /// Resets the values using the specified links.
1198 /// </para>
1199 /// <para></para>
1200 /// </summary>
1201 /// <typeparam name="TLink">
1202 /// <para>The link.</para>
1203 /// <para></para>
1204 /// </typeparam>
1205 /// <param name="links">
1206 /// <para>The links.</para>
1207 /// <para></para>
1208 /// </param>
1209 /// <param name="linkIndex">
1210 /// <para>The link index.</para>
1211 /// <para></para>
1212 /// </param>
1213 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1214 public static TLink ResetValues<TLink>(this ILinks<TLink> links, TLink linkIndex,
1215     ↪ WriteHandler<TLink> handler)
1216 {
1217     var nullConstant = links.Constants.Null;
1218     var updateRequest = new Link<TLink>(linkIndex, nullConstant, nullConstant);
1219     return links.Update(updateRequest, handler);
1220 }
1221
1222 public static void EnforceResetValues<TLink>(this ILinks<TLink> links, TLink linkIndex)
1223     ↪ => links.EnforceResetValues(linkIndex, null);
1224
1225 // TODO: Create a universal version of this method in Platform.Data (with using of for
1226     ↪ loop)
1227 /// <summary>
1228 /// <para>
1229 /// Enforces the reset values using the specified links.
1230 /// </para>
1231 /// <para></para>
1232 /// </summary>
1233 /// <typeparam name="TLink">
1234 /// <para>The link.</para>
1235 /// <para></para>
1236 /// </typeparam>
1237 /// <param name="links">
1238 /// <para>The links.</para>
1239 /// <para></para>
1240 /// </param>
1241 /// <param name="linkIndex">
1242 /// <para>The link index.</para>
1243 /// <para></para>
1244 /// </param>
1245 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1246 public static TLink EnforceResetValues<TLink>(this ILinks<TLink> links, TLink linkIndex,
1247     ↪ WriteHandler<TLink> handler)
1248 {
1249     if (!links.AreValuesReset(linkIndex))
1250     {
1251         return links.ResetValues(linkIndex, handler);
1252     }
1253     return links.Constants.Continue;
1254 }
1255
1256 public static void MergeUsages<TLink>(this ILinks<TLink> links, TLink oldLinkIndex,
1257     ↪ TLink newLinkIndex) => links.MergeUsages(oldLinkIndex, newLinkIndex, null);
1258
1259 /// <summary>

```

```

1254 /// Merging two usages graphs, all children of old link moved to be children of new link
1255 ↪ or deleted.
1256 /// </summary>
1257 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1258 public static TLink MergeUsages<TLink>(this ILinks<TLink> links, TLink oldLinkIndex,
1259 ↪ TLink newLinkIndex, WriteHandler<TLink> handler)
1260 {
1261     var equalityComparer = EqualityComparer<TLink>.Default;
1262     if (equalityComparer.Equals(oldLinkIndex, newLinkIndex))
1263     {
1264         return newLinkIndex;
1265     }
1266     var constants = links.Constants;
1267     var usagesAsSource = links.All(new Link<TLink>(constants.Any, oldLinkIndex,
1268 ↪ constants.Any));
1269     WriteHandlerState<TLink> handlerState = new(constants.Continue, constants.Break,
1270 ↪ handler);
1271     for (var i = 0; i < usagesAsSource.Count; i++)
1272     {
1273         var usageAsSource = usagesAsSource[i];
1274         if (equalityComparer.Equals(usageAsSource[constants.IndexPart], oldLinkIndex))
1275         {
1276             continue;
1277         }
1278         var restriction = new LinkAddress<TLink>(usageAsSource[constants.IndexPart]);
1279         var substitution = new Link<TLink>(newLinkIndex,
1280 ↪ usageAsSource[constants.TargetPart]);
1281         handlerState.Apply(links.Update(restriction, substitution,
1282 ↪ handlerState.Handler));
1283     }
1284     var usagesAsTarget = links.All(new Link<TLink>(constants.Any, constants.Any,
1285 ↪ oldLinkIndex));
1286     for (var i = 0; i < usagesAsTarget.Count; i++)
1287     {
1288         var usageAsTarget = usagesAsTarget[i];
1289         if (equalityComparer.Equals(usageAsTarget[constants.IndexPart], oldLinkIndex))
1290         {
1291             continue;
1292         }
1293         var restriction = links.GetLink(usageAsTarget[constants.IndexPart]);
1294         var substitution = new Link<TLink>(usageAsTarget[constants.TargetPart],
1295 ↪ newLinkIndex);
1296         handlerState.Apply(links.Update(restriction, substitution,
1297 ↪ handlerState.Handler));
1298     }
1299     return handlerState.Result;
1300 }
1301
1302 public static TLink MergeAndDelete<TLink>(this ILinks<TLink> links, TLink oldLinkIndex,
1303 ↪ TLink newLinkIndex)
1304 {
1305     var equalityComparer = EqualityComparer<TLink>.Default;
1306     if (!equalityComparer.Equals(oldLinkIndex, newLinkIndex))
1307     {
1308         links.MergeUsages(oldLinkIndex, newLinkIndex);
1309         links.Delete(oldLinkIndex);
1310     }
1311     return newLinkIndex;
1312 }
1313
1314 /// <summary>
1315 /// Replace one link with another (replaced link is deleted, children are updated or
1316 ↪ deleted).
1317 /// </summary>
1318 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1319 public static TLink MergeAndDelete<TLink>(this ILinks<TLink> links, TLink oldLinkIndex,
1320 ↪ TLink newLinkIndex, WriteHandler<TLink> handler)
1321 {
1322     var equalityComparer = EqualityComparer<TLink>.Default;
1323     var constants = links.Constants;
1324     WriteHandlerState<TLink> handlerState = new(constants.Continue, constants.Break,
1325 ↪ handler);
1326     if (!equalityComparer.Equals(oldLinkIndex, newLinkIndex))
1327     {
1328         handlerState.Apply(links.MergeUsages(oldLinkIndex, newLinkIndex,
1329 ↪ handlerState.Handler));
1330         handlerState.Apply(links.Delete(oldLinkIndex, handlerState.Handler));
1331     }

```

```

1317     }
1318     return handlerState.Result;
1319 }
1320
1321 /// <summary>
1322 /// <para>
1323 /// Decorates the with automatic uniqueness and usages resolution using the specified
1324   ↳ links.
1325 /// </para>
1326 /// <para></para>
1327 /// </summary>
1328 /// <typeparam name="TLink">
1329 /// <para>The link.</para>
1330 /// <para></para>
1331 /// </typeparam>
1332 /// <param name="links">
1333 /// <para>The links.</para>
1334 /// <para></para>
1335 /// </param>
1336 /// <returns>
1337 /// <para>The links.</para>
1338 /// <para></para>
1339 /// </returns>
1340 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1341 public static ILinks<TLink>
1342   ↳ DecorateWithAutomaticUniquenessAndUsagesResolution<TLink>(this ILinks<TLink> links)
1343 {
1344     links = new LinksCascadeUsagesResolver<TLink>(links);
1345     links = new NonNullContentsLinkDeletionResolver<TLink>(links);
1346     links = new LinksCascadeUniquenessAndUsagesResolver<TLink>(links);
1347     return links;
1348 }
1349
1350 /// <summary>
1351 /// <para>
1352 /// Formats the links.
1353 /// </para>
1354 /// <para></para>
1355 /// </summary>
1356 /// <typeparam name="TLink">
1357 /// <para>The link.</para>
1358 /// <para></para>
1359 /// </typeparam>
1360 /// <param name="links">
1361 /// <para>The links.</para>
1362 /// <para></para>
1363 /// </param>
1364 /// <param name="link">
1365 /// <para>The link.</para>
1366 /// <para></para>
1367 /// </param>
1368 /// <returns>
1369 /// <para>The string</para>
1370 /// <para></para>
1371 /// </returns>
1372 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1373 public static string Format<TLink>(this ILinks<TLink> links, IList<TLink> link)
1374 {
1375     var constants = links.Constants;
1376     return $"({link[constants.IndexPart]}: {link[constants.SourcePart]})
1377   ↳ {link[constants.TargetPart]}";
1378 }
1379
1380 /// <summary>
1381 /// <para>
1382 /// Formats the links.
1383 /// </para>
1384 /// <para></para>
1385 /// </summary>
1386 /// <typeparam name="TLink">
1387 /// <para>The link.</para>
1388 /// <para></para>
1389 /// </typeparam>
1390 /// <param name="links">
1391 /// <para>The links.</para>
1392 /// <para></para>
1393 /// </param>
1394 /// <param name="link">

```



```

1392     /// <para>The link.</para>
1393     /// <para></para>
1394     /// </param>
1395     /// <returns>
1396     /// <para>The string</para>
1397     /// <para></para>
1398     /// </returns>
1399     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1400     public static string Format<TLink>(this ILinks<TLink> links, TLink link) =>
        ↪ links.Format(links.GetLink(link));
1401 }
1402 }

```

1.23 ./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>,
        ↪ LinksConstants<TLink>>, ILinks<TLink>
14     {
15     }
16 }

```

1.24 ./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         private static readonly LinksConstants<TLink> _constants =
            ↪ Default<LinksConstants<TLink>>.Instance;
27         private static readonly EqualityComparer<TLink> _equalityComparer =
            ↪ EqualityComparer<TLink>.Default;
28         private const int Length = 3;
29
30         /// <summary>
31         /// <para>
32         /// The index.
33         /// </para>
34         /// <para></para>
35         /// </summary>
36         public readonly TLink Index;
37         /// <summary>
38         /// <para>
39         /// The source.
40         /// </para>
41         /// <para></para>
42         /// </summary>
43         public readonly TLink Source;
44         /// <summary>

```

```

45     /// <para>
46     /// The target.
47     /// </para>
48     /// <para></para>
49     /// </summary>
50     public readonly TLink Target;
51
52     /// <summary>
53     /// <para>
54     /// Initializes a new <see cref="Link"/> instance.
55     /// </para>
56     /// <para></para>
57     /// </summary>
58     /// <param name="values">
59     /// <para>A values.</para>
60     /// <para></para>
61     /// </param>
62     [MethodImpl(MethodImplOptions.AggressiveInlining)]
63     public Link(params TLink[] values) => SetValues(values, out Index, out Source, out
        ↪ Target);
64
65     /// <summary>
66     /// <para>
67     /// Initializes a new <see cref="Link"/> instance.
68     /// </para>
69     /// <para></para>
70     /// </summary>
71     /// <param name="values">
72     /// <para>A values.</para>
73     /// <para></para>
74     /// </param>
75     [MethodImpl(MethodImplOptions.AggressiveInlining)]
76     public Link(ICollection<TLink> values) => SetValues(values, out Index, out Source, out Target);
77
78     /// <summary>
79     /// <para>
80     /// Initializes a new <see cref="Link"/> instance.
81     /// </para>
82     /// <para></para>
83     /// </summary>
84     /// <param name="other">
85     /// <para>A other.</para>
86     /// <para></para>
87     /// </param>
88     /// <exception cref="NotSupportedException">
89     /// <para></para>
90     /// <para></para>
91     /// </exception>
92     [MethodImpl(MethodImplOptions.AggressiveInlining)]
93     public Link(object other)
94     {
95         if (other is Link<TLink> otherLink)
96         {
97             SetValues(ref otherLink, out Index, out Source, out Target);
98         }
99         else if (other is ICollection<TLink> otherList)
100         {
101             SetValues(otherList, out Index, out Source, out Target);
102         }
103         else
104         {
105             throw new NotSupportedException();
106         }
107     }
108
109     /// <summary>
110     /// <para>
111     /// Initializes a new <see cref="Link"/> instance.
112     /// </para>
113     /// <para></para>
114     /// </summary>
115     /// <param name="other">
116     /// <para>A other.</para>
117     /// <para></para>
118     /// </param>
119     [MethodImpl(MethodImplOptions.AggressiveInlining)]
120     public Link(ref Link<TLink> other) => SetValues(ref other, out Index, out Source, out
        ↪ Target);

```

```

121     /// <summary>
122     /// <para>
123     /// Initializes a new <see cref="Link"/> instance.
124     /// </para>
125     /// <para></para>
126     /// </summary>
127     /// <param name="index">
128     /// <para>A index.</para>
129     /// <para></para>
130     /// </param>
131     /// <param name="source">
132     /// <para>A source.</para>
133     /// <para></para>
134     /// </param>
135     /// <param name="target">
136     /// <para>A target.</para>
137     /// <para></para>
138     /// </param>
139     [MethodImpl(MethodImplOptions.AggressiveInlining)]
140     public Link(TLink index, TLink source, TLink target)
141     {
142         Index = index;
143         Source = source;
144         Target = target;
145     }
146     [MethodImpl(MethodImplOptions.AggressiveInlining)]
147     private static void SetValues(ref Link<TLink> other, out TLink index, out TLink source,
148     ↪ out TLink target)
149     {
150         index = other.Index;
151         source = other.Source;
152         target = other.Target;
153     }
154     [MethodImpl(MethodImplOptions.AggressiveInlining)]
155     private static void SetValues(IList<TLink> values, out TLink index, out TLink source,
156     ↪ out TLink target)
157     {
158         if (values == null)
159         {
160             index = default;
161             source = default;
162             target = default;
163             return;
164         }
165         switch (values.Count)
166         {
167             case 3:
168                 index = values[0];
169                 source = values[1];
170                 target = values[2];
171                 break;
172             case 2:
173                 index = values[0];
174                 source = values[1];
175                 target = default;
176                 break;
177             case 1:
178                 index = values[0];
179                 source = default;
180                 target = default;
181                 break;
182             default:
183                 index = default;
184                 source = default;
185                 target = default;
186                 break;
187         }
188     }
189     /// <summary>
190     /// <para>
191     /// Gets the hash code.
192     /// </para>
193     /// <para></para>
194     /// </summary>
195     /// <returns>
196     /// <para>The int</para>
197     /// <para></para>
198     /// </returns>

```

```

199 [MethodImpl(MethodImplOptions.AggressiveInlining)]
200 public override int GetHashCode() => (Index, Source, Target).GetHashCode();
201
202 /// <summary>
203 /// <para>
204 /// Determines whether this instance is null.
205 /// </para>
206 /// <para></para>
207 /// </summary>
208 /// <returns>
209 /// <para>The bool</para>
210 /// <para></para>
211 /// </returns>
212 [MethodImpl(MethodImplOptions.AggressiveInlining)]
213 public bool IsNull() => _equalityComparer.Equals(Index, _constants.Null)
214     && _equalityComparer.Equals(Source, _constants.Null)
215     && _equalityComparer.Equals(Target, _constants.Null);
216
217 /// <summary>
218 /// <para>
219 /// Determines whether this instance equals.
220 /// </para>
221 /// <para></para>
222 /// </summary>
223 /// <param name="other">
224 /// <para>The other.</para>
225 /// <para></para>
226 /// </param>
227 /// <returns>
228 /// <para>The bool</para>
229 /// <para></para>
230 /// </returns>
231 [MethodImpl(MethodImplOptions.AggressiveInlining)]
232 public override bool Equals(object other) => other is Link<TLink> &&
    ↳ Equals((Link<TLink>)other);
233
234 /// <summary>
235 /// <para>
236 /// Determines whether this instance equals.
237 /// </para>
238 /// <para></para>
239 /// </summary>
240 /// <param name="other">
241 /// <para>The other.</para>
242 /// <para></para>
243 /// </param>
244 /// <returns>
245 /// <para>The bool</para>
246 /// <para></para>
247 /// </returns>
248 [MethodImpl(MethodImplOptions.AggressiveInlining)]
249 public bool Equals(Link<TLink> other) => _equalityComparer.Equals(Index, other.Index)
250     && _equalityComparer.Equals(Source, other.Source)
251     && _equalityComparer.Equals(Target, other.Target);
252
253 /// <summary>
254 /// <para>
255 /// Returns the string using the specified index.
256 /// </para>
257 /// <para></para>
258 /// </summary>
259 /// <param name="index">
260 /// <para>The index.</para>
261 /// <para></para>
262 /// </param>
263 /// <param name="source">
264 /// <para>The source.</para>
265 /// <para></para>
266 /// </param>
267 /// <param name="target">
268 /// <para>The target.</para>
269 /// <para></para>
270 /// </param>
271 /// <returns>
272 /// <para>The string</para>
273 /// <para></para>
274 /// </returns>
275 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

276 public static string ToString(TLink index, TLink source, TLink target) => $"({index}:
    ↳ {source}->{target})";
277
278 /// <summary>
279 /// <para>
280 /// Returns the string using the specified source.
281 /// </para>
282 /// <para></para>
283 /// </summary>
284 /// <param name="source">
285 /// <para>The source.</para>
286 /// <para></para>
287 /// </param>
288 /// <param name="target">
289 /// <para>The target.</para>
290 /// <para></para>
291 /// </param>
292 /// <returns>
293 /// <para>The string</para>
294 /// <para></para>
295 /// </returns>
296 [MethodImpl(MethodImplOptions.AggressiveInlining)]
297 public static string ToString(TLink source, TLink target) => $"({source}->{target})";
298
299 [MethodImpl(MethodImplOptions.AggressiveInlining)]
300 public static implicit operator TLink[] (Link<TLink> link) => link.ToArray();
301
302 [MethodImpl(MethodImplOptions.AggressiveInlining)]
303 public static implicit operator Link<TLink>(TLink[] linkArray) => new
    ↳ Link<TLink>(linkArray);
304
305 /// <summary>
306 /// <para>
307 /// Returns the string.
308 /// </para>
309 /// <para></para>
310 /// </summary>
311 /// <returns>
312 /// <para>The string</para>
313 /// <para></para>
314 /// </returns>
315 [MethodImpl(MethodImplOptions.AggressiveInlining)]
316 public override string ToString() => _equalityComparer.Equals(Index, _constants.Null) ?
    ↳ ToString(Source, Target) : ToString(Index, Source, Target);
317
318 #region IList
319
320 /// <summary>
321 /// <para>
322 /// Gets the count value.
323 /// </para>
324 /// <para></para>
325 /// </summary>
326 public int Count
327 {
328     [MethodImpl(MethodImplOptions.AggressiveInlining)]
329     get => Length;
330 }
331
332 /// <summary>
333 /// <para>
334 /// Gets the is read only value.
335 /// </para>
336 /// <para></para>
337 /// </summary>
338 public bool IsReadOnly
339 {
340     [MethodImpl(MethodImplOptions.AggressiveInlining)]
341     get => true;
342 }
343
344 /// <summary>
345 /// <para>
346 /// The not supported exception.
347 /// </para>
348 /// <para></para>
349 /// </summary>
350 public TLink this[int index]

```

```

351 {
352     [MethodImpl(MethodImplOptions.AggressiveInlining)]
353     get
354     {
355         Ensure.OnDebug.ArgumentInRange(index, new Range<int>(0, Length - 1),
356             ↳ nameof(index));
357         if (index == _constants.IndexPart)
358         {
359             return Index;
360         }
361         if (index == _constants.SourcePart)
362         {
363             return Source;
364         }
365         if (index == _constants.TargetPart)
366         {
367             return Target;
368         }
369         throw new NotSupportedException(); // Impossible path due to
370             ↳ Ensure.ArgumentInRange
371     }
372     [MethodImpl(MethodImplOptions.AggressiveInlining)]
373     set => throw new NotSupportedException();
374 }
375
376 /// <summary>
377 /// <para>
378 /// Gets the enumerator.
379 /// </para>
380 /// </summary>
381 /// <returns>
382 /// <para>The enumerator</para>
383 /// </returns>
384 [MethodImpl(MethodImplOptions.AggressiveInlining)]
385 IEnumerator IEnumerable.GetEnumerator() => GetEnumerator();
386
387 /// <summary>
388 /// <para>
389 /// Gets the enumerator.
390 /// </para>
391 /// <para></para>
392 /// </summary>
393 /// <returns>
394 /// <para>An enumerator of t link</para>
395 /// <para></para>
396 /// </returns>
397 [MethodImpl(MethodImplOptions.AggressiveInlining)]
398 public IEnumerator<TLink> GetEnumerator()
399 {
400     yield return Index;
401     yield return Source;
402     yield return Target;
403 }
404
405 /// <summary>
406 /// <para>
407 /// Adds the item.
408 /// </para>
409 /// <para></para>
410 /// </summary>
411 /// <param name="item">
412 /// <para>The item.</para>
413 /// <para></para>
414 /// </param>
415 [MethodImpl(MethodImplOptions.AggressiveInlining)]
416 public void Add(TLink item) => throw new NotSupportedException();
417
418 /// <summary>
419 /// <para>
420 /// Clears this instance.
421 /// </para>
422 /// <para></para>
423 /// </summary>
424 [MethodImpl(MethodImplOptions.AggressiveInlining)]
425 public void Clear() => throw new NotSupportedException();
426

```

```

427     /// <summary>
428     /// <para>
429     /// Determines whether this instance contains.
430     /// </para>
431     /// <para></para>
432     /// </summary>
433     /// <param name="item">
434     /// <para>The item.</para>
435     /// <para></para>
436     /// </param>
437     /// <returns>
438     /// <para>The bool</para>
439     /// <para></para>
440     /// </returns>
441     [MethodImpl(MethodImplOptions.AggressiveInlining)]
442     public bool Contains(TLink item) => IndexOf(item) >= 0;
443
444     /// <summary>
445     /// <para>
446     /// Copies the to using the specified array.
447     /// </para>
448     /// <para></para>
449     /// </summary>
450     /// <param name="array">
451     /// <para>The array.</para>
452     /// <para></para>
453     /// </param>
454     /// <param name="arrayIndex">
455     /// <para>The array index.</para>
456     /// <para></para>
457     /// </param>
458     /// <exception cref="InvalidOperationException">
459     /// <para></para>
460     /// <para></para>
461     /// </exception>
462     [MethodImpl(MethodImplOptions.AggressiveInlining)]
463     public void CopyTo(TLink[] array, int arrayIndex)
464     {
465         Ensure.OnDebug.ArgumentNotNull(array, nameof(array));
466         Ensure.OnDebug.ArgumentInRange(arrayIndex, new Range<int>(0, array.Length - 1),
467             ↪ nameof(arrayIndex));
468         if (arrayIndex + Length > array.Length)
469         {
470             throw new InvalidOperationException();
471         }
472         array[arrayIndex++] = Index;
473         array[arrayIndex++] = Source;
474         array[arrayIndex] = Target;
475     }
476
477     /// <summary>
478     /// <para>
479     /// Determines whether this instance remove.
480     /// </para>
481     /// <para></para>
482     /// </summary>
483     /// <param name="item">
484     /// <para>The item.</para>
485     /// <para></para>
486     /// </param>
487     /// <returns>
488     /// <para>The bool</para>
489     /// <para></para>
490     /// </returns>
491     [MethodImpl(MethodImplOptions.AggressiveInlining)]
492     public bool Remove(TLink item) => Throw.A.NotSupportedExceptionAndReturn<bool>();
493
494     /// <summary>
495     /// <para>
496     /// Indexes the of using the specified item.
497     /// </para>
498     /// <para></para>
499     /// </summary>
500     /// <param name="item">
501     /// <para>The item.</para>
502     /// <para></para>
503     /// </param>
504     /// <returns>

```

```

504     /// <para>The int</para>
505     /// <para></para>
506     /// </returns>
507     [MethodImpl(MethodImplOptions.AggressiveInlining)]
508     public int IndexOf(TLink item)
509     {
510         if (_equalityComparer.Equals(Index, item))
511         {
512             return _constants.IndexPart;
513         }
514         if (_equalityComparer.Equals(Source, item))
515         {
516             return _constants.SourcePart;
517         }
518         if (_equalityComparer.Equals(Target, item))
519         {
520             return _constants.TargetPart;
521         }
522         return -1;
523     }
524
525     /// <summary>
526     /// <para>
527     /// Inserts the index.
528     /// </para>
529     /// <para></para>
530     /// </summary>
531     /// <param name="index">
532     /// <para>The index.</para>
533     /// <para></para>
534     /// </param>
535     /// <param name="item">
536     /// <para>The item.</para>
537     /// <para></para>
538     /// </param>
539     [MethodImpl(MethodImplOptions.AggressiveInlining)]
540     public void Insert(int index, TLink item) => throw new NotSupportedException();
541
542     /// <summary>
543     /// <para>
544     /// Removes the at using the specified index.
545     /// </para>
546     /// <para></para>
547     /// </summary>
548     /// <param name="index">
549     /// <para>The index.</para>
550     /// <para></para>
551     /// </param>
552     [MethodImpl(MethodImplOptions.AggressiveInlining)]
553     public void RemoveAt(int index) => throw new NotSupportedException();
554
555     [MethodImpl(MethodImplOptions.AggressiveInlining)]
556     public static bool operator ==(Link<TLink> left, Link<TLink> right) =>
557         left.Equals(right);
558
559     [MethodImpl(MethodImplOptions.AggressiveInlining)]
560     public static bool operator !=(Link<TLink> left, Link<TLink> right) => !(left == right);
561     #endregion
562 }
563 }

```

1.25 ./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) =>
35         ↪ Point<TLink>.IsFullPoint(link);
36
37     /// <summary>
38     /// <para>
39     /// Determines whether is partial point.
40     /// </para>
41     /// <para></para>
42     /// </summary>
43     /// <typeparam name="TLink">
44     /// <para>The link.</para>
45     /// <para></para>
46     /// </typeparam>
47     /// <param name="link">
48     /// <para>The link.</para>
49     /// <para></para>
50     /// </param>
51     /// <returns>
52     /// <para>The bool</para>
53     /// <para></para>
54     /// </returns>
55     [MethodImpl(MethodImplOptions.AggressiveInlining)]
56     public static bool IsPartialPoint<TLink>(this Link<TLink> link) =>
57         ↪ Point<TLink>.IsPartialPoint(link);
58 }
59 }

```

1.26 ./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 }

```

```

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 }

```

1.27 ./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 }

```

1.28 ./csharp/Platform.Data.Doublets/Memory/ILinksTreeMethods.cs

```

1 using System;
2 using System.Collections.Generic;
3 using System.Runtime.CompilerServices;
4 using Platform.Delegates;
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    /// Defines the links tree methods.
13    /// </para>
14    /// <para></para>
15    /// </summary>
16    public interface ILinksTreeMethods<TLink>
17    {
18        /// <summary>

```

```

19    /// <para>
20    /// Counts the usages using the specified root.
21    /// </para>
22    /// <para></para>
23    /// </summary>
24    /// <param name="root">
25    /// <para>The root.</para>
26    /// <para></para>
27    /// </param>
28    /// <returns>
29    /// <para>The link</para>
30    /// <para></para>
31    /// </returns>
32    [MethodImpl(MethodImplOptions.AggressiveInlining)]
33    TLink CountUsages(TLink root);
34
35    /// <summary>
36    /// <para>
37    /// Searches the source.
38    /// </para>
39    /// <para></para>
40    /// </summary>
41    /// <param name="source">
42    /// <para>The source.</para>
43    /// <para></para>
44    /// </param>
45    /// <param name="target">
46    /// <para>The target.</para>
47    /// <para></para>
48    /// </param>
49    /// <returns>
50    /// <para>The link</para>
51    /// <para></para>
52    /// </returns>
53    [MethodImpl(MethodImplOptions.AggressiveInlining)]
54    TLink Search(TLink source, TLink target);
55
56    /// <summary>
57    /// <para>
58    /// Eaches the usage using the specified root.
59    /// </para>
60    /// <para></para>
61    /// </summary>
62    /// <param name="root">
63    /// <para>The root.</para>
64    /// <para></para>
65    /// </param>
66    /// <param name="handler">
67    /// <para>The handler.</para>
68    /// <para></para>
69    /// </param>
70    /// <returns>
71    /// <para>The link</para>
72    /// <para></para>
73    /// </returns>
74    [MethodImpl(MethodImplOptions.AggressiveInlining)]
75    TLink EachUsage(TLink root, ReadHandler<TLink> handler);
76
77    /// <summary>
78    /// <para>
79    /// Detaches the root.
80    /// </para>
81    /// <para></para>
82    /// </summary>
83    /// <param name="root">
84    /// <para>The root.</para>
85    /// <para></para>
86    /// </param>
87    /// <param name="linkIndex">
88    /// <para>The link index.</para>
89    /// <para></para>
90    /// </param>
91    [MethodImpl(MethodImplOptions.AggressiveInlining)]
92    void Detach(ref TLink root, TLink linkIndex);
93
94    /// <summary>
95    /// <para>
96    /// Attaches the root.

```

```

97     /// </para>
98     /// <para></para>
99     /// </summary>
100    /// <param name="root">
101    /// <para>The root.</para>
102    /// <para></para>
103    /// </param>
104    /// <param name="linkIndex">
105    /// <para>The link index.</para>
106    /// <para></para>
107    /// </param>
108    [MethodImpl(MethodImplOptions.AggressiveInlining)]
109    void Attach(ref TLink root, TLink linkIndex);
110 }
111 }

```

1.29 ./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 }

```

1.30 ./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 private static readonly EqualityComparer<TLink> _equalityComparer =
    ↳ EqualityComparer<TLink>.Default;
19
20 /// <summary>
21 /// <para>
22 /// The size.
23 /// </para>
24 /// <para></para>
25 /// </summary>
26 public static readonly long SizeInBytes = Structure<LinksHeader<TLink>>.Size;
27
28 /// <summary>
29 /// <para>
30 /// The allocated links.
31 /// </para>
32 /// <para></para>
33 /// </summary>
34 public TLink AllocatedLinks;
35 /// <summary>
36 /// <para>
37 /// The reserved links.
38 /// </para>
39 /// <para></para>
40 /// </summary>
41 public TLink ReservedLinks;
42 /// <summary>
43 /// <para>
44 /// The free links.
45 /// </para>
46 /// <para></para>
47 /// </summary>
48 public TLink FreeLinks;
49 /// <summary>
50 /// <para>
51 /// The first free link.
52 /// </para>
53 /// <para></para>
54 /// </summary>
55 public TLink FirstFreeLink;
56 /// <summary>
57 /// <para>
58 /// The root as source.
59 /// </para>
60 /// <para></para>
61 /// </summary>
62 public TLink RootAsSource;
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 last free link.
73 /// </para>
74 /// <para></para>
75 /// </summary>
76 public TLink LastFreeLink;
77 /// <summary>
78 /// <para>
79 /// The reserved.
80 /// </para>
81 /// <para></para>
82 /// </summary>
83 public TLink Reserved8;
84
85 /// <summary>
86 /// <para>
87 /// Determines whether this instance equals.
88 /// </para>
89 /// <para></para>
90 /// </summary>
91 /// <param name="obj">
92 /// <para>The obj.</para>
93 /// <para></para>
94 /// </param>
95 /// <returns>

```

```

96     /// <para>The bool</para>
97     /// <para></para>
98     /// </returns>
99     [MethodImpl(MethodImplOptions.AggressiveInlining)]
100    public override bool Equals(object obj) => obj is LinksHeader<TLink> linksHeader ?
        ↳ Equals(linksHeader) : false;

101
102    /// <summary>
103    /// <para>
104    /// Determines whether this instance equals.
105    /// </para>
106    /// <para></para>
107    /// </summary>
108    /// <param name="other">
109    /// <para>The other.</para>
110    /// <para></para>
111    /// </param>
112    /// <returns>
113    /// <para>The bool</para>
114    /// <para></para>
115    /// </returns>
116    [MethodImpl(MethodImplOptions.AggressiveInlining)]
117    public bool Equals(LinksHeader<TLink> other)
118        => _equalityComparer.Equals(AllocatedLinks, other.AllocatedLinks)
119        && _equalityComparer.Equals(ReservedLinks, other.ReservedLinks)
120        && _equalityComparer.Equals(FreeLinks, other.FreeLinks)
121        && _equalityComparer.Equals(FirstFreeLink, other.FirstFreeLink)
122        && _equalityComparer.Equals(RootAsSource, other.RootAsSource)
123        && _equalityComparer.Equals(RootAsTarget, other.RootAsTarget)
124        && _equalityComparer.Equals>LastFreeLink, other.LastFreeLink)
125        && _equalityComparer.Equals(Reserved8, other.Reserved8);
126
127    /// <summary>
128    /// <para>
129    /// Gets the hash code.
130    /// </para>
131    /// <para></para>
132    /// </summary>
133    /// <returns>
134    /// <para>The int</para>
135    /// <para></para>
136    /// </returns>
137    [MethodImpl(MethodImplOptions.AggressiveInlining)]
138    public override int GetHashCode() => (AllocatedLinks, ReservedLinks, FreeLinks,
        ↳ FirstFreeLink, RootAsSource, RootAsTarget, LastFreeLink, Reserved8).GetHashCode();

139
140    [MethodImpl(MethodImplOptions.AggressiveInlining)]
141    public static bool operator ==(LinksHeader<TLink> left, LinksHeader<TLink> right) =>
        ↳ left.Equals(right);

142
143    [MethodImpl(MethodImplOptions.AggressiveInlining)]
144    public static bool operator !=(LinksHeader<TLink> left, LinksHeader<TLink> right) =>
        ↳ !(left == right);

145 }
146 }

```

1.31 ./csharp/Platform.Data.Doublets/Memory/Split/Generic/ExternalLinksRecursionlessSizeBalancedTreeMethod

```

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.Delegates;
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.Split.Generic
13 {
14     /// <summary>
15     /// <para>
16     /// Represents the external links recursionless size balanced tree methods base.
17     /// </para>
18     /// <para></para>
19     /// </summary>
20     /// <seealso cref="RecursionlessSizeBalancedTreeMethods{TLink}"/>
21     /// <seealso cref="ILinksTreeMethods{TLink}"/>

```

```

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

```

```

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

```



```

174     /// </param>
175     /// <returns>
176     /// <para>The bool</para>
177     /// <para></para>
178     /// </returns>
179     [MethodImpl(MethodImplOptions.AggressiveInlining)]
180     protected abstract bool FirstIsToTheLeftOfSecond(TLink source, TLink target, TLink
        ↪ rootSource, TLink rootTarget);
181
182     /// <summary>
183     /// <para>
184     /// Gets the header reference.
185     /// </para>
186     /// <para></para>
187     /// </summary>
188     /// <returns>
189     /// <para>A ref links header of t link</para>
190     /// <para></para>
191     /// </returns>
192     [MethodImpl(MethodImplOptions.AggressiveInlining)]
193     protected virtual ref LinksHeader<TLink> GetHeaderReference() => ref
        ↪ AsRef<LinksHeader<TLink>>(Header);
194
195     /// <summary>
196     /// <para>
197     /// Gets the link data part reference 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>A ref raw link data part of t link</para>
207     /// <para></para>
208     /// </returns>
209     [MethodImpl(MethodImplOptions.AggressiveInlining)]
210     protected virtual ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) => ref
        ↪ AsRef<RawLinkDataPart<TLink>>(LinksDataParts + (RawLinkDataPart<TLink>.SizeInBytes *
        ↪ _addressToInt64Converter.Convert(link)));
211
212     /// <summary>
213     /// <para>
214     /// Gets the link index part reference 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>A ref raw link index part of t link</para>
224     /// <para></para>
225     /// </returns>
226     [MethodImpl(MethodImplOptions.AggressiveInlining)]
227     protected virtual ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
        ↪ ref AsRef<RawLinkIndexPart<TLink>>(LinksIndexParts +
        ↪ (RawLinkIndexPart<TLink>.SizeInBytes * _addressToInt64Converter.Convert(link)));
228
229     /// <summary>
230     /// <para>
231     /// Gets the link values using the specified link index.
232     /// </para>
233     /// <para></para>
234     /// </summary>
235     /// <param name="linkIndex">
236     /// <para>The link index.</para>
237     /// <para></para>
238     /// </param>
239     /// <returns>
240     /// <para>A list of t link</para>
241     /// <para></para>
242     /// </returns>
243     [MethodImpl(MethodImplOptions.AggressiveInlining)]
244     protected virtual IList<TLink> GetLinkValues(TLink linkIndex)
245     {

```

```

246     ref var link = ref GetLinkDataPartReference(linkIndex);
247     return new Link<TLink>(linkIndex, link.Source, link.Target);
248 }
249
250 /// <summary>
251 /// <para>
252 /// Determines whether this instance first is to the left of second.
253 /// </para>
254 /// <para></para>
255 /// </summary>
256 /// <param name="first">
257 /// <para>The first.</para>
258 /// <para></para>
259 /// </param>
260 /// <param name="second">
261 /// <para>The second.</para>
262 /// <para></para>
263 /// </param>
264 /// <returns>
265 /// <para>The bool</para>
266 /// <para></para>
267 /// </returns>
268 [MethodImpl(MethodImplOptions.AggressiveInlining)]
269 protected override bool FirstIsToLeftOfSecond(TLink first, TLink second)
270 {
271     ref var firstLink = ref GetLinkDataPartReference(first);
272     ref var secondLink = ref GetLinkDataPartReference(second);
273     return FirstIsToLeftOfSecond(firstLink.Source, firstLink.Target,
274         ↪ secondLink.Source, secondLink.Target);
275 }
276
277 /// <summary>
278 /// <para>
279 /// Determines whether this instance first is to the right of second.
280 /// </para>
281 /// <para></para>
282 /// </summary>
283 /// <param name="first">
284 /// <para>The first.</para>
285 /// <para></para>
286 /// </param>
287 /// <param name="second">
288 /// <para>The second.</para>
289 /// <para></para>
290 /// </param>
291 /// <returns>
292 /// <para>The bool</para>
293 /// <para></para>
294 /// </returns>
295 [MethodImpl(MethodImplOptions.AggressiveInlining)]
296 protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second)
297 {
298     ref var firstLink = ref GetLinkDataPartReference(first);
299     ref var secondLink = ref GetLinkDataPartReference(second);
300     return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
301         ↪ secondLink.Source, secondLink.Target);
302 }
303
304 /// <summary>
305 /// <para>
306 /// The zero.
307 /// </para>
308 /// <para></para>
309 /// </summary>
310 public TLink this[TLink index]
311 {
312     [MethodImpl(MethodImplOptions.AggressiveInlining)]
313     get
314     {
315         var root = GetTreeRoot();
316         if (GreaterOrEqualThan(index, GetSize(root)))
317         {
318             return Zero;
319         }
320         while (!EqualToZero(root))
321         {
322             var left = GetLeftOrDefault(root);
323             var leftSize = GetSizeOrZero(left);

```

```

322         if (LessThan(index, leftSize))
323         {
324             root = left;
325             continue;
326         }
327         if (AreEqual(index, leftSize))
328         {
329             return root;
330         }
331         root = GetRightOrDefault(root);
332         index = Subtract(index, Increment(leftSize));
333     }
334     return Zero; // TODO: Impossible situation exception (only if tree structure
335                  // → broken)
336 }
337
338 /// <summary>
339 /// Выполняет поиск и возвращает индекс связи с указанными Source (началом) и Target
340 /// → (концом).
341 /// </summary>
342 /// <param name="source">Индекс связи, которая является началом на искомой связи.</param>
343 /// <param name="target">Индекс связи, которая является концом на искомой связи.</param>
344 /// <returns>Индекс искомой связи.</returns>
345 [MethodImpl(MethodImplOptions.AggressiveInlining)]
346 public TLink Search(TLink source, TLink target)
347 {
348     var root = GetTreeRoot();
349     while (!EqualToZero(root))
350     {
351         ref var rootLink = ref GetLinkDataPartReference(root);
352         var rootSource = rootLink.Source;
353         var rootTarget = rootLink.Target;
354         if (FirstIsToTheLeftOfSecond(source, target, rootSource, rootTarget)) //
355             → node.Key < root.Key
356         {
357             root = GetLeftOrDefault(root);
358         }
359         else if (FirstIsToTheRightOfSecond(source, target, rootSource, rootTarget)) //
360             → node.Key > root.Key
361         {
362             root = GetRightOrDefault(root);
363         }
364         else // node.Key == root.Key
365         {
366             return root;
367         }
368     }
369     return Zero;
370 }
371
372 // TODO: Return indices range instead of references count
373 /// <summary>
374 /// <para>
375 /// Counts the usages using the specified link.
376 /// </para>
377 /// <para></para>
378 /// </summary>
379 /// <param name="link">
380 /// <para>The link.</para>
381 /// <para></para>
382 /// </param>
383 /// <returns>
384 /// <para>The link</para>
385 /// <para></para>
386 /// </returns>
387 [MethodImpl(MethodImplOptions.AggressiveInlining)]
388 public TLink CountUsages(TLink link)
389 {
390     var root = GetTreeRoot();
391     var total = GetSize(root);
392     var totalRightIgnore = Zero;
393     while (!EqualToZero(root))
394     {
395         var @base = GetBasePartValue(root);
396         if (LessOrEqualThan(@base, link))
397         {
398             root = GetRightOrDefault(root);
399         }
400     }
401     return total - totalRightIgnore;
402 }

```

```

396     }
397     else
398     {
399         totalRightIgnore = Add(totalRightIgnore, Increment(GetRightSize(root)));
400         root = GetLeftOrDefault(root);
401     }
402 }
403 root = GetTreeRoot();
404 var totalLeftIgnore = Zero;
405 while (!EqualToZero(root))
406 {
407     var @base = GetBasePartValue(root);
408     if (GreaterOrEqualThan(@base, link))
409     {
410         root = GetLeftOrDefault(root);
411     }
412     else
413     {
414         totalLeftIgnore = Add(totalLeftIgnore, Increment(GetLeftSize(root)));
415         root = GetRightOrDefault(root);
416     }
417 }
418 return Subtract(Subtract(total, totalRightIgnore), totalLeftIgnore);
419 }
420
421 /// <summary>
422 /// <para>
423 /// Eaches the usage 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="handler">
432 /// <para>The handler.</para>
433 /// <para></para>
434 /// </param>
435 /// <returns>
436 /// <para>The link</para>
437 /// <para></para>
438 /// </returns>
439 [MethodImpl(MethodImplOptions.AggressiveInlining)]
440 public TLink EachUsage(TLink @base, ReadHandler<TLink> handler) => EachUsageCore(@base,
    ↪ GetTreeRoot(), handler);
441
442 // TODO: 1. Move target, handler to separate object. 2. Use stack or walker 3. Use
    ↪ low-level MSIL stack.
443 [MethodImpl(MethodImplOptions.AggressiveInlining)]
444 private TLink EachUsageCore(TLink @base, TLink link, ReadHandler<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     if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
474     {
475         return @break;
476     }
477     if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
478     {
479         return @break;
480     }
481 }
482 return @continue;
483 }
484
485 /// <summary>
486 /// <para>
487 /// Prints the node value using the specified node.
488 /// </para>
489 /// <para></para>
490 /// </summary>
491 /// <param name="node">
492 /// <para>The node.</para>
493 /// <para></para>
494 /// </param>
495 /// <param name="sb">
496 /// <para>The sb.</para>
497 /// <para></para>
498 /// </param>
499 [MethodImpl(MethodImplOptions.AggressiveInlining)]
500 protected override void PrintNodeValue(TLink node, StringBuilder sb)
501 {
502     ref var link = ref GetLinkDataPartReference(node);
503     sb.Append(' ');
504     sb.Append(link.Source);
505     sb.Append('-');
506     sb.Append('>');
507     sb.Append(link.Target);
508 }
509 }
510 }

```

1.32 ./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 Platform.Delegates;
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.Split.Generic
13 {
14     /// <summary>
15     /// <para>
16     /// Represents the external links size balanced tree methods base.
17     /// </para>
18     /// <para></para>
19     /// </summary>
20     /// <seealso cref="SizeBalancedTreeMethods{TLink}"/>
21     /// <seealso cref="ILinksTreeMethods{TLink}"/>
22     public unsafe abstract class ExternalLinksSizeBalancedTreeMethodsBase<TLink> :
23         ↳ SizeBalancedTreeMethods<TLink>, ILinksTreeMethods<TLink>
24     {
25         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
26             ↳ UncheckedConverter<TLink, long>.Default;
27
28         /// <summary>
29         /// <para>
30         /// The break.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         protected readonly TLink Break;
35
36         /// <summary>
37         /// <para>
38         /// The continue.
39         /// </para>
40         /// </summary>
41         protected readonly TLink Continue;
42     }
43 }

```

```

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

```

```

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

```

```

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

```



```

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

```

```

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

```

```

413         {
414             totalLeftIgnore = Add(totalLeftIgnore, Increment(GetLeftSize(root)));
415             root = GetRightOrDefault(root);
416         }
417     }
418     return Subtract(Subtract(total, totalRightIgnore), totalLeftIgnore);
419 }
420
421 /// <summary>
422 /// <para>
423 /// Eaches the usage 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="handler">
432 /// <para>The handler.</para>
433 /// <para></para>
434 /// </param>
435 /// <returns>
436 /// <para>The link</para>
437 /// <para></para>
438 /// </returns>
439 [MethodImpl(MethodImplOptions.AggressiveInlining)]
440 public TLink EachUsage(TLink @base, ReadHandler<TLink> handler) => EachUsageCore(@base,
    ↳ GetTreeRoot(), handler);
441
442 // TODO: 1. Move target, handler to separate object. 2. Use stack or walker 3. Use
    ↳ low-level MSIL stack.
443 [MethodImpl(MethodImplOptions.AggressiveInlining)]
444 private TLink EachUsageCore(TLink @base, TLink link, ReadHandler<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         if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
474         {
475             return @break;
476         }
477         if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
478         {
479             return @break;
480         }
481     }
482     return @continue;
483 }
484
485 /// <summary>
486 /// <para>
487 /// Prints the node value using the specified node.
488 /// </para>

```

```

489     /// <para></para>
490     /// </summary>
491     /// <param name="node">
492     /// <para>The node.</para>
493     /// <para></para>
494     /// </param>
495     /// <param name="sb">
496     /// <para>The sb.</para>
497     /// <para></para>
498     /// </param>
499     [MethodImpl(MethodImplOptions.AggressiveInlining)]
500     protected override void PrintNodeValue(TLink node, StringBuilder sb)
501     {
502         ref var link = ref GetLinkDataPartReference(node);
503         sb.Append(' ');
504         sb.Append(link.Source);
505         sb.Append('-');
506         sb.Append('>');
507         sb.Append(link.Target);
508     }
509 }
510 }

```

1.33 ./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>
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 ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods(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>

```

```

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
57         ↳ GetLinkIndexPartReference(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
75         ↳ GetLinkIndexPartReference(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) =>
93         ↳ GetLinkIndexPartReference(node).LeftAsSource;
94
95     /// <summary>
96     /// <para>
97     /// Gets the right using the specified node.
98     /// </para>
99     /// <para></para>
100    /// </summary>
101    /// <param name="node">
102    /// <para>The node.</para>
103    /// <para></para>
104    /// </param>
105    /// <returns>
106    /// <para>The link</para>
107    /// <para></para>
108    /// </returns>
109    [MethodImpl(MethodImplOptions.AggressiveInlining)]
110    protected override TLink GetRight(TLink node) =>
111        ↳ GetLinkIndexPartReference(node).RightAsSource;
112
113    /// <summary>
114    /// <para>
115    /// Sets the left using the specified node.
116    /// </para>
117    /// <para></para>
118    /// </summary>
119    /// <param name="node">
120    /// <para>The node.</para>
121    /// <para></para>
122    /// </param>
123    /// <param name="left">
124    /// <para>The left.</para>
125    /// <para></para>
126    /// </param>
127    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

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

```

```

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 FirstIsToTheLeftOfSecond(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">
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(firstSource, secondSource) ||
268         ↪ (AreEqual(firstSource, secondSource) && GreaterThan(firstTarget, secondTarget));
269
270     /// <summary>
271     /// <para>
272     /// Clears the node using the specified node.
273     /// </para>
274     /// <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 }

```

1.34 ./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> :
15         ↪ ExternalLinksSizeBalancedTreeMethodsBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="ExternalLinksSourcesSizeBalancedTreeMethods"/> instance.
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,
40             ↪ byte* linksDataParts, byte* linksIndexParts, byte* header) : base(constants,
41             ↪ linksDataParts, linksIndexParts, header) { }
42
43         /// <summary>
44         /// <para>
45         /// Gets the left reference using the specified node.
46         /// </para>
47         /// <para></para>
48         /// </summary>
49         /// <param name="node">
50         /// <para>The node.</para>
51         /// <para></para>
52         /// </param>
53         /// <returns>
54         /// <para>The ref link</para>
55         /// <para></para>
56         /// </returns>
57         [MethodImpl(MethodImplOptions.AggressiveInlining)]
58         protected override ref TLink GetLeftReference(TLink node) => ref
59             ↪ GetLinkIndexPartReference(node).LeftAsSource;

```



```

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.
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() => GetHeaderReference().RootAsSource;
192
193    /// <summary>
194    /// <para>
195    /// Gets the base part value using the specified link.
196    /// </para>
197    /// <para></para>
198    /// </summary>
199    /// <param name="link">
200    /// <para>The link.</para>
201    /// <para></para>
202    /// </param>
203    /// <returns>
204    /// <para>The link</para>
205    /// <para></para>
206    /// </returns>
207    [MethodImpl(MethodImplOptions.AggressiveInlining)]
208    protected override TLink GetBasePartValue(TLink link) =>
209        ↪ GetLinkDataPartReference(link).Source;

```

```

206
207     /// <summary>
208     /// <para>
209     /// Determines whether this instance first is to the left of second.
210     /// </para>
211     /// <para></para>
212     /// </summary>
213     /// <param name="firstSource">
214     /// <para>The first source.</para>
215     /// <para></para>
216     /// </param>
217     /// <param name="firstTarget">
218     /// <para>The first target.</para>
219     /// <para></para>
220     /// </param>
221     /// <param name="secondSource">
222     /// <para>The second source.</para>
223     /// <para></para>
224     /// </param>
225     /// <param name="secondTarget">
226     /// <para>The second target.</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 FirstIsToLeftOfSecond(TLink firstSource, TLink firstTarget,
        ↪ TLink secondSource, TLink secondTarget) => LessThan(firstSource, secondSource) ||
        ↪ (AreEqual(firstSource, secondSource) && LessThan(firstTarget, secondTarget));
235
236     /// <summary>
237     /// <para>
238     /// Determines whether this instance first is to the right of second.
239     /// </para>
240     /// <para></para>
241     /// </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
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 }

```

1.35 ./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> :
15         ↪ ExternalLinksRecursionlessSizeBalancedTreeMethodsBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see
20         ↪ cref="ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods"/> 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 ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods(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).LeftAsTarget;
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
79             ↪ GetLinkIndexPartReference(node).RightAsTarget;
80     }
81 }

```

```

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) =>
    ↪ 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) =>
    ↳ GetLinkIndexPartReference(node).RightAsTarget = right;
142
143 /// <summary>
144 /// <para>
145 /// Gets the size using the specified node.
146 /// </para>
147 /// <para></para>
148 /// </summary>
149 /// <param name="node">
150 /// <para>The node.</para>
151 /// <para></para>
152 /// </param>
153 /// <returns>
154 /// <para>The link</para>
155 /// <para></para>
156 /// </returns>
157 [MethodImpl(MethodImplOptions.AggressiveInlining)]
158 protected override TLink GetSize(TLink node) =>
    ↳ GetLinkIndexPartReference(node).SizeAsTarget;
159
160 /// <summary>
161 /// <para>
162 /// Sets the size using the specified node.
163 /// </para>
164 /// <para></para>
165 /// </summary>
166 /// <param name="node">
167 /// <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) =>
    ↳ GetLinkIndexPartReference(node).SizeAsTarget = 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().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) =>
    ↳ GetLinkDataPartReference(link).Target;
206
207 /// <summary>
208 /// <para>
209 /// Determines whether this instance first is to the left of second.
210 /// </para>
211 /// <para></para>
212 /// </summary>
213 /// <param name="firstSource">

```

```

214     /// <para>The first source.</para>
215     /// <para></para>
216     /// </param>
217     /// <param name="firstTarget">
218     /// <para>The first target.</para>
219     /// <para></para>
220     /// </param>
221     /// <param name="secondSource">
222     /// <para>The second source.</para>
223     /// <para></para>
224     /// </param>
225     /// <param name="secondTarget">
226     /// <para>The second target.</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 FirstIsToTheLeftOfSecond(TLink firstSource, TLink firstTarget,
    ↪ TLink secondSource, TLink secondTarget) => LessThan(firstTarget, secondTarget) ||
    ↪ (AreEqual(firstTarget, secondTarget) && LessThan(firstSource, secondSource));

235
236     /// <summary>
237     /// <para>
238     /// Determines whether this instance first is to the right of second.
239     /// </para>
240     /// <para></para>
241     /// </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(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 }

```

1.36 ./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> :
15        ↳ ExternalLinksSizeBalancedTreeMethodsBase<TLink>
16    {
17        /// <summary>
18        /// <para>
19        /// Initializes a new <see cref="ExternalLinksTargetsSizeBalancedTreeMethods"/> 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 ExternalLinksTargetsSizeBalancedTreeMethods(LinksConstants<TLink> constants,
41            ↳ byte* linksDataParts, byte* linksIndexParts, byte* header) : base(constants,
42            ↳ linksDataParts, linksIndexParts, header) { }
43
44        /// <summary>
45        /// <para>
46        /// Gets the left reference using the specified node.
47        /// </para>
48        /// <para></para>
49        /// </summary>
50        /// <param name="node">
51        /// <para>The node.</para>
52        /// <para></para>
53        /// </param>
54        /// <returns>
55        /// <para>The ref link</para>
56        /// <para></para>
57        /// </returns>
58        [MethodImpl(MethodImplOptions.AggressiveInlining)]
59        protected override ref TLink GetLeftReference(TLink node) => ref
60            ↳ GetLinkIndexPartReference(node).LeftAsTarget;
61
62        /// <summary>
63        /// <para>
64        /// Gets the right reference using the specified node.
65        /// </para>
66        /// <para></para>
67        /// </summary>
68        /// <param name="node">
69        /// <para>The node.</para>
70        /// <para></para>
71        /// </param>
72        /// <returns>
73        /// <para>The ref link</para>
74        /// <para></para>
75        /// </returns>
76        [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>
140    /// <param name="right">
141    /// <para>The right.</para>
142    /// <para></para>
143    /// </param>
144    [MethodImpl(MethodImplOptions.AggressiveInlining)]
145    protected override void SetRight(TLink node, TLink right) =>
146        ↪ GetLinkIndexPartReference(node).RightAsTarget = right;

```

```

145     /// Gets the size using the specified node.
146     /// </para>
147     /// <para></para>
148     /// </summary>
149     /// <param name="node">
150     /// <para>The node.</para>
151     /// <para></para>
152     /// </param>
153     /// <returns>
154     /// <para>The link</para>
155     /// <para></para>
156     /// </returns>
157     [MethodImpl(MethodImplOptions.AggressiveInlining)]
158     protected override TLink GetSize(TLink node) =>
159         ↪ GetLinkIndexPartReference(node).SizeAsTarget;
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         ↪ GetLinkIndexPartReference(node).SizeAsTarget = 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() => GetHeaderReference().RootAsTarget;
191
192     /// <summary>
193     /// <para>
194     /// Gets the base part value using the specified link.
195     /// </para>
196     /// <para></para>
197     /// </summary>
198     /// <param name="link">
199     /// <para>The link.</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 link) =>
208         ↪ GetLinkDataPartReference(link).Target;
209
210     /// <summary>
211     /// <para>
212     /// Determines whether this instance first is to the left of second.
213     /// </para>
214     /// <para></para>
215     /// </summary>
216     /// <param name="firstSource">
217     /// <para>The first source.</para>
218     /// <para></para>
219     /// </param>
220     /// <param name="firstTarget">
221     /// <para>The first target.</para>
222     /// <para></para>
223     /// </param>

```

```

220     /// </param>
221     /// <param name="secondSource">
222     /// <para>The second source.</para>
223     /// <para></para>
224     /// </param>
225     /// <param name="secondTarget">
226     /// <para>The second target.</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 FirstIsToLeftOfSecond(TLink firstSource, TLink firstTarget,
        ↪ TLink secondSource, TLink secondTarget) => LessThan(firstTarget, secondTarget) ||
        ↪ (AreEqual(firstTarget, secondTarget) && LessThan(firstSource, secondSource));

235
236     /// <summary>
237     /// <para>
238     /// Determines whether this instance first is to the right of second.
239     /// </para>
240     /// <para></para>
241     /// </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(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 }

```

1.37 ./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 Platform.Delegates;

```

```

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.Split.Generic
13 {
14     /// <summary>
15     /// <para>
16     /// Represents the internal links recursionless size balanced tree methods base.
17     /// </para>
18     /// <para></para>
19     /// </summary>
20     /// <seealso cref="RecursionlessSizeBalancedTreeMethods{TLink}"/>
21     /// <seealso cref="ILinksTreeMethods{TLink}"/>
22     public unsafe abstract class InternalLinksRecursionlessSizeBalancedTreeMethodsBase<TLink> :
23     ↪ RecursionlessSizeBalancedTreeMethods<TLink>, ILinksTreeMethods<TLink>
24     {
25         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
26         ↪ UncheckedConverter<TLink, long>.Default;
27
28         /// <summary>
29         /// <para>
30         /// The break.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         protected readonly TLink Break;
35
36         /// <summary>
37         /// <para>
38         /// The continue.
39         /// </para>
40         /// <para></para>
41         /// </summary>
42         protected readonly TLink Continue;
43
44         /// <summary>
45         /// <para>
46         /// The links data parts.
47         /// </para>
48         /// <para></para>
49         /// </summary>
50         protected readonly byte* LinksDataParts;
51
52         /// <summary>
53         /// <para>
54         /// The links index parts.
55         /// </para>
56         /// <para></para>
57         /// </summary>
58         protected readonly byte* LinksIndexParts;
59
60         /// <summary>
61         /// <para>
62         /// The header.
63         /// </para>
64         /// <para></para>
65         /// </summary>
66         protected readonly byte* Header;
67
68         /// <summary>
69         /// <para>
70         /// Initializes a new <see
71         ↪ cref="InternalLinksRecursionlessSizeBalancedTreeMethodsBase"/> instance.
72         /// </para>
73         /// <para></para>
74         /// </summary>
75         /// <param name="constants">
76         /// <para>A constants.</para>
77         /// <para></para>
78         /// </param>
79         /// <param name="linksDataParts">
80         /// <para>A links data parts.</para>
81         /// <para></para>
82         /// </param>
83         /// <param name="linksIndexParts">
84         /// <para>A links index parts.</para>
85         /// <para></para>
86         /// </param>
87         /// <param name="header">
88         /// <para>A header.</para>
89         /// <para></para>
90         /// </param>

```

```

83     /// </param>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     protected InternalLinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<TLink>
86     ↪ constants, byte* linksDataParts, byte* linksIndexParts, byte* header)
87     {
88         LinksDataParts = linksDataParts;
89         LinksIndexParts = linksIndexParts;
90         Header = header;
91         Break = constants.Break;
92         Continue = constants.Continue;
93     }
94     /// <summary>
95     /// <para>
96     /// Gets the tree root using the specified link.
97     /// </para>
98     /// <para></para>
99     /// </summary>
100    /// <param name="link">
101    /// <para>The link.</para>
102    /// <para></para>
103    /// </param>
104    /// <returns>
105    /// <para>The link</para>
106    /// <para></para>
107    /// </returns>
108    [MethodImpl(MethodImplOptions.AggressiveInlining)]
109    protected abstract TLink GetTreeRoot(TLink link);
110
111    /// <summary>
112    /// <para>
113    /// Gets the base part value using the specified link.
114    /// </para>
115    /// <para></para>
116    /// </summary>
117    /// <param name="link">
118    /// <para>The link.</para>
119    /// <para></para>
120    /// </param>
121    /// <returns>
122    /// <para>The link</para>
123    /// <para></para>
124    /// </returns>
125    [MethodImpl(MethodImplOptions.AggressiveInlining)]
126    protected abstract TLink GetBasePartValue(TLink link);
127
128    /// <summary>
129    /// <para>
130    /// Gets the key part value using the specified link.
131    /// </para>
132    /// <para></para>
133    /// </summary>
134    /// <param name="link">
135    /// <para>The link.</para>
136    /// <para></para>
137    /// </param>
138    /// <returns>
139    /// <para>The link</para>
140    /// <para></para>
141    /// </returns>
142    [MethodImpl(MethodImplOptions.AggressiveInlining)]
143    protected abstract TLink GetKeyPartValue(TLink link);
144
145    /// <summary>
146    /// <para>
147    /// Gets the link data part reference using the specified link.
148    /// </para>
149    /// <para></para>
150    /// </summary>
151    /// <param name="link">
152    /// <para>The link.</para>
153    /// <para></para>
154    /// </param>
155    /// <returns>
156    /// <para>A ref raw link data part of t link</para>
157    /// <para></para>
158    /// </returns>
159    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

160 protected virtual ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) => ref
161     ↳ AsRef<RawLinkDataPart<TLink>>(LinksDataParts + (RawLinkDataPart<TLink>.SizeInBytes *
162     ↳ _addressToInt64Converter.Convert(link)));
163
164 /// <summary>
165 /// <para>
166 /// Gets the link index part reference using the specified link.
167 /// </para>
168 /// </summary>
169 /// <param name="link">
170 /// <para>The link.</para>
171 /// </param>
172 /// <returns>
173 /// <para>A ref raw link index part of t link</para>
174 /// </returns>
175 [MethodImpl(MethodImplOptions.AggressiveInlining)]
176 protected virtual ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
177     ↳ ref AsRef<RawLinkIndexPart<TLink>>(LinksIndexParts +
178     ↳ (RawLinkIndexPart<TLink>.SizeInBytes * _addressToInt64Converter.Convert(link)));
179
180 /// <summary>
181 /// <para>
182 /// Determines whether this instance first is to the left of second.
183 /// </para>
184 /// </summary>
185 /// <param name="first">
186 /// <para>The first.</para>
187 /// </param>
188 /// <param name="second">
189 /// <para>The second.</para>
190 /// </param>
191 /// <returns>
192 /// <para>The bool</para>
193 /// </returns>
194 [MethodImpl(MethodImplOptions.AggressiveInlining)]
195 protected override bool FirstIsToLeftOfSecond(TLink first, TLink second) =>
196     ↳ LessThan(GetKeyPartValue(first), GetKeyPartValue(second));
197
198 /// <summary>
199 /// <para>
200 /// Determines whether this instance first is to the right of second.
201 /// </para>
202 /// </summary>
203 /// <param name="first">
204 /// <para>The first.</para>
205 /// </param>
206 /// <param name="second">
207 /// <para>The second.</para>
208 /// </param>
209 /// <returns>
210 /// <para>The bool</para>
211 /// </returns>
212 [MethodImpl(MethodImplOptions.AggressiveInlining)]
213 protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second) =>
214     ↳ GreaterThan(GetKeyPartValue(first), GetKeyPartValue(second));
215
216 /// <summary>
217 /// <para>
218 /// Gets the link values using the specified link index.
219 /// </para>
220 /// </summary>
221 /// <param name="linkIndex">
222 /// <para>The link index.</para>
223 /// </param>
224 /// <returns>

```

```

232 /// <para>A list of t link</para>
233 /// <para></para>
234 /// </returns>
235 [MethodImpl(MethodImplOptions.AggressiveInlining)]
236 protected virtual IList<TLink> GetLinkValues(TLink linkIndex)
237 {
238     ref var link = ref GetLinkDataPartReference(linkIndex);
239     return new Link<TLink>(linkIndex, link.Source, link.Target);
240 }
241
242 /// <summary>
243 /// <para>
244 /// The zero.
245 /// </para>
246 /// <para></para>
247 /// </summary>
248 public TLink this[TLink link, TLink index]
249 {
250     [MethodImpl(MethodImplOptions.AggressiveInlining)]
251     get
252     {
253         var root = GetTreeRoot(link);
254         if (GreaterOrEqualThan(index, GetSize(root)))
255         {
256             return Zero;
257         }
258         while (!EqualToZero(root))
259         {
260             var left = GetLeftOrDefault(root);
261             var leftSize = GetSizeOrZero(left);
262             if (LessThan(index, leftSize))
263             {
264                 root = left;
265                 continue;
266             }
267             if (AreEqual(index, leftSize))
268             {
269                 return root;
270             }
271             root = GetRightOrDefault(root);
272             index = Subtract(index, Increment(leftSize));
273         }
274         return Zero; // TODO: Impossible situation exception (only if tree structure
275             ↳ broken)
276     }
277 }
278
279 /// <summary>
280 /// Выполняет поиск и возвращает индекс связи с указанными Source (началом) и Target
281 ↳ (концом).
282 /// </summary>
283 /// <param name="source">Индекс связи, которая является началом на искомой связи.</param>
284 /// <param name="target">Индекс связи, которая является концом на искомой связи.</param>
285 /// <returns>Индекс искомой связи.</returns>
286 [MethodImpl(MethodImplOptions.AggressiveInlining)]
287 public abstract TLink Search(TLink source, TLink target);
288
289 /// <summary>
290 /// <para>
291 /// Searches the core using the specified root.
292 /// </para>
293 /// <para></para>
294 /// </summary>
295 /// <param name="root">
296 /// <para>The root.</para>
297 /// <para></para>
298 /// </param>
299 /// <param name="key">
300 /// <para>The key.</para>
301 /// <para></para>
302 /// </param>
303 /// <returns>
304 /// <para>The zero.</para>
305 /// <para></para>
306 /// </returns>
307 [MethodImpl(MethodImplOptions.AggressiveInlining)]
308 protected TLink SearchCore(TLink root, TLink key)
309 {

```

```

308 while (!EqualToZero(root))
309 {
310     var rootKey = GetKeyPartValue(root);
311     if (LessThan(key, rootKey)) // node.Key < root.Key
312     {
313         root = GetLeftOrDefault(root);
314     }
315     else if (GreaterThan(key, rootKey)) // node.Key > root.Key
316     {
317         root = GetRightOrDefault(root);
318     }
319     else // node.Key == root.Key
320     {
321         return root;
322     }
323 }
324 return Zero;
325 }
326
327 // TODO: Return indices range instead of references count
328 /// <summary>
329 /// <para>
330 /// Counts the usages using the specified link.
331 /// </para>
332 /// <para></para>
333 /// </summary>
334 /// <param name="link">
335 /// <para>The link.</para>
336 /// <para></para>
337 /// </param>
338 /// <returns>
339 /// <para>The link</para>
340 /// <para></para>
341 /// </returns>
342 [MethodImpl(MethodImplOptions.AggressiveInlining)]
343 public TLink CountUsages(TLink link) => GetSizeOrZero(GetTreeRoot(link));
344
345 /// <summary>
346 /// <para>
347 /// Eaches the usage using the specified base.
348 /// </para>
349 /// <para></para>
350 /// </summary>
351 /// <param name="@base">
352 /// <para>The base.</para>
353 /// <para></para>
354 /// </param>
355 /// <param name="handler">
356 /// <para>The handler.</para>
357 /// <para></para>
358 /// </param>
359 /// <returns>
360 /// <para>The link</para>
361 /// <para></para>
362 /// </returns>
363 [MethodImpl(MethodImplOptions.AggressiveInlining)]
364 public TLink EachUsage(TLink @base, ReadHandler<TLink> handler) => EachUsageCore(@base,
    ↳ GetTreeRoot(@base), handler);
365
366 // TODO: 1. Move target, handler to separate object. 2. Use stack or walker 3. Use
    ↳ low-level MSIL stack.
367 [MethodImpl(MethodImplOptions.AggressiveInlining)]
368 private TLink EachUsageCore(TLink @base, TLink link, ReadHandler<TLink> handler)
369 {
370     var @continue = Continue;
371     if (EqualToZero(link))
372     {
373         return @continue;
374     }
375     var @break = Break;
376     if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
377     {
378         return @break;
379     }
380     if (AreEqual(handler(GetLinkValues(link)), @break))
381     {
382         return @break;
383     }

```



```

384         if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
385         {
386             return @break;
387         }
388         return @continue;
389     }
390
391     /// <summary>
392     /// <para>
393     /// Prints the node value using the specified node.
394     /// </para>
395     /// <para></para>
396     /// </summary>
397     /// <param name="node">
398     /// <para>The node.</para>
399     /// <para></para>
400     /// </param>
401     /// <param name="sb">
402     /// <para>The sb.</para>
403     /// <para></para>
404     /// </param>
405     [MethodImpl(MethodImplOptions.AggressiveInlining)]
406     protected override void PrintNodeValue(TLink node, StringBuilder sb)
407     {
408         ref var link = ref GetLinkDataPartReference(node);
409         sb.Append(' ');
410         sb.Append(link.Source);
411         sb.Append('-');
412         sb.Append('>');
413         sb.Append(link.Target);
414     }
415 }
416 }

```

1.38 ./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 Platform.Delegates;
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.Split.Generic
13 {
14     /// <summary>
15     /// <para>
16     /// Represents the internal links size balanced tree methods base.
17     /// </para>
18     /// <para></para>
19     /// </summary>
20     /// <seealso cref="SizeBalancedTreeMethods{TLink}">
21     /// <seealso cref="ILinksTreeMethods{TLink}">
22     public unsafe abstract class InternalLinksSizeBalancedTreeMethodsBase<TLink> :
23     ↪ SizeBalancedTreeMethods<TLink>, ILinksTreeMethods<TLink>
24     {
25         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
26         ↪ UncheckedConverter<TLink, long>.Default;
27
28         /// <summary>
29         /// <para>
30         /// The break.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         protected readonly TLink Break;
35
36         /// <summary>
37         /// <para>
38         /// The continue.
39         /// </para>
40         /// <para></para>
41         /// </summary>
42         protected readonly TLink Continue;
43
44         /// <summary>
45         /// <para>
46         /// The links data parts.

```

```

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

```

```

120    /// </param>
121    /// <returns>
122    /// <para>The link</para>
123    /// <para></para>
124    /// </returns>
125    [MethodImpl(MethodImplOptions.AggressiveInlining)]
126    protected abstract TLink GetBasePartValue(TLink link);
127
128    /// <summary>
129    /// <para>
130    /// Gets the key part value using the specified link.
131    /// </para>
132    /// <para></para>
133    /// </summary>
134    /// <param name="link">
135    /// <para>The link.</para>
136    /// <para></para>
137    /// </param>
138    /// <returns>
139    /// <para>The link</para>
140    /// <para></para>
141    /// </returns>
142    [MethodImpl(MethodImplOptions.AggressiveInlining)]
143    protected abstract TLink GetKeyPartValue(TLink link);
144
145    /// <summary>
146    /// <para>
147    /// Gets the link data part reference using the specified link.
148    /// </para>
149    /// <para></para>
150    /// </summary>
151    /// <param name="link">
152    /// <para>The link.</para>
153    /// <para></para>
154    /// </param>
155    /// <returns>
156    /// <para>A ref raw link data part of t link</para>
157    /// <para></para>
158    /// </returns>
159    [MethodImpl(MethodImplOptions.AggressiveInlining)]
160    protected virtual ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) => ref
    ↪ AsRef<RawLinkDataPart<TLink>>(LinksDataParts + (RawLinkDataPart<TLink>.SizeInBytes *
    ↪ _addressToInt64Converter.Convert(link)));
161
162    /// <summary>
163    /// <para>
164    /// Gets the link index part reference using the specified link.
165    /// </para>
166    /// <para></para>
167    /// </summary>
168    /// <param name="link">
169    /// <para>The link.</para>
170    /// <para></para>
171    /// </param>
172    /// <returns>
173    /// <para>A ref raw link index part of t link</para>
174    /// <para></para>
175    /// </returns>
176    [MethodImpl(MethodImplOptions.AggressiveInlining)]
177    protected virtual ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
    ↪ ref AsRef<RawLinkIndexPart<TLink>>(LinksIndexParts +
    ↪ (RawLinkIndexPart<TLink>.SizeInBytes * _addressToInt64Converter.Convert(link)));
178
179    /// <summary>
180    /// <para>
181    /// Determines whether this instance first is to the left of second.
182    /// </para>
183    /// <para></para>
184    /// </summary>
185    /// <param name="first">
186    /// <para>The first.</para>
187    /// <para></para>
188    /// </param>
189    /// <param name="second">
190    /// <para>The second.</para>
191    /// <para></para>
192    /// </param>
193    /// <returns>

```

```

194    /// <para>The bool</para>
195    /// <para></para>
196    /// </returns>
197    [MethodImpl(MethodImplOptions.AggressiveInlining)]
198    protected override bool FirstIsToLeftOfSecond(TLink first, TLink second) =>
199        ↳ LessThan(GetKeyPartValue(first), GetKeyPartValue(second));
200
201    /// <summary>
202    /// <para>
203    /// Determines whether this instance first is to the right of second.
204    /// </para>
205    /// </summary>
206    /// <param name="first">
207    /// <para>The first.</para>
208    /// </param>
209    /// <param name="second">
210    /// <para>The second.</para>
211    /// </param>
212    /// </returns>
213    /// <para>The bool</para>
214    /// </returns>
215    [MethodImpl(MethodImplOptions.AggressiveInlining)]
216    protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second) =>
217        ↳ GreaterThan(GetKeyPartValue(first), GetKeyPartValue(second));
218
219    /// <summary>
220    /// <para>
221    /// Gets the link values using the specified link index.
222    /// </para>
223    /// </summary>
224    /// <param name="linkIndex">
225    /// <para>The link index.</para>
226    /// </param>
227    /// </returns>
228    /// <para>A list of t link</para>
229    /// </returns>
230    [MethodImpl(MethodImplOptions.AggressiveInlining)]
231    protected virtual IList<TLink> GetLinkValues(TLink linkIndex)
232    {
233        ref var link = ref GetLinkDataPartReference(linkIndex);
234        return new Link<TLink>(linkIndex, link.Source, link.Target);
235    }
236
237    /// <summary>
238    /// <para>
239    /// The zero.
240    /// </para>
241    /// </summary>
242    public TLink this[TLink link, TLink index]
243    {
244        [MethodImpl(MethodImplOptions.AggressiveInlining)]
245        get
246        {
247            var root = GetTreeRoot(link);
248            if (GreaterOrEqualThan(index, GetSize(root)))
249            {
250                return Zero;
251            }
252            while (!EqualToZero(root))
253            {
254                var left = GetLeftOrDefault(root);
255                var leftSize = GetSizeOrZero(left);
256                if (LessThan(index, leftSize))
257                {
258                    root = left;
259                    continue;
260                }
261                if (AreEqual(index, leftSize))
262                {
263                    return root;
264                }
265            }
266        }
267    }

```

```

270         }
271         root = GetRightOrDefault(root);
272         index = Subtract(index, Increment(leftSize));
273     }
274     return Zero; // TODO: Impossible situation exception (only if tree structure
    ↪ broken)
275 }
276 }
277
278 /// <summary>
279 /// Выполняет поиск и возвращает индекс связи с указанными Source (началом) и Target
    ↪ (концом).
280 /// </summary>
281 /// <param name="source">Индекс связи, которая является началом на искомой связи.</param>
282 /// <param name="target">Индекс связи, которая является концом на искомой связи.</param>
283 /// <returns>Индекс искомой связи.</returns>
284 [MethodImpl(MethodImplOptions.AggressiveInlining)]
285 public abstract TLink Search(TLink source, TLink target);
286
287 /// <summary>
288 /// <para>
289 /// Searches the core using the specified root.
290 /// </para>
291 /// <para></para>
292 /// </summary>
293 /// <param name="root">
294 /// <para>The root.</para>
295 /// <para></para>
296 /// </param>
297 /// <param name="key">
298 /// <para>The key.</para>
299 /// <para></para>
300 /// </param>
301 /// <returns>
302 /// <para>The zero.</para>
303 /// <para></para>
304 /// </returns>
305 [MethodImpl(MethodImplOptions.AggressiveInlining)]
306 protected TLink SearchCore(TLink root, TLink key)
307 {
308     while (!EqualToZero(root))
309     {
310         var rootKey = GetKeyPartValue(root);
311         if (LessThan(key, rootKey)) // node.Key < root.Key
312         {
313             root = GetLeftOrDefault(root);
314         }
315         else if (GreaterThan(key, rootKey)) // node.Key > root.Key
316         {
317             root = GetRightOrDefault(root);
318         }
319         else // node.Key == root.Key
320         {
321             return root;
322         }
323     }
324     return Zero;
325 }
326
327 // TODO: Return indices range instead of references count
328 /// <summary>
329 /// <para>
330 /// Counts the usages using the specified link.
331 /// </para>
332 /// <para></para>
333 /// </summary>
334 /// <param name="link">
335 /// <para>The link.</para>
336 /// <para></para>
337 /// </param>
338 /// <returns>
339 /// <para>The link</para>
340 /// <para></para>
341 /// </returns>
342 [MethodImpl(MethodImplOptions.AggressiveInlining)]
343 public TLink CountUsages(TLink link) => GetSizeOrZero(GetTreeRoot(link));
344
345 /// <summary>

```

```

346     /// <para>
347     /// Eaches the usage using the specified base.
348     /// </para>
349     /// <para></para>
350     /// </summary>
351     /// <param name="@base">
352     /// <para>The base.</para>
353     /// <para></para>
354     /// </param>
355     /// <param name="handler">
356     /// <para>The handler.</para>
357     /// <para></para>
358     /// </param>
359     /// <returns>
360     /// <para>The link</para>
361     /// <para></para>
362     /// </returns>
363     [MethodImpl(MethodImplOptions.AggressiveInlining)]
364     public TLink EachUsage(TLink @base, ReadHandler<TLink> handler) => EachUsageCore(@base,
        ↪ GetTreeRoot(@base), handler);
365
366     // TODO: 1. Move target, handler to separate object. 2. Use stack or walker 3. Use
        ↪ low-level MSIL stack.
367     [MethodImpl(MethodImplOptions.AggressiveInlining)]
368     private TLink EachUsageCore(TLink @base, TLink link, ReadHandler<TLink> handler)
369     {
370         var @continue = Continue;
371         if (EqualToZero(link))
372         {
373             return @continue;
374         }
375         var @break = Break;
376         if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
377         {
378             return @break;
379         }
380         if (AreEqual(handler(GetLinkValues(link)), @break))
381         {
382             return @break;
383         }
384         if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
385         {
386             return @break;
387         }
388         return @continue;
389     }
390
391     /// <summary>
392     /// <para>
393     /// Prints the node value using the specified node.
394     /// </para>
395     /// <para></para>
396     /// </summary>
397     /// <param name="node">
398     /// <para>The node.</para>
399     /// <para></para>
400     /// </param>
401     /// <param name="sb">
402     /// <para>The sb.</para>
403     /// <para></para>
404     /// </param>
405     [MethodImpl(MethodImplOptions.AggressiveInlining)]
406     protected override void PrintNodeValue(TLink node, StringBuilder sb)
407     {
408         ref var link = ref GetLinkDataPartReference(node);
409         sb.Append(' ');
410         sb.Append(link.Source);
411         sb.Append('-');
412         sb.Append('>');
413         sb.Append(link.Target);
414     }
415 }
416 }

```

1.39 ./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 Platform.Delegates;
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 sources linked list methods.
16     /// </para>
17     /// <para></para>
18     /// </summary>
19     /// <seealso cref="RelativeCircularDoublyLinkedListMethods{TLink}" />
20     public unsafe class InternalLinksSourcesLinkedListMethods<TLink> :
21         ↳ RelativeCircularDoublyLinkedListMethods<TLink>
22     {
23         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
24             ↳ UncheckedConverter<TLink, long>.Default;
25         private readonly byte* _linksDataParts;
26         private readonly byte* _linksIndexParts;
27         /// <summary>
28         /// <para>
29         /// The break.
30         /// </para>
31         /// <para></para>
32         /// </summary>
33         protected readonly TLink Break;
34         /// <summary>
35         /// <para>
36         /// The continue.
37         /// </para>
38         /// <para></para>
39         /// </summary>
40         protected readonly TLink Continue;
41         /// <summary>
42         /// <para>
43         /// Initializes a new <see cref="InternalLinksSourcesLinkedListMethods" /> instance.
44         /// </para>
45         /// <para></para>
46         /// </summary>
47         /// <param name="constants">
48         /// <para>A constants.</para>
49         /// </param>
50         /// <param name="linksDataParts">
51         /// <para>A links data parts.</para>
52         /// </param>
53         /// <param name="linksIndexParts">
54         /// <para>A links index parts.</para>
55         /// </param>
56         [MethodImpl(MethodImplOptions.AggressiveInlining)]
57         public InternalLinksSourcesLinkedListMethods(LinksConstants<TLink> constants, byte*
58             ↳ linksDataParts, byte* linksIndexParts)
59         {
60             _linksDataParts = linksDataParts;
61             _linksIndexParts = linksIndexParts;
62             Break = constants.Break;
63             Continue = constants.Continue;
64         }
65         /// <summary>
66         /// <para>
67         /// Gets the link data part reference using the specified link.
68         /// </para>
69         /// <para></para>
70         /// </summary>
71         /// <param name="link">
72         /// <para>The link.</para>
73         /// </param>
74         /// <returns>
75         /// <para>A ref raw link data part of t link</para>
76         /// <para></para>
77         /// </returns>

```

```

81 [MethodImpl(MethodImplOptions.AggressiveInlining)]
82 protected virtual ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) => ref
    ↳ AsRef<RawLinkDataPart<TLink>>(_linksDataParts + (RawLinkDataPart<TLink>.SizeInBytes
    ↳ * _addressToInt64Converter.Convert(link)));
83
84 /// <summary>
85 /// <para>
86 /// Gets the link index 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 index part of t link</para>
96 /// <para></para>
97 /// </returns>
98 [MethodImpl(MethodImplOptions.AggressiveInlining)]
99 protected virtual ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
    ↳ ref AsRef<RawLinkIndexPart<TLink>>(_linksIndexParts +
    ↳ (RawLinkIndexPart<TLink>.SizeInBytes * _addressToInt64Converter.Convert(link)));
100
101 /// <summary>
102 /// <para>
103 /// Gets the first using the specified head.
104 /// </para>
105 /// <para></para>
106 /// </summary>
107 /// <param name="head">
108 /// <para>The head.</para>
109 /// <para></para>
110 /// </param>
111 /// <returns>
112 /// <para>The link</para>
113 /// <para></para>
114 /// </returns>
115 [MethodImpl(MethodImplOptions.AggressiveInlining)]
116 protected override TLink GetFirst(TLink head) =>
    ↳ GetLinkIndexPartReference(head).RootAsSource;
117
118 /// <summary>
119 /// <para>
120 /// Gets the last 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 GetLast(TLink head)
134 {
135     var first = GetLinkIndexPartReference(head).RootAsSource;
136     if (EqualToZero(first))
137     {
138         return first;
139     }
140     else
141     {
142         return GetPrevious(first);
143     }
144 }
145
146 /// <summary>
147 /// <para>
148 /// Gets the previous using the specified element.
149 /// </para>
150 /// <para></para>
151 /// </summary>
152 /// <param name="element">
153 /// <para>The element.</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 GetPrevious(TLink element) =>
162        ↪ GetLinkIndexPartReference(element).LeftAsSource;
163
164    /// <summary>
165    /// <para>
166    /// Gets the next using the specified element.
167    /// </para>
168    /// <para></para>
169    /// </summary>
170    /// <param name="element">
171    /// <para>The element.</para>
172    /// <para></para>
173    /// </param>
174    /// <returns>
175    /// <para>The link</para>
176    /// <para></para>
177    /// </returns>
178    [MethodImpl(MethodImplOptions.AggressiveInlining)]
179    protected override TLink GetNext(TLink element) =>
180        ↪ GetLinkIndexPartReference(element).RightAsSource;
181
182    /// <summary>
183    /// <para>
184    /// Gets the size using the specified head.
185    /// </para>
186    /// <para></para>
187    /// </summary>
188    /// <param name="head">
189    /// <para>The head.</para>
190    /// <para></para>
191    /// </param>
192    /// <returns>
193    /// <para>The link</para>
194    /// <para></para>
195    /// </returns>
196    [MethodImpl(MethodImplOptions.AggressiveInlining)]
197    protected override TLink GetSize(TLink head) =>
198        ↪ GetLinkIndexPartReference(head).SizeAsSource;
199
200    /// <summary>
201    /// <para>
202    /// Sets the first using the specified head.
203    /// </para>
204    /// <para></para>
205    /// </summary>
206    /// <param name="head">
207    /// <para>The head.</para>
208    /// <para></para>
209    /// </param>
210    /// <param name="element">
211    /// <para>The element.</para>
212    /// <para></para>
213    /// </param>
214    [MethodImpl(MethodImplOptions.AggressiveInlining)]
215    protected override void SetFirst(TLink head, TLink element) =>
216        ↪ GetLinkIndexPartReference(head).RootAsSource = element;
217
218    /// <summary>
219    /// <para>
220    /// Sets the last using the specified head.
221    /// </para>
222    /// <para></para>
223    /// </summary>
224    /// <param name="head">
225    /// <para>The head.</para>
226    /// <para></para>
227    /// </param>
228    /// <param name="element">
229    /// <para>The element.</para>
230    /// <para></para>
231    /// </param>

```

```

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

```

```

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

```

1.40 ./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         /// <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
79         ↪ GetLinkIndexPartReference(node).RightAsSource;
80
81         /// <summary>
82         /// <para>
83         /// Gets the left using the specified node.
84         /// </para>
85         /// <para></para>
86         /// </summary>

```

```

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>

```

```

154    /// <para>The link</para>
155    /// <para></para>
156    /// </returns>
157    [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;

```

```

227
228     /// <summary>
229     /// <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 }

```

1.41 ./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> :
15        ↪ InternalLinksSizeBalancedTreeMethodsBase<TLink>
16    {
17        /// <summary>
18        /// <para>
19        /// Initializes a new <see cref="InternalLinksSourcesSizeBalancedTreeMethods"/> 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>

```

```

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) =>
    ↪    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) =>
    ↪ GetLinkIndexPartReference(node).RightAsSource;

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) =>
    ↪ GetLinkIndexPartReference(node).LeftAsSource = 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) =>
    ↪ GetLinkIndexPartReference(node).RightAsSource = right;

142
143 /// <summary>
144 /// <para>
145 /// Gets the size using the specified node.
146 /// </para>
147 /// <para></para>
148 /// </summary>
149 /// <param name="node">
150 /// <para>The node.</para>
151 /// <para></para>
152 /// </param>
153 /// <returns>
154 /// <para>The link</para>
155 /// <para></para>
156 /// </returns>
157 [MethodImpl(MethodImplOptions.AggressiveInlining)]
158 protected override TLink GetSize(TLink node) =>
    ↪ GetLinkIndexPartReference(node).SizeAsSource;

159
160 /// <summary>
161 /// <para>
162 /// Sets the size using the specified node.
163 /// </para>
164 /// <para></para>
165 /// </summary>
166 /// <param name="node">
167 /// <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) =>
    ↪ GetLinkIndexPartReference(node).SizeAsSource = size;

176
177 /// <summary>

```

```

178    /// <para>
179    /// Gets the tree root using the specified link.
180    /// </para>
181    /// <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).RootAsSource;
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).Source;
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).Target;
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.LeftAsSource = Zero;
246        link.RightAsSource = Zero;
247        link.SizeAsSource = Zero;
248    }
249
250    /// <summary>
251    /// <para>
252    /// Searches the source.
253    /// </para>
254    /// <para></para>
255    /// </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) =>
        ↪ SearchCore(GetTreeRoot(source), target);
266     }
267 }

```

1.42 ./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> :
        ↪ InternalLinksRecursionlessSizeBalancedTreeMethodsBase<TLink>
15     {
16         /// <summary>
17         /// <para>
18         /// Initializes a new <see
19         ↪ cref="InternalLinksTargetsRecursionlessSizeBalancedTreeMethods"/> 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 InternalLinksTargetsRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
41         ↪ constants, byte* linksDataParts, byte* linksIndexParts, byte* header) :
42         ↪ base(constants, linksDataParts, linksIndexParts, header) { }
43
44         /// <summary>
45         /// <para>
46         /// Gets the left reference using the specified node.
47         /// </para>
48         /// <para></para>
49         /// </summary>
50         /// <param name="node">
51         /// <para>The node.</para>
52         /// <para></para>
53         /// </param>
54         /// <returns>
55         /// <para>The ref link</para>
56         /// <para></para>
57         /// </returns>
58         [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

56     protected override ref TLink GetLeftReference(TLink node) => ref
57         ↪ GetLinkIndexPartReference(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         ↪ GetLinkIndexPartReference(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) =>
93         ↪ GetLinkIndexPartReference(node).LeftAsTarget;
94
95     /// <summary>
96     /// <para>
97     /// Gets the right using the specified node.
98     /// </para>
99     /// <para></para>
100    /// </summary>
101    /// <param name="node">
102    /// <para>The node.</para>
103    /// <para></para>
104    /// </param>
105    /// <returns>
106    /// <para>The link</para>
107    /// <para></para>
108    /// </returns>
109    [MethodImpl(MethodImplOptions.AggressiveInlining)]
110    protected override TLink GetRight(TLink node) =>
111        ↪ GetLinkIndexPartReference(node).RightAsTarget;
112
113    /// <summary>
114    /// <para>
115    /// Sets the left using the specified node.
116    /// </para>
117    /// <para></para>
118    /// </summary>
119    /// <param name="node">
120    /// <para>The node.</para>
121    /// <para></para>
122    /// </param>
123    /// <param name="left">
124    /// <para>The left.</para>
125    /// <para></para>
126    /// </param>
127    [MethodImpl(MethodImplOptions.AggressiveInlining)]
128    protected override void SetLeft(TLink node, TLink left) =>
129        ↪ GetLinkIndexPartReference(node).LeftAsTarget = left;
130
131    /// <summary>
132    /// <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>
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>

```

```

202     /// <para></para>
203     /// </param>
204     /// <returns>
205     /// <para>The link</para>
206     /// <para></para>
207     /// </returns>
208     [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 }

```

1.43 ./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
    ↳ 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) =>
91         ↪ GetLinkIndexPartReference(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) =>
109        ↪ GetLinkIndexPartReference(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        ↪ GetLinkIndexPartReference(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>
143    [MethodImpl(MethodImplOptions.AggressiveInlining)]
144    protected override void SetRight(TLink node, TLink right) =>
145        ↪ GetLinkIndexPartReference(node).RightAsTarget = 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>

```



```

155     /// <para></para>
156     /// </returns>
157     [MethodImpl(MethodImplOptions.AggressiveInlining)]
158     protected override TLink GetSize(TLink node) =>
159         ↪ GetLinkIndexPartReference(node).SizeAsTarget;
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).SizeAsTarget = 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).RootAsTarget;
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).Target;
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).Source;

```

```

227
228     /// <summary>
229     /// <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.LeftAsTarget = Zero;
243         link.RightAsTarget = Zero;
244         link.SizeAsTarget = 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(target), source);
267 }

```

1.44 ./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         private readonly Func<ILinksTreeMethods<TLink>> _createInternalSourceTreeMethods;
21         private readonly Func<ILinksTreeMethods<TLink>> _createExternalSourceTreeMethods;
22         private readonly Func<ILinksTreeMethods<TLink>> _createInternalTargetTreeMethods;
23         private readonly Func<ILinksTreeMethods<TLink>> _createExternalTargetTreeMethods;
24         private byte* _header;
25         private byte* _linksDataParts;
26         private byte* _linksIndexParts;
27
28         /// <summary>
29         /// <para>
30         /// Initializes a new <see cref="SplitMemoryLinks"/> instance.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         /// <param name="dataMemory">
35         /// <para>A data memory.</para>

```

```

36     /// <para></para>
37     /// </param>
38     /// <param name="indexMemory">
39     /// <para>A index memory.</para>
40     /// <para></para>
41     /// </param>
42     [MethodImpl(MethodImplOptions.AggressiveInlining)]
43     public SplitMemoryLinks(string dataMemory, string indexMemory) : this(new
        ↳ FileMappedResizableDirectMemory(dataMemory), new
        ↳ FileMappedResizableDirectMemory(indexMemory)) { }
44
45     /// <summary>
46     /// <para>
47     /// Initializes a new <see cref="SplitMemoryLinks"/> instance.
48     /// </para>
49     /// <para></para>
50     /// </summary>
51     /// <param name="dataMemory">
52     /// <para>A data memory.</para>
53     /// <para></para>
54     /// </param>
55     /// <param name="indexMemory">
56     /// <para>A index memory.</para>
57     /// <para></para>
58     /// </param>
59     [MethodImpl(MethodImplOptions.AggressiveInlining)]
60     public SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
        ↳ indexMemory) : this(dataMemory, indexMemory, DefaultLinksSizeStep) { }
61
62     /// <summary>
63     /// <para>
64     /// Initializes a new <see cref="SplitMemoryLinks"/> instance.
65     /// </para>
66     /// <para></para>
67     /// </summary>
68     /// <param name="dataMemory">
69     /// <para>A data memory.</para>
70     /// <para></para>
71     /// </param>
72     /// <param name="indexMemory">
73     /// <para>A index memory.</para>
74     /// <para></para>
75     /// </param>
76     /// <param name="memoryReservationStep">
77     /// <para>A memory reservation step.</para>
78     /// <para></para>
79     /// </param>
80     [MethodImpl(MethodImplOptions.AggressiveInlining)]
81     public SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
        ↳ indexMemory, long memoryReservationStep) : this(dataMemory, indexMemory,
        ↳ memoryReservationStep, Default<LinksConstants<TLink>>.Instance,
        ↳ IndexTreeType.Default, useLinkedList: true) { }
82
83     /// <summary>
84     /// <para>
85     /// Initializes a new <see cref="SplitMemoryLinks"/> instance.
86     /// </para>
87     /// <para></para>
88     /// </summary>
89     /// <param name="dataMemory">
90     /// <para>A data memory.</para>
91     /// <para></para>
92     /// </param>
93     /// <param name="indexMemory">
94     /// <para>A index memory.</para>
95     /// <para></para>
96     /// </param>
97     /// <param name="memoryReservationStep">
98     /// <para>A memory reservation step.</para>
99     /// <para></para>
100    /// </param>
101    /// <param name="constants">
102    /// <para>A constants.</para>
103    /// <para></para>
104    /// </param>
105    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

106 public SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
    ↪ indexMemory, long memoryReservationStep, LinksConstants<TLink> constants) :
    ↪ this(dataMemory, indexMemory, memoryReservationStep, constants,
    ↪ IndexTreeType.Default, useLinkedList: true) { }
107
108 /// <summary>
109 /// <para>
110 /// Initializes a new <see cref="SplitMemoryLinks"/> instance.
111 /// </para>
112 /// </summary>
113
114 /// <param name="dataMemory">
115 /// <para>A data memory.</para>
116 /// </param>
117
118 /// <param name="indexMemory">
119 /// <para>A index memory.</para>
120 /// </param>
121
122 /// <param name="memoryReservationStep">
123 /// <para>A memory reservation step.</para>
124 /// </param>
125
126 /// <param name="constants">
127 /// <para>A constants.</para>
128 /// </param>
129
130 /// <param name="indexTreeType">
131 /// <para>A index tree type.</para>
132 /// </param>
133
134 /// <param name="useLinkedList">
135 /// <para>A use linked list.</para>
136 /// </param>
137
138 [MethodImpl(MethodImplOptions.AggressiveInlining)]
139 public SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
    ↪ indexMemory, long memoryReservationStep, LinksConstants<TLink> constants,
    ↪ IndexTreeType indexTreeType, bool useLinkedList) : base(dataMemory, indexMemory,
    ↪ memoryReservationStep, constants, useLinkedList)
140 {
141     if (indexTreeType == IndexTreeType.SizeBalancedTree)
142     {
143         _createInternalSourceTreeMethods = () => new
            ↪ InternalLinksSourcesSizeBalancedTreeMethods<TLink>(Constants,
            ↪ _linksDataParts, _linksIndexParts, _header);
144         _createExternalSourceTreeMethods = () => new
            ↪ ExternalLinksSourcesSizeBalancedTreeMethods<TLink>(Constants,
            ↪ _linksDataParts, _linksIndexParts, _header);
145         _createInternalTargetTreeMethods = () => new
            ↪ InternalLinksTargetsSizeBalancedTreeMethods<TLink>(Constants,
            ↪ _linksDataParts, _linksIndexParts, _header);
146         _createExternalTargetTreeMethods = () => new
            ↪ ExternalLinksTargetsSizeBalancedTreeMethods<TLink>(Constants,
            ↪ _linksDataParts, _linksIndexParts, _header);
147     }
148     else
149     {
150         _createInternalSourceTreeMethods = () => new
            ↪ InternalLinksSourcesRecursionlessSizeBalancedTreeMethods<TLink>(Constants,
            ↪ _linksDataParts, _linksIndexParts, _header);
151         _createExternalSourceTreeMethods = () => new
            ↪ ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods<TLink>(Constants,
            ↪ _linksDataParts, _linksIndexParts, _header);
152         _createInternalTargetTreeMethods = () => new
            ↪ InternalLinksTargetsRecursionlessSizeBalancedTreeMethods<TLink>(Constants,
            ↪ _linksDataParts, _linksIndexParts, _header);
153         _createExternalTargetTreeMethods = () => new
            ↪ ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods<TLink>(Constants,
            ↪ _linksDataParts, _linksIndexParts, _header);
154     }
155     Init(dataMemory, indexMemory);
156 }
157
158 /// <summary>
159 /// <para>
160 /// Sets the pointers using the specified data memory.

```

```

161    /// </para>
162    /// <para></para>
163    /// </summary>
164    /// <param name="dataMemory">
165    /// <para>The data memory.</para>
166    /// <para></para>
167    /// </param>
168    /// <param name="indexMemory">
169    /// <para>The index memory.</para>
170    /// <para></para>
171    /// </param>
172    [MethodImpl(MethodImplOptions.AggressiveInlining)]
173    protected override void SetPointers(IResizableDirectMemory dataMemory,
174    ↪ IResizableDirectMemory indexMemory)
175    {
176        _linksDataParts = (byte*)dataMemory.Pointer;
177        _linksIndexParts = (byte*)indexMemory.Pointer;
178        _header = _linksIndexParts;
179        if (_useLinkedList)
180        {
181            InternalSourcesListMethods = new
182            ↪ InternalLinksSourcesLinkedListMethods<TLink>(Constants, _linksDataParts,
183            ↪ _linksIndexParts);
184        }
185        else
186        {
187            InternalSourcesTreeMethods = _createInternalSourceTreeMethods();
188        }
189        ExternalSourcesTreeMethods = _createExternalSourceTreeMethods();
190        InternalTargetsTreeMethods = _createInternalTargetTreeMethods();
191        ExternalTargetsTreeMethods = _createExternalTargetTreeMethods();
192        UnusedLinksListMethods = new UnusedLinksListMethods<TLink>(_linksDataParts, _header);
193    }
194
195    /// <summary>
196    /// <para>
197    /// Resets the pointers.
198    /// </para>
199    /// <para></para>
200    /// </summary>
201    [MethodImpl(MethodImplOptions.AggressiveInlining)]
202    protected override void ResetPointers()
203    {
204        base.ResetPointers();
205        _linksDataParts = null;
206        _linksIndexParts = null;
207        _header = null;
208    }
209
210    /// <summary>
211    /// <para>
212    /// Gets the header reference.
213    /// </para>
214    /// <para></para>
215    /// </summary>
216    /// <returns>
217    /// <para>A ref links header of t link</para>
218    /// <para></para>
219    /// </returns>
220    [MethodImpl(MethodImplOptions.AggressiveInlining)]
221    protected override ref LinksHeader<TLink> GetHeaderReference() => ref
222    ↪ AsRef<LinksHeader<TLink>>(_header);
223
224    /// <summary>
225    /// <para>
226    /// Gets the link data part reference using the specified link index.
227    /// </para>
228    /// <para></para>
229    /// </summary>
230    /// <param name="linkIndex">
231    /// <para>The link index.</para>
232    /// <para></para>
233    /// </param>
234    /// <returns>
235    /// <para>A ref raw link data part of t link</para>
236    /// <para></para>
237    /// </returns>
238    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

235     protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink linkIndex)
236     ↪ => ref AsRef<RawLinkDataPart<TLink>>(_linksDataParts + (LinkDataPartSizeInBytes *
237     ↪ ConvertToInt64(linkIndex)));
238
239     /// <summary>
240     /// <para>
241     /// Gets the link index part reference 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 ref raw link index part of t link</para>
251     /// <para></para>
252     /// </returns>
253     [MethodImpl(MethodImplOptions.AggressiveInlining)]
254     protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink
    ↪ linkIndex) => ref AsRef<RawLinkIndexPart<TLink>>(_linksIndexParts +
    ↪ (LinkIndexPartSizeInBytes * ConvertToInt64(linkIndex)));
    }
}

```

1.45 ./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 using Platform.Delegates;
11
12 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
13
14 namespace Platform.Data.Doublets.Memory.Split.Generic
15 {
16     /// <summary>
17     /// <para>
18     /// Represents the split memory links base.
19     /// </para>
20     /// <para></para>
21     /// </summary>
22     /// <seealso cref="DisposableBase"/>
23     /// <seealso cref="ILinks{TLink}"/>
24     public abstract class SplitMemoryLinksBase<TLink> : DisposableBase, ILinks<TLink>
25     {
26         private static readonly EqualityComparer<TLink> _equalityComparer =
27         ↪ EqualityComparer<TLink>.Default;
28         private static readonly Comparer<TLink> _comparer = Comparer<TLink>.Default;
29         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
30         ↪ UncheckedConverter<TLink, long>.Default;
31         private static readonly UncheckedConverter<long, TLink> _int64ToAddressConverter =
32         ↪ UncheckedConverter<long, TLink>.Default;
33         private static readonly TLink _zero = default;
34         private static readonly TLink _one = Arithmetic.Increment(_zero);
35
36         /// <summary>Возвращает размер одной связи в байтах.</summary>
37         /// <remarks>
38         /// Используется только во вне класса, не рекомендуется использовать внутри.
39         /// Так как во вне не обязательно будет доступен unsafe C#.
40         /// </remarks>
41         public static readonly long LinkDataPartSizeInBytes = RawLinkDataPart<TLink>.SizeInBytes;
42
43         /// <summary>
44         /// <para>
45         /// The size in bytes.
46         /// </para>
47         /// <para></para>
48         /// </summary>
49         public static readonly long LinkIndexPartSizeInBytes =
50         ↪ RawLinkIndexPart<TLink>.SizeInBytes;
51
52         /// <summary>
53         /// <para>
54         /// The size in bytes.

```

```

51     /// </para>
52     /// <para></para>
53     /// </summary>
54     public static readonly long LinkHeaderSizeInBytes = LinksHeader<TLink>.SizeInBytes;
55
56     /// <summary>
57     /// <para>
58     /// The default links size step.
59     /// </para>
60     /// <para></para>
61     /// </summary>
62     public static readonly long DefaultLinksSizeStep = 1 * 1024 * 1024;
63
64     /// <summary>
65     /// <para>
66     /// The data memory.
67     /// </para>
68     /// <para></para>
69     /// </summary>
70     protected readonly IResizableDirectMemory _dataMemory;
71     /// <summary>
72     /// <para>
73     /// The index memory.
74     /// </para>
75     /// <para></para>
76     /// </summary>
77     protected readonly IResizableDirectMemory _indexMemory;
78     /// <summary>
79     /// <para>
80     /// The use linked list.
81     /// </para>
82     /// <para></para>
83     /// </summary>
84     protected readonly bool _useLinkedList;
85     /// <summary>
86     /// <para>
87     /// The data memory reservation step in bytes.
88     /// </para>
89     /// <para></para>
90     /// </summary>
91     protected readonly long _dataMemoryReservationStepInBytes;
92     /// <summary>
93     /// <para>
94     /// The index memory reservation step in bytes.
95     /// </para>
96     /// <para></para>
97     /// </summary>
98     protected readonly long _indexMemoryReservationStepInBytes;
99
100    /// <summary>
101    /// <para>
102    /// The internal sources list methods.
103    /// </para>
104    /// <para></para>
105    /// </summary>
106    protected InternalLinksSourcesLinkedListMethods<TLink> InternalSourcesListMethods;
107    /// <summary>
108    /// <para>
109    /// The internal sources tree methods.
110    /// </para>
111    /// <para></para>
112    /// </summary>
113    protected ILinksTreeMethods<TLink> InternalSourcesTreeMethods;
114    /// <summary>
115    /// <para>
116    /// The external sources tree methods.
117    /// </para>
118    /// <para></para>
119    /// </summary>
120    protected ILinksTreeMethods<TLink> ExternalSourcesTreeMethods;
121    /// <summary>
122    /// <para>
123    /// The internal targets tree methods.
124    /// </para>
125    /// <para></para>
126    /// </summary>
127    protected ILinksTreeMethods<TLink> InternalTargetsTreeMethods;
128    /// <summary>
129    /// <para>

```

```

130     /// The external targets tree methods.
131     /// </para>
132     /// <para></para>
133     /// </summary>
134     protected ILinksTreeMethods<TLink> ExternalTargetsTreeMethods;
135     // TODO: Возможно чтобы гарантированно проверять на то, является ли связь удалённой,
136     // → нужно использовать не список а дерево, так как так можно быстрее проверить на
137     // → наличие связи внутри
138     /// <summary>
139     /// <para>
140     /// The unused links list methods.
141     /// </para>
142     /// <para></para>
143     /// </summary>
144     protected ILinksListMethods<TLink> UnusedLinksListMethods;
145     /// <summary>
146     /// Возвращает общее число связей находящихся в хранилище.
147     /// </summary>
148     protected virtual TLink Total
149     {
150         [MethodImpl(MethodImplOptions.AggressiveInlining)]
151         get
152         {
153             ref var header = ref GetHeaderReference();
154             return Subtract(header.AllocatedLinks, header.FreeLinks);
155         }
156     }
157     /// <summary>
158     /// <para>
159     /// Gets the constants value.
160     /// </para>
161     /// <para></para>
162     /// </summary>
163     public virtual LinksConstants<TLink> Constants
164     {
165         [MethodImpl(MethodImplOptions.AggressiveInlining)]
166         get;
167     }
168     /// <summary>
169     /// <para>
170     /// Initializes a new <see cref="SplitMemoryLinksBase"/> instance.
171     /// </para>
172     /// <para></para>
173     /// </summary>
174     /// <param name="dataMemory">
175     /// <para>A data memory.</para>
176     /// <para></para>
177     /// </param>
178     /// <param name="indexMemory">
179     /// <para>A index memory.</para>
180     /// <para></para>
181     /// </param>
182     /// <param name="memoryReservationStep">
183     /// <para>A memory reservation step.</para>
184     /// <para></para>
185     /// </param>
186     /// <param name="constants">
187     /// <para>A constants.</para>
188     /// <para></para>
189     /// </param>
190     /// <param name="useLinkedList">
191     /// <para>A use linked list.</para>
192     /// <para></para>
193     /// </param>
194     [MethodImpl(MethodImplOptions.AggressiveInlining)]
195     protected SplitMemoryLinksBase(IResizableDirectMemory dataMemory, IResizableDirectMemory
196     // → indexMemory, long memoryReservationStep, LinksConstants<TLink> constants, bool
197     // → useLinkedList)
198     {
199         _dataMemory = dataMemory;
200         _indexMemory = indexMemory;
201         _dataMemoryReservationStepInBytes = memoryReservationStep * LinkDataPartSizeInBytes;
202         _indexMemoryReservationStepInBytes = memoryReservationStep *
203         // → LinkIndexPartSizeInBytes;
204         _useLinkedList = useLinkedList;
205         Constants = constants;

```



```

204 }
205
206 /// <summary>
207 /// <para>
208 /// Initializes a new <see cref="SplitMemoryLinksBase"/> instance.
209 /// </para>
210 /// <para></para>
211 /// </summary>
212 /// <param name="dataMemory">
213 /// <para>A data memory.</para>
214 /// <para></para>
215 /// </param>
216 /// <param name="indexMemory">
217 /// <para>A index memory.</para>
218 /// <para></para>
219 /// </param>
220 /// <param name="memoryReservationStep">
221 /// <para>A memory reservation step.</para>
222 /// <para></para>
223 /// </param>
224 [MethodImpl(MethodImplOptions.AggressiveInlining)]
225 protected SplitMemoryLinksBase(IResizableDirectMemory dataMemory, IResizableDirectMemory
    ↪ indexMemory, long memoryReservationStep) : this(dataMemory, indexMemory,
    ↪ memoryReservationStep, Default<LinksConstants<TLink>>.Instance, useLinkedList: true)
    ↪ { }
226
227 /// <summary>
228 /// <para>
229 /// Inits the data memory.
230 /// </para>
231 /// <para></para>
232 /// </summary>
233 /// <param name="dataMemory">
234 /// <para>The data memory.</para>
235 /// <para></para>
236 /// </param>
237 /// <param name="indexMemory">
238 /// <para>The index memory.</para>
239 /// <para></para>
240 /// </param>
241 [MethodImpl(MethodImplOptions.AggressiveInlining)]
242 protected virtual void Init(IResizableDirectMemory dataMemory, IResizableDirectMemory
    ↪ indexMemory)
243 {
244     // Read allocated links from header
245     if (indexMemory.ReservedCapacity < LinkHeaderSizeInBytes)
246     {
247         indexMemory.ReservedCapacity = LinkHeaderSizeInBytes;
248     }
249     SetPointers(dataMemory, indexMemory);
250     ref var header = ref GetHeaderReference();
251     var allocatedLinks = ConvertToInt64(header.AllocatedLinks);
252     // Adjust reserved capacity
253     var minimumDataReservedCapacity = allocatedLinks * LinkDataPartSizeInBytes;
254     if (minimumDataReservedCapacity < dataMemory.UsedCapacity)
255     {
256         minimumDataReservedCapacity = dataMemory.UsedCapacity;
257     }
258     if (minimumDataReservedCapacity < _dataMemoryReservationStepInBytes)
259     {
260         minimumDataReservedCapacity = _dataMemoryReservationStepInBytes;
261     }
262     var minimumIndexReservedCapacity = allocatedLinks * LinkDataPartSizeInBytes;
263     if (minimumIndexReservedCapacity < indexMemory.UsedCapacity)
264     {
265         minimumIndexReservedCapacity = indexMemory.UsedCapacity;
266     }
267     if (minimumIndexReservedCapacity < _indexMemoryReservationStepInBytes)
268     {
269         minimumIndexReservedCapacity = _indexMemoryReservationStepInBytes;
270     }
271     // Check for alignment
272     if (minimumDataReservedCapacity % _dataMemoryReservationStepInBytes > 0)
273     {
274         minimumDataReservedCapacity = ((minimumDataReservedCapacity /
    ↪ _dataMemoryReservationStepInBytes) * _dataMemoryReservationStepInBytes) +
    ↪ _dataMemoryReservationStepInBytes;
275     }

```

```

276     if (minimumIndexReservedCapacity % _indexMemoryReservationStepInBytes > 0)
277     {
278         minimumIndexReservedCapacity = ((minimumIndexReservedCapacity /
279             ↪ _indexMemoryReservationStepInBytes) * _indexMemoryReservationStepInBytes) +
280             ↪ _indexMemoryReservationStepInBytes;
281     }
282     if (dataMemory.ReservedCapacity != minimumDataReservedCapacity)
283     {
284         dataMemory.ReservedCapacity = minimumDataReservedCapacity;
285     }
286     if (indexMemory.ReservedCapacity != minimumIndexReservedCapacity)
287     {
288         indexMemory.ReservedCapacity = minimumIndexReservedCapacity;
289     }
290     SetPointers(dataMemory, indexMemory);
291     header = ref GetHeaderReference();
292     // Ensure correctness _memory.UsedCapacity over _header->AllocatedLinks
293     // Гарантия корректности _memory.UsedCapacity относительно _header->AllocatedLinks
294     dataMemory.UsedCapacity = (ConvertToInt64(header.AllocatedLinks) *
295         ↪ LinkDataPartSizeInBytes) + LinkDataPartSizeInBytes; // First link is read only
296     ↪ zero link.
297     indexMemory.UsedCapacity = (ConvertToInt64(header.AllocatedLinks) *
298         ↪ LinkIndexPartSizeInBytes) + LinkHeaderSizeInBytes;
299     // Ensure correctness _memory.ReservedLinks over _header->ReservedCapacity
300     // Гарантия корректности _header->ReservedLinks относительно _memory.ReservedCapacity
301     header.ReservedLinks = ConvertToAddress((dataMemory.ReservedCapacity -
302         ↪ LinkDataPartSizeInBytes) / LinkDataPartSizeInBytes);
303 }
304
305 /// <summary>
306 /// <para>
307 /// Counts the substitution.
308 /// </para>
309 /// <para></para>
310 /// </summary>
311 /// <param name="restriction">
312 /// <para>The substitution.</para>
313 /// <para></para>
314 /// </param>
315 /// <exception cref="NotSupportedException">
316 /// <para>Другие размеры и способы ограничений не поддерживаются.</para>
317 /// <para></para>
318 /// </exception>
319 /// <returns>
320 /// <para>The link</para>
321 /// <para></para>
322 /// </returns>
323 [MethodImpl(MethodImplOptions.AggressiveInlining)]
324 public virtual TLink Count(IList<TLink> restriction)
325 {
326     // Если нет ограничений, тогда возвращаем общее число связей находящихся в хранилище.
327     if (restriction.Count == 0)
328     {
329         return Total;
330     }
331     var constants = Constants;
332     var any = constants.Any;
333     var index = restriction[constants.IndexPart];
334     if (restriction.Count == 1)
335     {
336         if (AreEqual(index, any))
337         {
338             return Total;
339         }
340         return Exists(index) ? GetOne() : GetZero();
341     }
342     if (restriction.Count == 2)
343     {
344         var value = restriction[1];
345         if (AreEqual(index, any))
346         {
347             if (AreEqual(value, any))
348             {
349                 return Total; // Any - как отсутствие ограничения
350             }
351             var externalReferencesRange = constants.ExternalReferencesRange;
352             if (externalReferencesRange.HasValue &&
353                 ↪ externalReferencesRange.Value.Contains(value))

```

```

347     {
348         return Add(ExternalSourcesTreeMethods.CountUsages(value),
349             ↪ ExternalTargetsTreeMethods.CountUsages(value));
350     }
351     else
352     {
353         if (_useLinkedList)
354         {
355             return Add(InternalSourcesListMethods.CountUsages(value),
356                 ↪ InternalTargetsTreeMethods.CountUsages(value));
357         }
358         else
359         {
360             return Add(InternalSourcesTreeMethods.CountUsages(value),
361                 ↪ InternalTargetsTreeMethods.CountUsages(value));
362         }
363     }
364 }
365 else
366 {
367     if (!Exists(index))
368     {
369         return GetZero();
370     }
371     if (AreEqual(value, any))
372     {
373         return GetOne();
374     }
375     ref var storedLinkValue = ref GetLinkDataPartReference(index);
376     if (AreEqual(storedLinkValue.Source, value) ||
377         ↪ AreEqual(storedLinkValue.Target, value))
378     {
379         return GetOne();
380     }
381     return GetZero();
382 }
383 }
384 if (restriction.Count == 3)
385 {
386     var externalReferencesRange = constants.ExternalReferencesRange;
387     var source = restriction[constants.SourcePart];
388     var target = restriction[constants.TargetPart];
389     if (AreEqual(index, any))
390     {
391         if (AreEqual(source, any) && AreEqual(target, any))
392         {
393             return Total;
394         }
395         else if (AreEqual(source, any))
396         {
397             if (externalReferencesRange.HasValue &&
398                 ↪ externalReferencesRange.Value.Contains(target))
399             {
400                 return ExternalTargetsTreeMethods.CountUsages(target);
401             }
402             else
403             {
404                 return InternalTargetsTreeMethods.CountUsages(target);
405             }
406         }
407         else if (AreEqual(target, any))
408         {
409             if (externalReferencesRange.HasValue &&
410                 ↪ externalReferencesRange.Value.Contains(source))
411             {
412                 return ExternalSourcesTreeMethods.CountUsages(source);
413             }
414             else
415             {
416                 if (_useLinkedList)
417                 {
418                     return InternalSourcesListMethods.CountUsages(source);
419                 }
420                 else
421                 {
422                     return InternalSourcesTreeMethods.CountUsages(source);
423                 }
424             }
425         }
426     }
427 }

```

```

419 }
420 else //if(source != Any && target != Any)
421 {
422     // ЭКВИВАЛЕНТ Exists(source, target) => Count(Any, source, target) > 0
423     TLink link;
424     if (externalReferencesRange.HasValue)
425     {
426         if (externalReferencesRange.Value.Contains(source) &&
427             ↪ externalReferencesRange.Value.Contains(target))
428         {
429             link = ExternalSourcesTreeMethods.Search(source, target);
430         }
431         else if (externalReferencesRange.Value.Contains(source))
432         {
433             link = InternalTargetsTreeMethods.Search(source, target);
434         }
435         else if (externalReferencesRange.Value.Contains(target))
436         {
437             if (_useLinkedList)
438             {
439                 link = ExternalSourcesTreeMethods.Search(source, target);
440             }
441             else
442             {
443                 link = InternalSourcesTreeMethods.Search(source, target);
444             }
445         }
446         else
447         {
448             if (_useLinkedList ||
449                 ↪ GreaterThan(InternalSourcesTreeMethods.CountUsages(source),
450                 ↪ InternalTargetsTreeMethods.CountUsages(target)))
451             {
452                 link = InternalTargetsTreeMethods.Search(source, target);
453             }
454             else
455             {
456                 link = InternalSourcesTreeMethods.Search(source, target);
457             }
458         }
459     }
460     }
461     else
462     {
463         if (_useLinkedList ||
464             ↪ GreaterThan(InternalSourcesTreeMethods.CountUsages(source),
465             ↪ InternalTargetsTreeMethods.CountUsages(target)))
466         {
467             link = InternalTargetsTreeMethods.Search(source, target);
468         }
469         else
470         {
471             link = InternalSourcesTreeMethods.Search(source, target);
472         }
473     }
474     return AreEqual(link, constants.Null) ? GetZero() : GetOne();
475 }
476 }
477 else
478 {
479     if (!Exists(index))
480     {
481         return GetZero();
482     }
483     if (AreEqual(source, any) && AreEqual(target, any))
484     {
485         return GetOne();
486     }
487     ref var storedLinkValue = ref GetLinkDataPartReference(index);
488     if (!AreEqual(source, any) && !AreEqual(target, any))
489     {
490         if (AreEqual(storedLinkValue.Source, source) &&
491             ↪ AreEqual(storedLinkValue.Target, target))
492         {
493             return GetOne();
494         }
495     }
496     return GetZero();
497 }
498 var value = default(TLink);

```

```

491         if (AreEqual(source, any))
492         {
493             value = target;
494         }
495         if (AreEqual(target, any))
496         {
497             value = source;
498         }
499         if (AreEqual(storedLinkValue.Source, value) ||
500             ↪ AreEqual(storedLinkValue.Target, value))
501         {
502             return GetOne();
503         }
504         return GetZero();
505     }
506     throw new NotSupportedException("Другие размеры и способы ограничений не
507     ↪ поддерживаются.");
508 }
509
510 /// <summary>
511 /// <para>
512 /// Eaches the handler.
513 /// </para>
514 /// <para></para>
515 /// </summary>
516 /// <param name="handler">
517 /// <para>The handler.</para>
518 /// </param>
519 /// <param name="restriction">
520 /// <para>The substitution.</para>
521 /// </param>
522 /// <exception cref="NotSupportedException">
523 /// <para>Другие размеры и способы ограничений не поддерживаются.</para>
524 /// </exception>
525 /// </returns>
526 /// <para>The link</para>
527 /// </returns>
528 [MethodImpl(MethodImplOptions.AggressiveInlining)]
529 public virtual TLink Each(ICollection<TLink> restriction, ReadHandler<TLink> handler)
530 {
531     var constants = Constants;
532     var @break = constants.Break;
533     if (restriction.Count == 0)
534     {
535         for (var link = GetOne(); LessOrEqualThan(link,
536             ↪ GetHeaderReference().AllocatedLinks); link = Increment(link))
537         {
538             if (Exists(link) && AreEqual(handler(GetLinkStruct(link)), @break))
539             {
540                 return @break;
541             }
542         }
543         return @break;
544     }
545     var @continue = constants.Continue;
546     var any = constants.Any;
547     var index = restriction[constants.IndexPart];
548     if (restriction.Count == 1)
549     {
550         if (AreEqual(index, any))
551         {
552             return Each(Array.Empty<TLink>(), handler);
553         }
554         if (!Exists(index))
555         {
556             return @continue;
557         }
558         return handler(GetLinkStruct(index));
559     }
560     if (restriction.Count == 2)
561     {
562         var value = restriction[1];
563         if (AreEqual(index, any))

```

```

566 {
567     if (AreEqual(value, any))
568     {
569         return Each(Array.Empty<TLink>(), handler);
570     }
571     if (AreEqual(Each(new Link<TLink>(index, value, any), handler), @break))
572     {
573         return @break;
574     }
575     return Each(new Link<TLink>(index, any, value), handler);
576 }
577 else
578 {
579     if (!Exists(index))
580     {
581         return @continue;
582     }
583     if (AreEqual(value, any))
584     {
585         return handler(GetLinkStruct(index));
586     }
587     ref var storedLinkValue = ref GetLinkDataPartReference(index);
588     if (AreEqual(storedLinkValue.Source, value) ||
589         AreEqual(storedLinkValue.Target, value))
590     {
591         return handler(GetLinkStruct(index));
592     }
593     return @continue;
594 }
595 }
596 if (restriction.Count == 3)
597 {
598     var externalReferencesRange = constants.ExternalReferencesRange;
599     var source = restriction[constants.SourcePart];
600     var target = restriction[constants.TargetPart];
601     if (AreEqual(index, any))
602     {
603         if (AreEqual(source, any) && AreEqual(target, any))
604         {
605             return Each(Array.Empty<TLink>(), handler);
606         }
607         else if (AreEqual(source, any))
608         {
609             if (externalReferencesRange.HasValue &&
610                 ⇨ externalReferencesRange.Value.Contains(target))
611             {
612                 return ExternalTargetsTreeMethods.EachUsage(target, handler);
613             }
614             else
615             {
616                 return InternalTargetsTreeMethods.EachUsage(target, handler);
617             }
618         }
619         else if (AreEqual(target, any))
620         {
621             if (externalReferencesRange.HasValue &&
622                 ⇨ externalReferencesRange.Value.Contains(source))
623             {
624                 return ExternalSourcesTreeMethods.EachUsage(source, handler);
625             }
626             else
627             {
628                 if (_useLinkedList)
629                 {
630                     return InternalSourcesListMethods.EachUsage(source, handler);
631                 }
632                 else
633                 {
634                     return InternalSourcesTreeMethods.EachUsage(source, handler);
635                 }
636             }
637         }
638         else //if(source != Any && target != Any)
639         {
640             TLink link;
641             if (externalReferencesRange.HasValue)
642             {

```

```

641         if (externalReferencesRange.Value.Contains(source) &&
        ↪ externalReferencesRange.Value.Contains(target))
642         {
643             link = ExternalSourcesTreeMethods.Search(source, target);
644         }
645         else if (externalReferencesRange.Value.Contains(source))
646         {
647             link = InternalTargetsTreeMethods.Search(source, target);
648         }
649         else if (externalReferencesRange.Value.Contains(target))
650         {
651             if (_useLinkedList)
652             {
653                 link = ExternalSourcesTreeMethods.Search(source, target);
654             }
655             else
656             {
657                 link = InternalSourcesTreeMethods.Search(source, target);
658             }
659         }
660         else
661         {
662             if (_useLinkedList ||
        ↪ GreaterThan(InternalSourcesTreeMethods.CountUsages(source),
        ↪ InternalTargetsTreeMethods.CountUsages(target)))
663             {
664                 link = InternalTargetsTreeMethods.Search(source, target);
665             }
666             else
667             {
668                 link = InternalSourcesTreeMethods.Search(source, target);
669             }
670         }
671     }
672     else
673     {
674         if (_useLinkedList ||
        ↪ GreaterThan(InternalSourcesTreeMethods.CountUsages(source),
        ↪ InternalTargetsTreeMethods.CountUsages(target)))
675         {
676             link = InternalTargetsTreeMethods.Search(source, target);
677         }
678         else
679         {
680             link = InternalSourcesTreeMethods.Search(source, target);
681         }
682     }
683     return AreEqual(link, constants.Null) ? @continue :
        ↪ handler(GetLinkStruct(link));
684 }
685 }
686 else
687 {
688     if (!Exists(index))
689     {
690         return @continue;
691     }
692     if (AreEqual(source, any) && AreEqual(target, any))
693     {
694         return handler(GetLinkStruct(index));
695     }
696     ref var storedLinkValue = ref GetLinkDataPartReference(index);
697     if (!AreEqual(source, any) && !AreEqual(target, any))
698     {
699         if (AreEqual(storedLinkValue.Source, source) &&
700             AreEqual(storedLinkValue.Target, target))
701         {
702             return handler(GetLinkStruct(index));
703         }
704         return @continue;
705     }
706     var value = default(TLink);
707     if (AreEqual(source, any))
708     {
709         value = target;
710     }
711     if (AreEqual(target, any))
712     {

```

```

713         value = source;
714     }
715     if (AreEqual(storedLinkValue.Source, value) ||
716         AreEqual(storedLinkValue.Target, value))
717     {
718         return handler(GetLinkStruct(index));
719     }
720     return @continue;
721 }
722 }
723 throw new NotSupportedException("Другие размеры и способы ограничений не
    ↳ поддерживаются.");
724 }
725
726 /// <remarks>
727 /// TODO: Возможно можно перемещать значения, если указан индекс, но значение существует
    ↳ в другом месте (но не в менеджере памяти, а в логике Links)
728 /// </remarks>
729 [MethodImpl(MethodImplOptions.AggressiveInlining)]
730 public virtual TLink Update(ICollection<TLink> restriction, ICollection<TLink> substitution,
    ↳ WriteHandler<TLink> handler)
731 {
732     var constants = Constants;
733     var @null = constants.Null;
734     var externalReferencesRange = constants.ExternalReferencesRange;
735     var linkIndex = restriction[constants.IndexPart];
736     var before = GetLinkStruct(linkIndex);
737     ref var link = ref GetLinkDataPartReference(linkIndex);
738     var source = link.Source;
739     var target = link.Target;
740     ref var header = ref GetHeaderReference();
741     ref var rootAsSource = ref header.RootAsSource;
742     ref var rootAsTarget = ref header.RootAsTarget;
743     // Будет корректно работать только в том случае, если пространство выделенной связи
    ↳ предварительно заполнено нулями
744     if (!AreEqual(source, @null))
745     {
746         if (externalReferencesRange.HasValue &&
747             ↳ externalReferencesRange.Value.Contains(source))
748         {
749             ExternalSourcesTreeMethods.Detach(ref rootAsSource, linkIndex);
750         }
751         else
752         {
753             if (_useLinkedList)
754             {
755                 InternalSourcesListMethods.Detach(source, linkIndex);
756             }
757             else
758             {
759                 InternalSourcesTreeMethods.Detach(ref
760                     ↳ GetLinkIndexPartReference(source).RootAsSource, linkIndex);
761             }
762         }
763     }
764     if (!AreEqual(target, @null))
765     {
766         if (externalReferencesRange.HasValue &&
767             ↳ externalReferencesRange.Value.Contains(target))
768         {
769             ExternalTargetsTreeMethods.Detach(ref rootAsTarget, linkIndex);
770         }
771         else
772         {
773             InternalTargetsTreeMethods.Detach(ref
774                 ↳ GetLinkIndexPartReference(target).RootAsTarget, linkIndex);
775         }
776     }
777     source = link.Source = substitution[constants.SourcePart];
778     target = link.Target = substitution[constants.TargetPart];
779     if (!AreEqual(source, @null))
780     {
781         if (externalReferencesRange.HasValue &&
782             ↳ externalReferencesRange.Value.Contains(source))
783         {
784             ExternalSourcesTreeMethods.Attach(ref rootAsSource, linkIndex);
785         }
786         else

```



```

782     {
783         if (_useLinkedList)
784         {
785             InternalSourcesListMethods.AttachAsLast(source, linkIndex);
786         }
787         else
788         {
789             InternalSourcesTreeMethods.Attach(ref
790                 ↪ GetLinkIndexPartReference(source).RootAsSource, linkIndex);
791         }
792     }
793     if (!AreEqual(target, @null))
794     {
795         if (externalReferencesRange.HasValue &&
796             ↪ externalReferencesRange.Value.Contains(target))
797         {
798             ExternalTargetsTreeMethods.Attach(ref rootAsTarget, linkIndex);
799         }
800         else
801         {
802             InternalTargetsTreeMethods.Attach(ref
803                 ↪ GetLinkIndexPartReference(target).RootAsTarget, linkIndex);
804         }
805     }
806     return handler != null ? handler(before, new Link<TLink>(linkIndex, source, target))
807         ↪ : Constants.Continue;
808 }
809
810 /// <remarks>
811 /// TODO: Возможно нужно будет заполнение нулями, если внешнее API ими не заполняет
812 ↪ пространство
813 /// </remarks>
814 [MethodImpl(MethodImplOptions.AggressiveInlining)]
815 public virtual TLink Create(IList<TLink> substitution, WriteHandler<TLink> handler)
816 {
817     ref var header = ref GetHeaderReference();
818     var freeLink = header.FirstFreeLink;
819     if (!AreEqual(freeLink, Constants.Null))
820     {
821         UnusedLinksListMethods.Detach(freeLink);
822     }
823     else
824     {
825         var maximumPossibleInnerReference = Constants.InternalReferencesRange.Maximum;
826         if (GreaterThan(header.AllocatedLinks, maximumPossibleInnerReference))
827         {
828             throw new LinksLimitReachedException<TLink>(maximumPossibleInnerReference);
829         }
830         if (GreaterOrEqualThan(header.AllocatedLinks, Decrement(header.ReservedLinks)))
831         {
832             _dataMemory.ReservedCapacity += _dataMemory.ReservationStepInBytes;
833             _indexMemory.ReservedCapacity += _indexMemory.ReservationStepInBytes;
834             SetPointers(_dataMemory, _indexMemory);
835             header = ref GetHeaderReference();
836             header.ReservedLinks = ConvertToAddress(_dataMemory.ReservedCapacity /
837                 ↪ LinkDataPartSizeInBytes);
838         }
839         freeLink = header.AllocatedLinks = Increment(header.AllocatedLinks);
840         _dataMemory.UsedCapacity += LinkDataPartSizeInBytes;
841         _indexMemory.UsedCapacity += LinkIndexPartSizeInBytes;
842     }
843     return handler != null ? handler(null, GetLinkStruct(freeLink)) : Constants.Continue;
844 }
845
846 /// <summary>
847 /// <para>
848 /// Deletes the substitution.
849 /// </para>
850 /// <para></para>
851 /// </summary>
852 /// <param name="restriction">
853 /// <para>The substitution.</para>
854 /// <para></para>
855 /// </param>
856 [MethodImpl(MethodImplOptions.AggressiveInlining)]
857 public virtual TLink Delete(IList<TLink> restriction, WriteHandler<TLink> handler)
858 {

```

```

854     ref var header = ref GetHeaderReference();
855     var link = restriction[Constants.IndexPart];
856     var before = GetLinkStruct(link);
857     if (LessThan(link, header.AllocatedLinks))
858     {
859         UnusedLinksListMethods.AttachAsFirst(link);
860     }
861     else if (AreEqual(link, header.AllocatedLinks))
862     {
863         header.AllocatedLinks = Decrement(header.AllocatedLinks);
864         _dataMemory.UsedCapacity -= LinkDataPartSizeInBytes;
865         _indexMemory.UsedCapacity -= LinkIndexPartSizeInBytes;
866         // Убираем все связи, находящиеся в списке свободных в конце файла, до тех пор,
867         //   ↳ пока не дойдём до первой существующей связи
868         // Позволяет оптимизировать количество выделенных связей (AllocatedLinks)
869         while (GreaterThan(header.AllocatedLinks, GetZero()) &&
870             ↳ IsUnusedLink(header.AllocatedLinks))
871         {
872             UnusedLinksListMethods.Detach(header.AllocatedLinks);
873             header.AllocatedLinks = Decrement(header.AllocatedLinks);
874             _dataMemory.UsedCapacity -= LinkDataPartSizeInBytes;
875             _indexMemory.UsedCapacity -= LinkIndexPartSizeInBytes;
876         }
877     }
878     return handler != null ? handler(before, null) : Constants.Continue;
879 }
880
881 /// <summary>
882 /// <para>
883 /// Gets the link struct using the specified link index.
884 /// </para>
885 /// <para></para>
886 /// </summary>
887 /// <param name="linkIndex">
888 /// <para>The link index.</para>
889 /// </param>
890 /// <returns>
891 /// <para>A list of t link</para>
892 /// </returns>
893 [MethodImpl(MethodImplOptions.AggressiveInlining)]
894 public IList<TLink> GetLinkStruct(TLink linkIndex)
895 {
896     ref var link = ref GetLinkDataPartReference(linkIndex);
897     return new Link<TLink>(linkIndex, link.Source, link.Target);
898 }
899
900 /// <remarks>
901 /// TODO: Возможно это должно быть событием, вызываемым из IMemory, в том случае, если
902 ///   ↳ адрес реально поменялся
903 ///
904 /// Указатель this.links может быть в том же месте,
905 /// так как 0-я связь не используется и имеет такой же размер как Header,
906 /// поэтому header размещается в том же месте, что и 0-я связь
907 /// </remarks>
908 [MethodImpl(MethodImplOptions.AggressiveInlining)]
909 protected abstract void SetPointers(IResizableDirectMemory dataMemory,
910     ↳ IResizableDirectMemory indexMemory);
911
912 /// <summary>
913 /// <para>
914 /// Resets the pointers.
915 /// </para>
916 /// </summary>
917 [MethodImpl(MethodImplOptions.AggressiveInlining)]
918 protected virtual void ResetPointers()
919 {
920     InternalSourcesListMethods = null;
921     InternalSourcesTreeMethods = null;
922     ExternalSourcesTreeMethods = null;
923     InternalTargetsTreeMethods = null;
924     ExternalTargetsTreeMethods = null;
925     UnusedLinksListMethods = null;
926 }
927
928 /// <summary>
929 /// <para>

```

```

929     /// Gets the header reference.
930     /// </para>
931     /// <para></para>
932     /// </summary>
933     /// <returns>
934     /// <para>A ref links header of t link</para>
935     /// <para></para>
936     /// </returns>
937     [MethodImpl(MethodImplOptions.AggressiveInlining)]
938     protected abstract ref LinksHeader<TLink> GetHeaderReference();
939
940     /// <summary>
941     /// <para>
942     /// Gets the link data part reference using the specified link index.
943     /// </para>
944     /// <para></para>
945     /// </summary>
946     /// <param name="linkIndex">
947     /// <para>The link index.</para>
948     /// <para></para>
949     /// </param>
950     /// <returns>
951     /// <para>A ref raw link data part of t link</para>
952     /// <para></para>
953     /// </returns>
954     [MethodImpl(MethodImplOptions.AggressiveInlining)]
955     protected abstract ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink linkIndex);
956
957     /// <summary>
958     /// <para>
959     /// Gets the link index part reference using the specified link index.
960     /// </para>
961     /// <para></para>
962     /// </summary>
963     /// <param name="linkIndex">
964     /// <para>The link index.</para>
965     /// <para></para>
966     /// </param>
967     /// <returns>
968     /// <para>A ref raw link index part of t link</para>
969     /// <para></para>
970     /// </returns>
971     [MethodImpl(MethodImplOptions.AggressiveInlining)]
972     protected abstract ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink
    ↪ linkIndex);
973
974     /// <summary>
975     /// <para>
976     /// Determines whether this instance exists.
977     /// </para>
978     /// <para></para>
979     /// </summary>
980     /// <param name="link">
981     /// <para>The link.</para>
982     /// <para></para>
983     /// </param>
984     /// <returns>
985     /// <para>The bool</para>
986     /// <para></para>
987     /// </returns>
988     [MethodImpl(MethodImplOptions.AggressiveInlining)]
989     protected virtual bool Exists(TLink link)
990         => GreaterOrEqualThan(link, Constants.InternalReferencesRange.Minimum)
991             && LessOrEqualThan(link, GetHeaderReference().AllocatedLinks)
992             && !IsUnusedLink(link);
993
994     /// <summary>
995     /// <para>
996     /// Determines whether this instance is unused link.
997     /// </para>
998     /// <para></para>
999     /// </summary>
1000    /// <param name="linkIndex">
1001    /// <para>The link index.</para>
1002    /// <para></para>
1003    /// </param>
1004    /// <returns>
1005    /// <para>The bool</para>

```

```

1006    /// <para></para>
1007    /// </returns>
1008    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1009    protected virtual bool IsUnusedLink(TLink linkIndex)
1010    {
1011        if (!AreEqual(GetHeaderReference().FirstFreeLink, linkIndex)) // May be this check
1012        ↪ is not needed
1013        {
1014            // TODO: Reduce access to memory in different location (should be enough to use
1015            ↪ just linkIndexPart)
1016            ref var linkDataPart = ref GetLinkDataPartReference(linkIndex);
1017            ref var linkIndexPart = ref GetLinkIndexPartReference(linkIndex);
1018            return AreEqual(linkIndexPart.SizeAsTarget, default) &&
1019            ↪ !AreEqual(linkDataPart.Source, default);
1020        }
1021        else
1022        {
1023            return true;
1024        }
1025    }
1026
1027    /// <summary>
1028    /// <para>
1029    /// Gets the one.
1030    /// </para>
1031    /// <para></para>
1032    /// </summary>
1033    /// <returns>
1034    /// <para>The link</para>
1035    /// <para></para>
1036    /// </returns>
1037    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1038    protected virtual TLink GetOne() => _one;
1039
1040    /// <summary>
1041    /// <para>
1042    /// Gets the zero.
1043    /// </para>
1044    /// <para></para>
1045    /// </summary>
1046    /// <returns>
1047    /// <para>The link</para>
1048    /// <para></para>
1049    /// </returns>
1050    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1051    protected virtual TLink GetZero() => default;
1052
1053    /// <summary>
1054    /// <para>
1055    /// Determines whether this instance are equal.
1056    /// </para>
1057    /// <para></para>
1058    /// </summary>
1059    /// <param name="first">
1060    /// <para>The first.</para>
1061    /// <para></para>
1062    /// </param>
1063    /// <param name="second">
1064    /// <para>The second.</para>
1065    /// <para></para>
1066    /// </param>
1067    /// <returns>
1068    /// <para>The bool</para>
1069    /// <para></para>
1070    /// </returns>
1071    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1072    protected virtual bool AreEqual(TLink first, TLink second) =>
1073    ↪ _equalityComparer.Equals(first, second);
1074
1075    /// <summary>
1076    /// <para>
1077    /// Determines whether this instance less than.
1078    /// </para>
1079    /// <para></para>
1080    /// </summary>
1081    /// <param name="first">
1082    /// <para>The first.</para>
1083    /// <para></para>

```

```

1080     /// </param>
1081     /// <param name="second">
1082     /// <para>The second.</para>
1083     /// <para></para>
1084     /// </param>
1085     /// <returns>
1086     /// <para>The bool</para>
1087     /// <para></para>
1088     /// </returns>
1089     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1090     protected virtual bool LessThan(TLink first, TLink second) => _comparer.Compare(first,
1091     ↪ second) < 0;
1092
1093     /// <summary>
1094     /// <para>
1095     /// Determines whether this instance less or equal than.
1096     /// </para>
1097     /// <para></para>
1098     /// </summary>
1099     /// <param name="first">
1100     /// <para>The first.</para>
1101     /// <para></para>
1102     /// </param>
1103     /// <param name="second">
1104     /// <para>The second.</para>
1105     /// <para></para>
1106     /// </param>
1107     /// <returns>
1108     /// <para>The bool</para>
1109     /// <para></para>
1110     /// </returns>
1111     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1112     protected virtual bool LessOrEqualThan(TLink first, TLink second) =>
1113     ↪ _comparer.Compare(first, second) <= 0;
1114
1115     /// <summary>
1116     /// <para>
1117     /// Determines whether this instance greater than.
1118     /// </para>
1119     /// <para></para>
1120     /// </summary>
1121     /// <param name="first">
1122     /// <para>The first.</para>
1123     /// <para></para>
1124     /// </param>
1125     /// <param name="second">
1126     /// <para>The second.</para>
1127     /// <para></para>
1128     /// </param>
1129     /// <returns>
1130     /// <para>The bool</para>
1131     /// <para></para>
1132     /// </returns>
1133     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1134     protected virtual bool GreaterThan(TLink first, TLink second) =>
1135     ↪ _comparer.Compare(first, second) > 0;
1136
1137     /// <summary>
1138     /// <para>
1139     /// Determines whether this instance greater or equal than.
1140     /// </para>
1141     /// <para></para>
1142     /// </summary>
1143     /// <param name="first">
1144     /// <para>The first.</para>
1145     /// <para></para>
1146     /// </param>
1147     /// <param name="second">
1148     /// <para>The second.</para>
1149     /// <para></para>
1150     /// </param>
1151     /// <returns>
1152     /// <para>The bool</para>
1153     /// <para></para>
1154     /// </returns>
1155     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1156     protected virtual bool GreaterOrEqualThan(TLink first, TLink second) =>
1157     ↪ _comparer.Compare(first, second) >= 0;

```

```

1154
1155     /// <summary>
1156     /// <para>
1157     /// Converts the to int 64 using the specified value.
1158     /// </para>
1159     /// <para></para>
1160     /// </summary>
1161     /// <param name="value">
1162     /// <para>The value.</para>
1163     /// <para></para>
1164     /// </param>
1165     /// <returns>
1166     /// <para>The long</para>
1167     /// <para></para>
1168     /// </returns>
1169     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1170     protected virtual long ConvertToInt64(TLink value) =>
1171         ↪ _addressToInt64Converter.Convert(value);
1172
1173     /// <summary>
1174     /// <para>
1175     /// Converts the to address using the specified value.
1176     /// </para>
1177     /// <para></para>
1178     /// </summary>
1179     /// <param name="value">
1180     /// <para>The value.</para>
1181     /// <para></para>
1182     /// </param>
1183     /// <returns>
1184     /// <para>The link</para>
1185     /// <para></para>
1186     /// </returns>
1187     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1188     protected virtual TLink ConvertToAddress(long value) =>
1189         ↪ _int64ToAddressConverter.Convert(value);
1190
1191     /// <summary>
1192     /// <para>
1193     /// Adds the first.
1194     /// </para>
1195     /// <para></para>
1196     /// </summary>
1197     /// <param name="first">
1198     /// <para>The first.</para>
1199     /// <para></para>
1200     /// </param>
1201     /// <param name="second">
1202     /// <para>The second.</para>
1203     /// <para></para>
1204     /// </param>
1205     /// <returns>
1206     /// <para>The link</para>
1207     /// <para></para>
1208     /// </returns>
1209     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1210     protected virtual TLink Add(TLink first, TLink second) => Arithmetic<TLink>.Add(first,
1211         ↪ second);
1212
1213     /// <summary>
1214     /// <para>
1215     /// Subtracts the first.
1216     /// </para>
1217     /// <para></para>
1218     /// </summary>
1219     /// <param name="first">
1220     /// <para>The first.</para>
1221     /// <para></para>
1222     /// </param>
1223     /// <param name="second">
1224     /// <para>The second.</para>
1225     /// <para></para>
1226     /// </param>
1227     /// <returns>
1228     /// <para>The link</para>
1229     /// <para></para>
1230     /// </returns>
1231     [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

1229     protected virtual TLink Subtract(TLink first, TLink second) =>
1230         ↪ Arithmetic<TLink>.Subtract(first, second);
1231
1232     /// <summary>
1233     /// <para>
1234     /// Increments the link.
1235     /// </para>
1236     /// <para></para>
1237     /// </summary>
1238     /// <param name="link">
1239     /// <para>The link.</para>
1240     /// <para></para>
1241     /// </param>
1242     /// <returns>
1243     /// <para>The link</para>
1244     /// <para></para>
1245     /// </returns>
1246     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1247     protected virtual TLink Increment(TLink link) => Arithmetic<TLink>.Increment(link);
1248
1249     /// <summary>
1250     /// <para>
1251     /// Decrements the link.
1252     /// </para>
1253     /// <para></para>
1254     /// </summary>
1255     /// <param name="link">
1256     /// <para>The link.</para>
1257     /// <para></para>
1258     /// </param>
1259     /// <returns>
1260     /// <para>The link</para>
1261     /// <para></para>
1262     /// </returns>
1263     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1264     protected virtual TLink Decrement(TLink link) => Arithmetic<TLink>.Decrement(link);
1265
1266     #region Disposable
1267
1268     /// <summary>
1269     /// <para>
1270     /// Gets the allow multiple dispose calls value.
1271     /// </para>
1272     /// <para></para>
1273     /// </summary>
1274     protected override bool AllowMultipleDisposeCalls
1275     {
1276         [MethodImpl(MethodImplOptions.AggressiveInlining)]
1277         get => true;
1278     }
1279
1280     /// <summary>
1281     /// <para>
1282     /// Disposes the manual.
1283     /// </para>
1284     /// <para></para>
1285     /// </summary>
1286     /// <param name="manual">
1287     /// <para>The manual.</para>
1288     /// <para></para>
1289     /// </param>
1290     /// <param name="wasDisposed">
1291     /// <para>The was disposed.</para>
1292     /// <para></para>
1293     /// </param>
1294     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1295     protected override void Dispose(bool manual, bool wasDisposed)
1296     {
1297         if (!wasDisposed)
1298         {
1299             ResetPointers();
1300             _dataMemory.DisposeIfPossible();
1301             _indexMemory.DisposeIfPossible();
1302         }
1303     }
1304
1305     #endregion

```

1.46 ./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         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
22             ↳ UncheckedConverter<TLink, long>.Default;
23         private readonly byte* _links;
24         private readonly byte* _header;
25
26         /// <summary>
27         /// <para>
28         /// Initializes a new <see cref="UnusedLinksListMethods"/> instance.
29         /// </para>
30         /// <para></para>
31         /// </summary>
32         /// <param name="links">
33         /// <para>A links.</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 UnusedLinksListMethods(byte* links, byte* header)
42         {
43             _links = links;
44             _header = header;
45         }
46
47         /// <summary>
48         /// <para>
49         /// Gets the header reference.
50         /// </para>
51         /// <para></para>
52         /// </summary>
53         /// <returns>
54         /// <para>A ref links header of t link</para>
55         /// <para></para>
56         /// </returns>
57         [MethodImpl(MethodImplOptions.AggressiveInlining)]
58         protected virtual ref LinksHeader<TLink> GetHeaderReference() => ref
59             ↳ AsRef<LinksHeader<TLink>>(_header);
60
61         /// <summary>
62         /// <para>
63         /// Gets the link data part reference using the specified link.
64         /// </para>
65         /// <para></para>
66         /// </summary>
67         /// <param name="link">
68         /// <para>The link.</para>
69         /// <para></para>
70         /// </param>
71         /// <returns>
72         /// <para>A ref raw link data part of t link</para>
73         /// <para></para>
74         /// </returns>
75         [MethodImpl(MethodImplOptions.AggressiveInlining)]

```



```

73     protected virtual ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) => ref
74     ↪ AsRef<RawLinkDataPart<TLink>>(_links + (RawLinkDataPart<TLink>.SizeInBytes *
75     ↪ _addressToInt64Converter.Convert(link)));
76
77     /// <summary>
78     /// <para>
79     /// Gets the first.
80     /// </para>
81     /// <para></para>
82     /// </summary>
83     /// <returns>
84     /// <para>The link</para>
85     /// <para></para>
86     /// </returns>
87     [MethodImpl(MethodImplOptions.AggressiveInlining)]
88     protected override TLink GetFirst() => GetHeaderReference().FirstFreeLink;
89
90     /// <summary>
91     /// <para>
92     /// Gets the last.
93     /// </para>
94     /// <para></para>
95     /// </summary>
96     /// <returns>
97     /// <para>The link</para>
98     /// <para></para>
99     /// </returns>
100    [MethodImpl(MethodImplOptions.AggressiveInlining)]
101    protected override TLink GetLast() => GetHeaderReference().LastFreeLink;
102
103    /// <summary>
104    /// <para>
105    /// Gets the previous using the specified element.
106    /// </para>
107    /// <para></para>
108    /// </summary>
109    /// <param name="element">
110    /// <para>The element.</para>
111    /// <para></para>
112    /// </param>
113    /// <returns>
114    /// <para>The link</para>
115    /// <para></para>
116    /// </returns>
117    [MethodImpl(MethodImplOptions.AggressiveInlining)]
118    protected override TLink GetPrevious(TLink element) =>
119    ↪ GetLinkDataPartReference(element).Source;
120
121    /// <summary>
122    /// <para>
123    /// Gets the next using the specified element.
124    /// </para>
125    /// <para></para>
126    /// </summary>
127    /// <param name="element">
128    /// <para>The element.</para>
129    /// <para></para>
130    /// </param>
131    /// <returns>
132    /// <para>The link</para>
133    /// <para></para>
134    /// </returns>
135    [MethodImpl(MethodImplOptions.AggressiveInlining)]
136    protected override TLink GetNext(TLink element) =>
137    ↪ GetLinkDataPartReference(element).Target;
138
139    /// <summary>
140    /// <para>
141    /// Gets the size.
142    /// </para>
143    /// <para></para>
144    /// </summary>
145    /// <returns>
146    /// <para>The link</para>
147    /// <para></para>
148    /// </returns>
149    [MethodImpl(MethodImplOptions.AggressiveInlining)]
150    protected override TLink GetSize() => GetHeaderReference().FreeLinks;

```

```

147
148     /// <summary>
149     /// <para>
150     /// Sets the first using the specified element.
151     /// </para>
152     /// <para></para>
153     /// </summary>
154     /// <param name="element">
155     /// <para>The element.</para>
156     /// <para></para>
157     /// </param>
158     [MethodImpl(MethodImplOptions.AggressiveInlining)]
159     protected override void SetFirst(TLink element) => GetHeaderReference().FirstFreeLink =
        ↪ element;
160
161     /// <summary>
162     /// <para>
163     /// Sets the last using the specified element.
164     /// </para>
165     /// <para></para>
166     /// </summary>
167     /// <param name="element">
168     /// <para>The element.</para>
169     /// <para></para>
170     /// </param>
171     [MethodImpl(MethodImplOptions.AggressiveInlining)]
172     protected override void SetLast(TLink element) => GetHeaderReference().LastFreeLink =
        ↪ element;
173
174     /// <summary>
175     /// <para>
176     /// Sets the previous using the specified element.
177     /// </para>
178     /// <para></para>
179     /// </summary>
180     /// <param name="element">
181     /// <para>The element.</para>
182     /// <para></para>
183     /// </param>
184     /// <param name="previous">
185     /// <para>The previous.</para>
186     /// <para></para>
187     /// </param>
188     [MethodImpl(MethodImplOptions.AggressiveInlining)]
189     protected override void SetPrevious(TLink element, TLink previous) =>
        ↪ GetLinkDataPartReference(element).Source = previous;
190
191     /// <summary>
192     /// <para>
193     /// Sets the next using the specified element.
194     /// </para>
195     /// <para></para>
196     /// </summary>
197     /// <param name="element">
198     /// <para>The element.</para>
199     /// <para></para>
200     /// </param>
201     /// <param name="next">
202     /// <para>The next.</para>
203     /// <para></para>
204     /// </param>
205     [MethodImpl(MethodImplOptions.AggressiveInlining)]
206     protected override void SetNext(TLink element, TLink next) =>
        ↪ GetLinkDataPartReference(element).Target = next;
207
208     /// <summary>
209     /// <para>
210     /// Sets the size using the specified size.
211     /// </para>
212     /// <para></para>
213     /// </summary>
214     /// <param name="size">
215     /// <para>The size.</para>
216     /// <para></para>
217     /// </param>
218     [MethodImpl(MethodImplOptions.AggressiveInlining)]
219     protected override void SetSize(TLink size) => GetHeaderReference().FreeLinks = size;
220 }

```

1.47 ./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     /// <para></para>
15     /// </summary>
16     public struct RawLinkDataPart<TLink> : IEquatable<RawLinkDataPart<TLink>>
17     {
18         private static readonly EqualityComparer<TLink> _equalityComparer =
19             ↪ EqualityComparer<TLink>.Default;
20
21         /// <summary>
22         /// <para>
23         /// The size.
24         /// </para>
25         /// <para></para>
26         /// </summary>
27         public static readonly long SizeInBytes = Structure<RawLinkDataPart<TLink>>.Size;
28
29         /// <summary>
30         /// <para>
31         /// The source.
32         /// </para>
33         /// <para></para>
34         /// </summary>
35         public TLink Source;
36
37         /// <summary>
38         /// <para>
39         /// The target.
40         /// </para>
41         /// <para></para>
42         /// </summary>
43         public TLink Target;
44
45         /// <summary>
46         /// <para>
47         /// Determines whether this instance equals.
48         /// </para>
49         /// <para></para>
50         /// </summary>
51         /// <param name="obj">
52         /// <para>The obj.</para>
53         /// <para></para>
54         /// </param>
55         /// <returns>
56         /// <para>The bool</para>
57         /// <para></para>
58         /// </returns>
59         [MethodImpl(MethodImplOptions.AggressiveInlining)]
60         public override bool Equals(object obj) => obj is RawLinkDataPart<TLink> link ?
61             ↪ Equals(link) : false;
62
63         /// <summary>
64         /// <para>
65         /// Determines whether this instance equals.
66         /// </para>
67         /// <para></para>
68         /// </summary>
69         /// <param name="other">
70         /// <para>The other.</para>
71         /// <para></para>
72         /// </param>
73         /// <returns>
74         /// <para>The bool</para>
75         /// <para></para>
76         /// </returns>
77         [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

75     public bool Equals(RawLinkDataPart<TLink> other)
76     => _equalityComparer.Equals(Source, other.Source)
77         && _equalityComparer.Equals(Target, other.Target);
78
79     /// <summary>
80     /// <para>
81     /// Gets the hash code.
82     /// </para>
83     /// <para></para>
84     /// </summary>
85     /// <returns>
86     /// <para>The int</para>
87     /// <para></para>
88     /// </returns>
89     [MethodImpl(MethodImplOptions.AggressiveInlining)]
90     public override int GetHashCode() => (Source, Target).GetHashCode();
91
92     [MethodImpl(MethodImplOptions.AggressiveInlining)]
93     public static bool operator ==(RawLinkDataPart<TLink> left, RawLinkDataPart<TLink>
94     ↪ right) => left.Equals(right);
95
96     [MethodImpl(MethodImplOptions.AggressiveInlining)]
97     public static bool operator !=(RawLinkDataPart<TLink> left, RawLinkDataPart<TLink>
98     ↪ right) => !(left == right);
99 }
100 }

```

1.48 ./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         private static readonly EqualityComparer<TLink> _equalityComparer =
19         ↪ EqualityComparer<TLink>.Default;
20
21         /// <summary>
22         /// <para>
23         /// The size.
24         /// </para>
25         /// <para></para>
26         /// </summary>
27         public static readonly long SizeInBytes = Structure<RawLinkIndexPart<TLink>>.Size;
28
29         /// <summary>
30         /// <para>
31         /// The root as source.
32         /// </para>
33         /// <para></para>
34         /// </summary>
35         public TLink RootAsSource;
36
37         /// <summary>
38         /// <para>
39         /// The left as source.
40         /// </para>
41         /// <para></para>
42         /// </summary>
43         public TLink LeftAsSource;
44
45         /// <summary>
46         /// <para>
47         /// The right as source.
48         /// </para>
49         /// <para></para>
50         /// </summary>
51         public TLink RightAsSource;
52     }
53 }

```

```

51     /// The size as source.
52     /// </para>
53     /// <para></para>
54     /// </summary>
55     public TLink SizeAsSource;
56     /// <summary>
57     /// <para>
58     /// The root as target.
59     /// </para>
60     /// <para></para>
61     /// </summary>
62     public TLink RootAsTarget;
63     /// <summary>
64     /// <para>
65     /// The left as target.
66     /// </para>
67     /// <para></para>
68     /// </summary>
69     public TLink LeftAsTarget;
70     /// <summary>
71     /// <para>
72     /// The right as target.
73     /// </para>
74     /// <para></para>
75     /// </summary>
76     public TLink RightAsTarget;
77     /// <summary>
78     /// <para>
79     /// The size as target.
80     /// </para>
81     /// <para></para>
82     /// </summary>
83     public TLink SizeAsTarget;
84
85     /// <summary>
86     /// <para>
87     /// Determines whether this instance equals.
88     /// </para>
89     /// <para></para>
90     /// </summary>
91     /// <param name="obj">
92     /// <para>The obj.</para>
93     /// <para></para>
94     /// </param>
95     /// <returns>
96     /// <para>The bool</para>
97     /// <para></para>
98     /// </returns>
99     [MethodImpl(MethodImplOptions.AggressiveInlining)]
100    public override bool Equals(object obj) => obj is RawLinkIndexPart<TLink> link ?
        ↳ Equals(link) : false;
101
102    /// <summary>
103    /// <para>
104    /// Determines whether this instance equals.
105    /// </para>
106    /// <para></para>
107    /// </summary>
108    /// <param name="other">
109    /// <para>The other.</para>
110    /// <para></para>
111    /// </param>
112    /// <returns>
113    /// <para>The bool</para>
114    /// <para></para>
115    /// </returns>
116    [MethodImpl(MethodImplOptions.AggressiveInlining)]
117    public bool Equals(RawLinkIndexPart<TLink> other)
118        => _equalityComparer.Equals(RootAsSource, other.RootAsSource)
119        && _equalityComparer.Equals(LeftAsSource, other.LeftAsSource)
120        && _equalityComparer.Equals(RightAsSource, other.RightAsSource)
121        && _equalityComparer.Equals(SizeAsSource, other.SizeAsSource)
122        && _equalityComparer.Equals(RootAsTarget, other.RootAsTarget)
123        && _equalityComparer.Equals(LeftAsTarget, other.LeftAsTarget)
124        && _equalityComparer.Equals(RightAsTarget, other.RightAsTarget)
125        && _equalityComparer.Equals(SizeAsTarget, other.SizeAsTarget);
126
127    /// <summary>

```

```

128     /// <para>
129     /// Gets the hash code.
130     /// </para>
131     /// <para></para>
132     /// </summary>
133     /// <returns>
134     /// <para>The int</para>
135     /// <para></para>
136     /// </returns>
137     [MethodImpl(MethodImplOptions.AggressiveInlining)]
138     public override int GetHashCode() => (RootAsSource, LeftAsSource, RightAsSource,
    ↪ SizeAsSource, RootAsTarget, LeftAsTarget, RightAsTarget, SizeAsTarget).GetHashCode();
139
140     [MethodImpl(MethodImplOptions.AggressiveInlining)]
141     public static bool operator ==(RawLinkIndexPart<TLink> left, RawLinkIndexPart<TLink>
    ↪ right) => left.Equals(right);
142
143     [MethodImpl(MethodImplOptions.AggressiveInlining)]
144     public static bool operator !=(RawLinkIndexPart<TLink> left, RawLinkIndexPart<TLink>
    ↪ right) => !(left == right);
145 }
146 }

```

1.49 ./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 :
    ↪ 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
    ↪ cref="UInt32ExternalLinksRecursionlessSizeBalancedTreeMethodsBase"/> 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
        ↳ UInt32 ExternalLinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<TLink>
        ↳ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
        ↳ linksIndexParts, LinksHeader<TLink>* header)
        : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
    {
        LinksDataParts = linksDataParts;
        LinksIndexParts = linksIndexParts;
        Header = header;
    }

71
72     /// <summary>
73     /// <para>
74     /// Gets the zero.
75     /// </para>
76     /// <para></para>
77     /// </summary>
78     /// <returns>
79     /// <para>The link</para>
80     /// <para></para>
81     /// </returns>
82     [MethodImpl(MethodImplOptions.AggressiveInlining)]
83     protected override TLink GetZero() => OU;
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 == OU;
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>

```



```

205     /// <param name="value">
206     /// <para>The value.</para>
207     /// </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
    ↪ 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>
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];
423         return FirstIsToLeftOfSecond(firstLink.Source, firstLink.Target,
424             ↪ secondLink.Source, secondLink.Target);
425     }
426
427     /// <summary>
428     /// <para>
429     /// Determines whether this instance first is to the right of second.
430     /// </para>
431     /// <para></para>
432     /// </summary>
433     /// <param name="first">
434     /// <para>The first.</para>
435     /// <para></para>
436     /// </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 }

```

1.50 ./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 :
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;
41
42         /// <summary>
43         /// <para>
44         /// Initializes a new <see cref="UInt32ExternalLinksSizeBalancedTreeMethodsBase"/>
45         ↪ 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>

```

```

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 UInt32 ExternalLinksSizeBalancedTreeMethodsBase(LinksConstants<TLink>
        ↳ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
        ↳ linksIndexParts, LinksHeader<TLink>* header)
65         : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
66     {
67         LinksDataParts = linksDataParts;
68         LinksIndexParts = linksIndexParts;
69         Header = header;
70     }
71
72     /// <summary>
73     /// <para>
74     /// Gets the zero.
75     /// </para>
76     /// <para></para>
77     /// </summary>
78     /// <returns>
79     /// <para>The link</para>
80     /// <para></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     /// <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>

```

```

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
    ↪ 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>
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];
423        return FirstIsToLeftOfSecond(firstLink.Source, firstLink.Target,
424            ↪ secondLink.Source, secondLink.Target);
425    }
426
427    /// <summary>
428    /// <para>
429    /// Determines whether this instance first is to the right of second.
430    /// </para>
431    /// <para></para>
432    /// </summary>
433    /// <param name="first">
434    /// <para>The first.</para>
435    /// <para></para>
436    /// </param>
437    /// <param name="second">
438    /// <para>The second.</para>
439    /// <para></para>
440    /// </param>
441    /// <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 }

```

1.51 ./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="UInt32ExternalLinksSourcesRecursionlessSizeBalancedTreeMethodsBase"/>
15     public unsafe class UInt32ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods :
16     ↪ UInt32ExternalLinksSourcesRecursionlessSizeBalancedTreeMethodsBase
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see
21         ↪ cref="UInt32ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods"/> 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         ↪ UInt32ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods(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>
61         /// </returns>
62         [MethodImpl(MethodImplOptions.AggressiveInlining)]
63         protected override ref TLink GetLeftReference(TLink node) => ref
64         ↪ LinksIndexParts[node].LeftAsSource;

```

```

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     ↪ 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">

```

```

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].RightAsSource = 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].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        ↳ LinksIndexParts[node].SizeAsSource = 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->RootAsSource;
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)]
208    protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Source;
209    /// <summary>
210    /// <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.
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.LeftAsSource = Zero;
287         link.RightAsSource = Zero;

```

```

284         link.SizeAsSource = Zero;
285     }
286 }
287 }

```

1.52 ./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">
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 UInt32ExternalLinksSourcesSizeBalancedTreeMethods(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 }

```

```

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) =>
        ↳ LinksIndexParts[node].LeftAsSource = 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].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.
177     /// </para>
178     /// </summary>
179     /// <returns>
180     /// <para>The link</para>
181     /// </returns>
182     [MethodImpl(MethodImplOptions.AggressiveInlining)]
183     protected override TLink GetTreeRoot() => Header->RootAsSource;
184
185     /// <summary>
186     /// <para>
187     /// Gets the base part value using the specified node.
188     /// </para>
189     /// </summary>
190     /// <param name="node">
191     /// <para>The node.</para>
192     /// </param>
193     /// <returns>
194     /// <para>The link</para>
195     /// </returns>
196     [MethodImpl(MethodImplOptions.AggressiveInlining)]
197     protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Source;
198
199     /// <summary>
200     /// <para>
201     /// Determines whether this instance first is to the left of second.
202     /// </para>
203     /// </summary>
204     /// <param name="firstSource">
205     /// <para>The first source.</para>
206     /// </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>
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.
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.LeftAsSource = Zero;
287         link.RightAsSource = Zero;
288         link.SizeAsSource = Zero;
289     }
290 }
291 }

```

1.53 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32ExternalLinksTargetsRecursionlessSizeBalance

```

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>
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        ↪ UInt32ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods(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>
61        /// </returns>
62        [MethodImpl(MethodImplOptions.AggressiveInlining)]
63        protected override ref TLink GetLeftReference(TLink node) => ref
64        ↪ LinksIndexParts[node].LeftAsTarget;
65
66        /// <summary>
67        /// <para>
68        /// Gets the right reference using the specified node.
69        /// </para>
70        /// <para></para>
71        /// </summary>
72        /// <param name="node">
73        /// <para>The node.</para>
74        /// <para></para>
75        /// </param>
76        /// <returns>
77        /// <para>The ref link</para>
78        /// <para></para>
79        /// </returns>
80        [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     /// </summary>
82     /// <param name="node">
83     /// <para>The node.</para>
84     /// </param>
85     /// </summary>
86     /// <returns>
87     /// <para>The link</para>
88     /// </returns>
89     [MethodImpl(MethodImplOptions.AggressiveInlining)]
90     protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsTarget;
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     /// </param>
100    /// </summary>
101    /// <returns>
102    /// <para>The link</para>
103    /// </returns>
104    [MethodImpl(MethodImplOptions.AggressiveInlining)]
105    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsTarget;
106
107    /// <summary>
108    /// <para>
109    /// Sets the left using the specified node.
110    /// </para>
111    /// </summary>
112    /// <param name="node">
113    /// <para>The node.</para>
114    /// </param>
115    /// <param name="left">
116    /// <para>The left.</para>
117    /// </param>
118    [MethodImpl(MethodImplOptions.AggressiveInlining)]
119    protected override void SetLeft(TLink node, TLink left) =>
120        ↳ LinksIndexParts[node].LeftAsTarget = left;
121
122    /// <summary>
123    /// <para>
124    /// Sets the right using the specified node.
125    /// </para>
126    /// </summary>
127    /// <param name="node">
128    /// <para>The node.</para>
129    /// </param>
130    /// <param name="right">
131    /// <para>The right.</para>
132    /// </param>
133    [MethodImpl(MethodImplOptions.AggressiveInlining)]
134    protected override void SetRight(TLink node, TLink right) =>
135        ↳ LinksIndexParts[node].RightAsTarget = right;
136
137    /// <summary>
138    /// <para>
139    /// Gets the size using the specified node.
140    /// </para>
141    /// </summary>
142    /// <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) => LinksIndexParts[node].SizeAsTarget;
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].SizeAsTarget = 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->RootAsTarget;
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].Target;
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>

```

```

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 }

```

1.54 ./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"/>
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 UInt32ExternalLinksTargetsSizeBalancedTreeMethods(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>

```

```

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>

```

```

158 [MethodImpl(MethodImplOptions.AggressiveInlining)]
159 protected override TLink GetSize(TLink node) => LinksIndexParts[node].SizeAsTarget;
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].SizeAsTarget = size;
178
179 /// <summary>
180 /// <para>
181 /// Gets the tree root.
182 /// </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 FirstIsToTheLeftOfSecond(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     /// </summary>
245     /// <param name="firstSource">
246     /// <para>The first source.</para>
247     /// </param>
248     /// <param name="firstTarget">
249     /// <para>The first target.</para>
250     /// </param>
251     /// <param name="secondSource">
252     /// <para>The second source.</para>
253     /// </param>
254     /// <param name="secondTarget">
255     /// <para>The second target.</para>
256     /// </param>
257     /// <returns>
258     /// <para>The bool</para>
259     /// </returns>
260     [MethodImpl(MethodImplOptions.AggressiveInlining)]
261     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
262     ↪ TLink secondSource, TLink 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     /// </summary>
271     /// <param name="node">
272     /// <para>The node.</para>
273     /// </param>
274     [MethodImpl(MethodImplOptions.AggressiveInlining)]
275     protected override void ClearNode(TLink node)
276     {
277         ref var link = ref LinksIndexParts[node];
278         link.LeftAsTarget = Zero;
279         link.RightAsTarget = Zero;
280         link.SizeAsTarget = Zero;
281     }
282 }
283
284 }

```

1.55 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32InternalLinksRecursionlessSizeBalancedTreeM

```

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     /// </summary>
14     /// <seealso cref="InternalLinksRecursionlessSizeBalancedTreeMethodsBase{TLink}"/>
15     public unsafe abstract class UInt32InternalLinksRecursionlessSizeBalancedTreeMethodsBase :
16     ↪ 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
43     ↪ cref="UInt32InternalLinksRecursionlessSizeBalancedTreeMethodsBase"/> instance.
44     /// </para>
45     /// <para></para>
46     /// </summary>
47     /// <param name="constants">
48     /// <para>A constants.</para>
49     /// </param>
50     /// <param name="linksDataParts">
51     /// <para>A links data parts.</para>
52     /// </param>
53     /// <param name="linksIndexParts">
54     /// <para>A links index parts.</para>
55     /// </param>
56     /// <param name="header">
57     /// <para>A header.</para>
58     /// </param>
59     [MethodImpl(MethodImplOptions.AggressiveInlining)]
60     protected
61     ↪ UInt32InternalLinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<TLink>
62     ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
63     ↪ linksIndexParts, LinksHeader<TLink>* header)
64     : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
65     {
66         LinksDataParts = linksDataParts;
67         LinksIndexParts = linksIndexParts;
68         Header = header;
69     }
70
71     /// <summary>
72     /// <para>
73     /// Gets the zero.
74     /// </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() => 0U;
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
    ↪ 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(TLink value) => value == OUL; // 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) =>
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>

```

```

400     /// <para></para>
401     /// </returns>
402     [MethodImpl(MethodImplOptions.AggressiveInlining)]
403     protected override bool FirstIsToLeftOfSecond(TLink first, TLink second) =>
404         ↪ GetKeyPartValue(first) < GetKeyPartValue(second);
405
406     /// <summary>
407     /// <para>
408     /// Determines whether this instance first is to the right of second.
409     /// </para>
410     /// <para></para>
411     /// </summary>
412     /// <param name="first">
413     /// <para>The first.</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) =>
425         ↪ GetKeyPartValue(first) > GetKeyPartValue(second);
426 }

```

1.56 ./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
27         /// <summary>
28         /// <para>
29         /// The links index parts.
30         /// </para>
31         /// <para></para>
32         /// </summary>
33         protected new readonly RawLinkIndexPart<TLink>* LinksIndexParts;
34
35         /// <summary>
36         /// <para>
37         /// The header.
38         /// </para>
39         /// <para></para>
40         /// </summary>
41         protected new readonly LinksHeader<TLink>* Header;
42
43         /// <summary>
44         /// <para>
45         /// Initializes a new <see cref="UInt32InternalLinksSizeBalancedTreeMethodsBase"/>
46         ↪ instance.
47         /// </para>
48         /// <para></para>
49         /// </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></para>
53     /// </param>
54     /// <param name="linksIndexParts">
55     /// <para>A links index parts.</para>
56     /// <para></para>
57     /// </param>
58     /// <param name="header">
59     /// <para>A header.</para>
60     /// <para></para>
61     /// </param>
62     [MethodImpl(MethodImplOptions.AggressiveInlining)]
63     protected UInt32InternalLinksSizeBalancedTreeMethodsBase(LinksConstants<TLink>
        ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
        ↪ linksIndexParts, LinksHeader<TLink>* header)
        : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
64     {
65         LinksDataParts = linksDataParts;
66         LinksIndexParts = linksIndexParts;
67         Header = header;
68     }
69
70
71     /// <summary>
72     /// <para>
73     /// Gets the zero.
74     /// </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() => 0U;
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 == 0U;
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 > 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
    ↪ 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(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) =>
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>
412     /// <para></para>
413     /// </summary>
414     /// <param name="first">
415     /// <para>The first.</para>
416     /// <para></para>
417     /// </param>
418     /// <param name="second">
419     /// <para>The second.</para>
420     /// <para></para>
421     /// </param>
422     /// <returns>
423     /// <para>The bool</para>
424     /// <para></para>
425     /// </returns>
426     [MethodImpl(MethodImplOptions.AggressiveInlining)]
427     protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second) =>
428         ↪ GetKeyPartValue(first) > GetKeyPartValue(second);
429 }

```

1.57 ./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    /// <para></para>
13    /// </summary>
14    /// <seealso cref="InternalLinksSourcesLinkedListMethods{TLink}" />
15    public unsafe class UInt32InternalLinksSourcesLinkedListMethods :
16    ↪ InternalLinksSourcesLinkedListMethods<TLink>
17    {
18        private readonly RawLinkDataPart<TLink>* _linksDataParts;
19        private readonly RawLinkIndexPart<TLink>* _linksIndexParts;
20
21        /// <summary>
22        /// <para>
23        /// Initializes a new <see cref="UInt32InternalLinksSourcesLinkedListMethods" /> instance.
24        /// </para>
25        /// <para></para>
26        /// </summary>
27        /// <param name="constants">
28        /// <para>A constants.</para>
29        /// </param>
30        /// <param name="linksDataParts">
31        /// <para>A links data parts.</para>
32        /// <para></para>
33        /// </param>
34        /// <param name="linksIndexParts">
35        /// <para>A links index parts.</para>
36        /// <para></para>
37        /// </param>
38        [MethodImpl(MethodImplOptions.AggressiveInlining)]
39        public UInt32InternalLinksSourcesLinkedListMethods(LinksConstants<TLink> constants,
40    ↪ RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>* linksIndexParts)
41        : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts)
42        {
43            _linksDataParts = linksDataParts;
44            _linksIndexParts = linksIndexParts;
45        }
46
47        /// <summary>
48        /// <para>
49        /// Gets the link data part reference using the specified link.
50        /// </para>
51        /// <para></para>
52        /// </summary>
53        /// <param name="link">
54        /// <para>The link.</para>
55        /// <para></para>
56        /// </param>
57        /// <returns>
58        /// <para>A ref raw link data part of t link</para>
59        /// <para></para>
60        /// </returns>
61        [MethodImpl(MethodImplOptions.AggressiveInlining)]
62        protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
63    ↪ ref _linksDataParts[link];
64
65        /// <summary>
66        /// <para>
67        /// Gets the link index part reference using the specified link.
68        /// </para>
69        /// <para></para>
70        /// </summary>
71        /// <param name="link">
72        /// <para>The link.</para>
73        /// <para></para>
74        /// </param>
75        /// <returns>

```

```

74     /// <para>A ref raw link index part of t link</para>
75     /// <para></para>
76     /// </returns>
77     [MethodImpl(MethodImplOptions.AggressiveInlining)]
78     protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
        ↪ ref _linksIndexParts[link];
79 }
80 }

```

1.58 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32InternalLinksSourcesRecursionlessSizeBalancedTreeMethodsBase

```

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 :
        ↪ UInt32InternalLinksRecursionlessSizeBalancedTreeMethodsBase
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         /// </param>
27         /// <param name="linksDataParts">
28         /// <para>A links data parts.</para>
29         /// </param>
30         /// <param name="linksIndexParts">
31         /// <para>A links index parts.</para>
32         /// </param>
33         /// <param name="header">
34         /// <para>A header.</para>
35         /// </param>
36         [MethodImpl(MethodImplOptions.AggressiveInlining)]
37         public
38         ↪ UInt32InternalLinksSourcesRecursionlessSizeBalancedTreeMethods(LinksConstants<TLink>
        ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
        ↪ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
        ↪ linksIndexParts, 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         /// </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
        ↪ LinksIndexParts[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         /// </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
        ↪ LinksIndexParts[node].RightAsSource;
70     }
71 }

```

```

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 }

```

1.59 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32InternalLinksSourcesSizeBalancedTreeMethods

```

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.

```

```

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 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>

```

```

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    /// </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 }

```

1.60 ./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
20         ↪ cref="UInt32InternalLinksTargetsRecursionlessSizeBalancedTreeMethods"/> 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         ↪ UInt32InternalLinksTargetsRecursionlessSizeBalancedTreeMethods(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     }

```

```

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
58     ↪ LinksIndexParts[node].LeftAsTarget;
59
60     /// <summary>
61     /// <para>
62     /// Gets the right reference using the specified node.
63     /// </para>
64     /// <para></para>
65     /// </summary>
66     /// <param name="node">
67     /// <para>The node.</para>
68     /// <para></para>
69     /// </param>
70     /// <returns>
71     /// <para>The ref link</para>
72     /// <para></para>
73     /// </returns>
74     [MethodImpl(MethodImplOptions.AggressiveInlining)]
75     protected override ref TLink GetRightReference(TLink node) => ref
76     ↪ LinksIndexParts[node].RightAsTarget;
77
78     /// <summary>
79     /// <para>
80     /// Gets the left using the specified node.
81     /// </para>
82     /// <para></para>
83     /// </summary>
84     /// <param name="node">
85     /// <para>The node.</para>
86     /// <para></para>
87     /// </param>
88     /// <returns>
89     /// <para>The link</para>
90     /// <para></para>
91     /// </returns>
92     [MethodImpl(MethodImplOptions.AggressiveInlining)]
93     protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsTarget;
94
95     /// <summary>
96     /// <para>
97     /// Gets the right using the specified node.
98     /// </para>
99     /// <para></para>
100    /// </summary>
101    /// <param name="node">
102    /// <para>The node.</para>
103    /// <para></para>
104    /// </param>
105    /// <returns>
106    /// <para>The link</para>
107    /// <para></para>
108    /// </returns>
109    [MethodImpl(MethodImplOptions.AggressiveInlining)]
110    protected override TLink GetRight(TLink node) => LinksIndexParts[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>

```

```

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 }

```

1.61 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt32InternalLinksTargetsSizeBalancedTreeMetho

```

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>
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 UInt32InternalLinksTargetsSizeBalancedTreeMethods(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 }

```

```

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>

```

```

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) => LinksIndexParts[node].SizeAsTarget;
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].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     /// <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 }

```

1.62 ./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         private readonly Func<ILinksTreeMethods<TLink>> _createInternalSourceTreeMethods;
22         private readonly Func<ILinksTreeMethods<TLink>> _createExternalSourceTreeMethods;
23         private readonly Func<ILinksTreeMethods<TLink>> _createInternalTargetTreeMethods;
24         private readonly Func<ILinksTreeMethods<TLink>> _createExternalTargetTreeMethods;
25         private LinksHeader<TLink>* _header;
26         private RawLinkDataPart<TLink>* _linksDataParts;
27         private RawLinkIndexPart<TLink>* _linksIndexParts;
28
29         /// <summary>
30         /// <para>
31         /// Initializes a new <see cref="UInt32SplitMemoryLinks" /> instance.
32         /// </para>
33         /// <para></para>
34         /// </summary>
35         /// <param name="dataMemory">
36         /// <para>A data memory.</para>

```

```

37     /// <para></para>
38     /// </param>
39     /// <param name="indexMemory">
40     /// <para>A index memory.</para>
41     /// <para></para>
42     /// </param>
43     [MethodImpl(MethodImplOptions.AggressiveInlining)]
44     public UInt32SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
        ↳ indexMemory) : this(dataMemory, indexMemory, DefaultLinksSizeStep) { }
45
46     /// <summary>
47     /// <para>
48     /// Initializes a new <see cref="UInt32SplitMemoryLinks"/> instance.
49     /// </para>
50     /// <para></para>
51     /// </summary>
52     /// <param name="dataMemory">
53     /// <para>A data memory.</para>
54     /// <para></para>
55     /// </param>
56     /// <param name="indexMemory">
57     /// <para>A index memory.</para>
58     /// <para></para>
59     /// </param>
60     /// <param name="memoryReservationStep">
61     /// <para>A memory reservation step.</para>
62     /// <para></para>
63     /// </param>
64     [MethodImpl(MethodImplOptions.AggressiveInlining)]
65     public UInt32SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
        ↳ indexMemory, long memoryReservationStep) : this(dataMemory, indexMemory,
        ↳ memoryReservationStep, Default<LinksConstants<TLink>>.Instance,
        ↳ IndexTreeType.Default, useLinkedList: true) { }
66
67     /// <summary>
68     /// <para>
69     /// Initializes a new <see cref="UInt32SplitMemoryLinks"/> instance.
70     /// </para>
71     /// <para></para>
72     /// </summary>
73     /// <param name="dataMemory">
74     /// <para>A data memory.</para>
75     /// <para></para>
76     /// </param>
77     /// <param name="indexMemory">
78     /// <para>A index memory.</para>
79     /// <para></para>
80     /// </param>
81     /// <param name="memoryReservationStep">
82     /// <para>A memory reservation step.</para>
83     /// <para></para>
84     /// </param>
85     /// <param name="constants">
86     /// <para>A constants.</para>
87     /// <para></para>
88     /// </param>
89     [MethodImpl(MethodImplOptions.AggressiveInlining)]
90     public UInt32SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
        ↳ indexMemory, long memoryReservationStep, LinksConstants<TLink> constants) :
        ↳ this(dataMemory, indexMemory, memoryReservationStep, constants,
        ↳ IndexTreeType.Default, useLinkedList: true) { }
91
92     /// <summary>
93     /// <para>
94     /// Initializes a new <see cref="UInt32SplitMemoryLinks"/> instance.
95     /// </para>
96     /// <para></para>
97     /// </summary>
98     /// <param name="dataMemory">
99     /// <para>A data memory.</para>
100    /// <para></para>
101    /// </param>
102    /// <param name="indexMemory">
103    /// <para>A index memory.</para>
104    /// <para></para>
105    /// </param>
106    /// <param name="memoryReservationStep">

```

```

107     /// <para>A memory reservation step.</para>
108     /// <para></para>
109     /// </param>
110     /// <param name="constants">
111     /// <para>A constants.</para>
112     /// <para></para>
113     /// </param>
114     /// <param name="indexTreeType">
115     /// <para>A index tree type.</para>
116     /// <para></para>
117     /// </param>
118     /// <param name="useLinkedList">
119     /// <para>A use linked list.</para>
120     /// <para></para>
121     /// </param>
122     [MethodImpl(MethodImplOptions.AggressiveInlining)]
123     public UInt32SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
        ↪ indexMemory, long memoryReservationStep, LinksConstants<TLink> constants,
        ↪ IndexTreeType indexTreeType, bool useLinkedList) : base(dataMemory, indexMemory,
        ↪ memoryReservationStep, constants, useLinkedList)
124     {
125         if (indexTreeType == IndexTreeType.SizeBalancedTree)
126         {
127             _createInternalSourceTreeMethods = () => new
        ↪ UInt32InternalLinksSourcesSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
128             _createExternalSourceTreeMethods = () => new
        ↪ UInt32ExternalLinksSourcesSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
129             _createInternalTargetTreeMethods = () => new
        ↪ UInt32InternalLinksTargetsSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
130             _createExternalTargetTreeMethods = () => new
        ↪ UInt32ExternalLinksTargetsSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
131         }
132         else
133         {
134             _createInternalSourceTreeMethods = () => new
        ↪ UInt32InternalLinksSourcesRecursionlessSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
135             _createExternalSourceTreeMethods = () => new
        ↪ UInt32ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
136             _createInternalTargetTreeMethods = () => new
        ↪ UInt32InternalLinksTargetsRecursionlessSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
137             _createExternalTargetTreeMethods = () => new
        ↪ UInt32ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods(Constants,
        ↪ _linksDataParts, _linksIndexParts, _header);
138         }
139         Init(dataMemory, indexMemory);
140     }
141
142     /// <summary>
143     /// <para>
144     /// Sets the pointers using the specified data memory.
145     /// </para>
146     /// <para></para>
147     /// </summary>
148     /// <param name="dataMemory">
149     /// <para>The data memory.</para>
150     /// <para></para>
151     /// </param>
152     /// <param name="indexMemory">
153     /// <para>The index memory.</para>
154     /// <para></para>
155     /// </param>
156     [MethodImpl(MethodImplOptions.AggressiveInlining)]
157     protected override void SetPointers(IResizableDirectMemory dataMemory,
        ↪ IResizableDirectMemory indexMemory)
158     {
159         _linksDataParts = (RawLinkDataPart<TLink>*)dataMemory.Pointer;
160         _linksIndexParts = (RawLinkIndexPart<TLink>*)indexMemory.Pointer;
161         _header = (LinksHeader<TLink>*)indexMemory.Pointer;
162         if (_useLinkedList)
163         {

```

```

164         InternalSourcesListMethods = new
165         ↪ UInt32InternalLinksSourcesLinkedListMethods(Constants, _linksDataParts,
166         ↪ _linksIndexParts);
167     }
168     else
169     {
170         InternalSourcesTreeMethods = _createInternalSourceTreeMethods();
171     }
172     ExternalSourcesTreeMethods = _createExternalSourceTreeMethods();
173     InternalTargetsTreeMethods = _createInternalTargetTreeMethods();
174     ExternalTargetsTreeMethods = _createExternalTargetTreeMethods();
175     UnusedLinksListMethods = new UInt32UnusedLinksListMethods(_linksDataParts, _header);
176 }
177
178 /// <summary>
179 /// <para>
180 /// Resets the pointers.
181 /// </para>
182 /// <para></para>
183 /// </summary>
184 [MethodImpl(MethodImplOptions.AggressiveInlining)]
185 protected override void ResetPointers()
186 {
187     base.ResetPointers();
188     _linksDataParts = null;
189     _linksIndexParts = null;
190     _header = null;
191 }
192
193 /// <summary>
194 /// <para>
195 /// Gets the header reference.
196 /// </para>
197 /// <para></para>
198 /// </summary>
199 /// <returns>
200 /// <para>A ref links header of t link</para>
201 /// <para></para>
202 /// </returns>
203 [MethodImpl(MethodImplOptions.AggressiveInlining)]
204 protected override ref LinksHeader<TLink> GetHeaderReference() => ref *_header;
205
206 /// <summary>
207 /// <para>
208 /// Gets the link data part reference using the specified link index.
209 /// </para>
210 /// <para></para>
211 /// </summary>
212 /// <param name="linkIndex">
213 /// <para>The link index.</para>
214 /// <para></para>
215 /// </param>
216 /// <returns>
217 /// <para>A ref raw link data part of t link</para>
218 /// <para></para>
219 /// </returns>
220 [MethodImpl(MethodImplOptions.AggressiveInlining)]
221 protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink linkIndex)
222     ↪ => ref _linksDataParts[linkIndex];
223
224 /// <summary>
225 /// <para>
226 /// Gets the link index part reference using the specified link index.
227 /// </para>
228 /// <para></para>
229 /// </summary>
230 /// <param name="linkIndex">
231 /// <para>The link index.</para>
232 /// <para></para>
233 /// </param>
234 /// <returns>
235 /// <para>A ref raw link index part of t link</para>
236 /// <para></para>
237 /// </returns>
238 [MethodImpl(MethodImplOptions.AggressiveInlining)]
239 protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink
240     ↪ linkIndex) => ref _linksIndexParts[linkIndex];

```

```

238     /// <summary>
239     /// <para>
240     /// Determines whether this instance are equal.
241     /// </para>
242     /// <para></para>
243     /// </summary>
244     /// <param name="first">
245     /// <para>The first.</para>
246     /// <para></para>
247     /// </param>
248     /// <param name="second">
249     /// <para>The second.</para>
250     /// <para></para>
251     /// </param>
252     /// <returns>
253     /// <para>The bool</para>
254     /// <para></para>
255     /// </returns>
256     [MethodImpl(MethodImplOptions.AggressiveInlining)]
257     protected override bool AreEqual(TLink first, TLink second) => first == second;
258
259     /// <summary>
260     /// <para>
261     /// Determines whether this instance less than.
262     /// </para>
263     /// <para></para>
264     /// </summary>
265     /// <param name="first">
266     /// <para>The first.</para>
267     /// <para></para>
268     /// </param>
269     /// <param name="second">
270     /// <para>The second.</para>
271     /// <para></para>
272     /// </param>
273     /// <returns>
274     /// <para>The bool</para>
275     /// <para></para>
276     /// </returns>
277     [MethodImpl(MethodImplOptions.AggressiveInlining)]
278     protected override bool LessThan(TLink first, TLink second) => first < second;
279
280     /// <summary>
281     /// <para>
282     /// Determines whether this instance less or equal than.
283     /// </para>
284     /// <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 LessOrEqualThan(TLink first, TLink second) => first <= second;
300
301     /// <summary>
302     /// <para>
303     /// Determines whether this instance greater 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 GreaterThan(TLink first, TLink second) => first > second;
321
322    /// <summary>
323    /// <para>
324    /// Determines whether this instance greater 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 GreaterOrEqualThan(TLink first, TLink second) => first >= second;
342
343    /// <summary>
344    /// <para>
345    /// Gets the zero.
346    /// </para>
347    /// <para></para>
348    /// </summary>
349    /// <returns>
350    /// <para>The link</para>
351    /// <para></para>
352    /// </returns>
353    [MethodImpl(MethodImplOptions.AggressiveInlining)]
354    protected override TLink GetZero() => 0U;
355
356    /// <summary>
357    /// <para>
358    /// Gets the one.
359    /// </para>
360    /// <para></para>
361    /// </summary>
362    /// <returns>
363    /// <para>The link</para>
364    /// <para></para>
365    /// </returns>
366    [MethodImpl(MethodImplOptions.AggressiveInlining)]
367    protected override TLink GetOne() => 1U;
368
369    /// <summary>
370    /// <para>
371    /// Converts the to int 64 using the specified value.
372    /// </para>
373    /// <para></para>
374    /// </summary>
375    /// <param name="value">
376    /// <para>The value.</para>
377    /// <para></para>
378    /// </param>
379    /// <returns>
380    /// <para>The long</para>
381    /// <para></para>
382    /// </returns>
383    [MethodImpl(MethodImplOptions.AggressiveInlining)]
384    protected override long ConvertToInt64(TLink value) => value;
385
386    /// <summary>
387    /// <para>
388    /// Converts the to address using the specified value.
389    /// </para>
390    /// <para></para>
391    /// </summary>
392    /// <param name="value">
393    /// <para>The value.</para>

```

```

394     /// <para></para>
395     /// </param>
396     /// <returns>
397     /// <para>The link</para>
398     /// <para></para>
399     /// </returns>
400     [MethodImpl(MethodImplOptions.AggressiveInlining)]
401     protected override TLink ConvertToAddress(long value) => (TLink)value;
402
403     /// <summary>
404     /// <para>
405     /// Adds the first.
406     /// </para>
407     /// <para></para>
408     /// </summary>
409     /// <param name="first">
410     /// <para>The first.</para>
411     /// <para></para>
412     /// </param>
413     /// <param name="second">
414     /// <para>The second.</para>
415     /// <para></para>
416     /// </param>
417     /// <returns>
418     /// <para>The link</para>
419     /// <para></para>
420     /// </returns>
421     [MethodImpl(MethodImplOptions.AggressiveInlining)]
422     protected override TLink Add(TLink first, TLink second) => first + second;
423
424     /// <summary>
425     /// <para>
426     /// Subtracts the first.
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 link</para>
440     /// <para></para>
441     /// </returns>
442     [MethodImpl(MethodImplOptions.AggressiveInlining)]
443     protected override TLink Subtract(TLink first, TLink second) => first - second;
444
445     /// <summary>
446     /// <para>
447     /// Increments the link.
448     /// </para>
449     /// <para></para>
450     /// </summary>
451     /// <param name="link">
452     /// <para>The link.</para>
453     /// <para></para>
454     /// </param>
455     /// <returns>
456     /// <para>The link</para>
457     /// <para></para>
458     /// </returns>
459     [MethodImpl(MethodImplOptions.AggressiveInlining)]
460     protected override TLink Increment(TLink link) => ++link;
461
462     /// <summary>
463     /// <para>
464     /// Decrements the link.
465     /// </para>
466     /// <para></para>
467     /// </summary>
468     /// <param name="link">
469     /// <para>The link.</para>
470     /// <para></para>
471     /// </param>

```

```

472     /// <returns>
473     /// <para>The link</para>
474     /// <para></para>
475     /// </returns>
476     [MethodImpl(MethodImplOptions.AggressiveInlining)]
477     protected override TLink Decrement(TLink link) => --link;
478 }
479 }

```

1.63 ./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         private readonly RawLinkDataPart<TLink>* _links;
19         private readonly LinksHeader<TLink>* _header;
20
21         /// <summary>
22         /// <para>
23         /// Initializes a new <see cref="UInt32UnusedLinksListMethods" /> instance.
24         /// </para>
25         /// <para></para>
26         /// </summary>
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 UInt32UnusedLinksListMethods(RawLinkDataPart<TLink>* links, LinksHeader<TLink>*
37             ↪ header)
38             : base((byte*)links, (byte*)header)
39         {
40             _links = links;
41             _header = header;
42         }
43
44         /// <summary>
45         /// <para>
46         /// Gets the link data part reference using the specified link.
47         /// </para>
48         /// <para></para>
49         /// </summary>
50         /// <param name="link">
51         /// <para>The link.</para>
52         /// <para></para>
53         /// </param>
54         /// <returns>
55         /// <para>A ref raw link data part of t link</para>
56         /// <para></para>
57         /// </returns>
58         [MethodImpl(MethodImplOptions.AggressiveInlining)]
59         protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
60             ↪ ref _links[link];
61
62         /// <summary>
63         /// <para>
64         /// Gets the header reference.
65         /// </para>
66         /// <para></para>
67         /// </summary>
68         /// <returns>
69         /// <para>A ref links header of t link</para>

```

```

68     /// <para></para>
69     /// </returns>
70     [MethodImpl(MethodImplOptions.AggressiveInlining)]
71     protected override ref LinksHeader<TLink> GetHeaderReference() => ref *_header;
72 }
73 }

```

1.64 ./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 :
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="UInt64ExternalLinksRecursionlessSizeBalancedTreeMethodsBase"/> 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
        ↪ UInt64ExternalLinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<TLink>
        ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
        ↪ linksIndexParts, LinksHeader<TLink>* header)
        : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
        {

```

```

67     LinksDataParts = linksDataParts;
68     LinksIndexParts = linksIndexParts;
69     Header = header;
70 }
71
72 /// <summary>
73 /// <para>
74 /// Gets the zero.
75 /// </para>
76 /// <para></para>
77 /// </summary>
78 /// <returns>
79 /// <para>The ulong</para>
80 /// <para></para>
81 /// </returns>
82 [MethodImpl(MethodImplOptions.AggressiveInlining)]
83 protected override ulong GetZero() => OUL;
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(ulong value) => value == OUL;
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(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 > OUL;
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
253     ↪ for ulong
254
255     /// <summary>
256     /// <para>
257     /// Determines whether this instance less than.
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 LessThan(ulong first, ulong second) => first < second;
275
276     /// <summary>
277     /// <para>
278     /// Increments the value.
279     /// </para>
280     /// <para></para>
281     /// </summary>
282     /// <param name="value">
283     /// <para>The value.</para>
284     /// <para></para>
285     /// </param>
286     /// <returns>
287     /// <para>The ulong</para>
288     /// <para></para>
289     /// </returns>
290     [MethodImpl(MethodImplOptions.AggressiveInlining)]
291     protected override ulong Increment(ulong value) => ++value;
292
293     /// <summary>
294     /// <para>
295     /// Decrements the value.
296     /// </para>
297     /// <para></para>
298     /// </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 LinkHeader<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) =>
    ↪ ref LinksDataParts[link];
380
381 /// <summary>
382 /// <para>
383 /// Gets the link index part reference using the specified link.
384 /// </para>
385 /// <para></para>
386 /// </summary>
387 /// <param name="link">
388 /// <para>The link.</para>
389 /// <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 }
```

1.65 ./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;  
41  
42         /// <summary>  
43         /// <para>  
44         /// Initializes a new <see cref="UInt64ExternalLinksSizeBalancedTreeMethodsBase"/>  
45         /// 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 UInt64ExternalLinksSizeBalancedTreeMethodsBase(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 }
```

```

72     /// <summary>
73     /// <para>
74     /// Gets the zero.
75     /// </para>
76     /// <para></para>
77     /// </summary>
78     /// <returns>
79     /// <para>The ulong</para>
80     /// <para></para>
81     /// </returns>
82     [MethodImpl(MethodImplOptions.AggressiveInlining)]
83     protected override ulong GetZero() => 0UL;
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(ulong value) => value == 0UL;
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(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
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(ulong 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>

```

```

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
253     ↪ for ulong
254
255     /// <summary>
256     /// <para>
257     /// Determines whether this instance less than.
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 LessThan(ulong first, ulong second) => first < second;
275
276     /// <summary>
277     /// <para>
278     /// Increments the value.
279     /// </para>
280     /// <para></para>
281     /// </summary>
282     /// <param name="value">
283     /// <para>The value.</para>
284     /// <para></para>
285     /// </param>
286     /// <returns>
287     /// <para>The ulong</para>
288     /// <para></para>
289     /// </returns>
290     [MethodImpl(MethodImplOptions.AggressiveInlining)]
291     protected override ulong Increment(ulong value) => ++value;
292
293     /// <summary>
294     /// <para>
295     /// Decrements the value.
296     /// </para>
297     /// <para></para>
298     /// </summary>
299     /// <param name="value">
300     /// <para>The value.</para>
301     /// <para></para>
302     /// </param>
303     /// <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 LinkHeader<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) =>
    ↪ ref LinkDataParts[link];

```

```

380
381     /// <summary>
382     /// <para>
383     /// Gets the link index part reference using the specified link.
384     /// </para>
385     /// <para></para>
386     /// </summary>
387     /// <param name="link">
388     /// <para>The link.</para>
389     /// <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) =>
397         ↪ ref LinksIndexParts[link];
398
399     /// <summary>
400     /// <para>
401     /// Determines whether this instance first is to the left of second.
402     /// </para>
403     /// <para></para>
404     /// </summary>
405     /// <param name="first">
406     /// <para>The first.</para>
407     /// <para></para>
408     /// </param>
409     /// <param name="second">
410     /// <para>The second.</para>
411     /// <para></para>
412     /// </param>
413     /// <returns>
414     /// <para>The bool</para>
415     /// <para></para>
416     /// </returns>
417     [MethodImpl(MethodImplOptions.AggressiveInlining)]
418     protected override bool FirstIsToLeftOfSecond(TLink first, TLink second)
419     {
420         ref var firstLink = ref LinksDataParts[first];
421         ref var secondLink = ref LinksDataParts[second];
422         return FirstIsToLeftOfSecond(firstLink.Source, firstLink.Target,
423             ↪ secondLink.Source, secondLink.Target);
424     }
425
426     /// <summary>
427     /// <para>
428     /// Determines whether this instance first is to the right of second.
429     /// </para>
430     /// <para></para>
431     /// </summary>
432     /// <param name="first">
433     /// <para>The first.</para>
434     /// <para></para>
435     /// </param>
436     /// <param name="second">
437     /// <para>The second.</para>
438     /// <para></para>
439     /// </param>
440     /// <returns>
441     /// <para>The bool</para>
442     /// <para></para>
443     /// </returns>
444     [MethodImpl(MethodImplOptions.AggressiveInlining)]
445     protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second)
446     {
447         ref var firstLink = ref LinksDataParts[first];
448         ref var secondLink = ref LinksDataParts[second];
449         return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
450             ↪ secondLink.Source, secondLink.Target);
451     }
452 }

```

1.66 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64ExternalLinksSourcesRecursionlessSizeBalance

```

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 :
16    ↪ UInt64ExternalLinksRecursionlessSizeBalancedTreeMethodsBase
17    {
18        /// <summary>
19        /// <para>
20        /// Initializes a new <see
21        ↪ cref="UInt64ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods"/> 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        ↪ UInt64ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods(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>
61        /// </returns>
62        [MethodImpl(MethodImplOptions.AggressiveInlining)]
63        protected override ref TLink GetLeftReference(TLink node) => ref
64        ↪ LinksIndexParts[node].LeftAsSource;
65
66        /// <summary>
67        /// <para>
68        /// Gets the right reference using the specified node.
69        /// </para>
70        /// <para></para>
71        /// </summary>
72        /// <param name="node">
73        /// <para>The node.</para>
74        /// <para></para>
75        /// </param>
76        /// <returns>
77        /// <para>The ref link</para>
78        /// <para></para>
79        /// </returns>
80        [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     /// </summary>
82     /// <param name="node">
83     /// <para>The node.</para>
84     /// </param>
85     /// </returns>
86     /// <para>The link</para>
87     /// </returns>
88     [MethodImpl(MethodImplOptions.AggressiveInlining)]
89     protected override TLink GetLeft(TLink node) => LinksIndexParts[node].LeftAsSource;
90
91     /// <summary>
92     /// <para>
93     /// Gets the right using the specified node.
94     /// </para>
95     /// </summary>
96     /// <param name="node">
97     /// <para>The node.</para>
98     /// </param>
99     /// </returns>
100    /// <para>The link</para>
101    /// </returns>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    protected override TLink GetRight(TLink node) => LinksIndexParts[node].RightAsSource;
104
105    /// <summary>
106    /// <para>
107    /// Sets the left using the specified node.
108    /// </para>
109    /// </summary>
110    /// <param name="node">
111    /// <para>The node.</para>
112    /// </param>
113    /// <param name="left">
114    /// <para>The left.</para>
115    /// </param>
116    [MethodImpl(MethodImplOptions.AggressiveInlining)]
117    protected override void SetLeft(TLink node, TLink left) =>
118        ↳ LinksIndexParts[node].LeftAsSource = left;
119
120    /// <summary>
121    /// <para>
122    /// Sets the right using the specified node.
123    /// </para>
124    /// </summary>
125    /// <param name="node">
126    /// <para>The node.</para>
127    /// </param>
128    /// <param name="right">
129    /// <para>The right.</para>
130    /// </param>
131    [MethodImpl(MethodImplOptions.AggressiveInlining)]
132    protected override void SetRight(TLink node, TLink right) =>
133        ↳ LinksIndexParts[node].RightAsSource = right;
134
135    /// <summary>
136    /// <para>
137    /// Gets the size using the specified node.
138    /// </para>
139    /// </summary>
140    /// <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) => 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.
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>

```

```

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.
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.LeftAsSource = Zero;
287         link.RightAsSource = Zero;
288         link.SizeAsSource = Zero;
289     }
290 }

```

1.67 ./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 :
    ↳ UInt64ExternalLinksSizeBalancedTreeMethodsBase
16  {
17      /// <summary>
18      /// <para>
19      /// Initializes a new <see cref="UInt64ExternalLinksSourcesSizeBalancedTreeMethods"/>
    ↳ 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 UInt64ExternalLinksSourcesSizeBalancedTreeMethods(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>

```

```

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

```

1.68 ./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     /// </summary>
13     /// <seealso cref="UInt64ExternalLinksRecursionlessSizeBalancedTreeMethodsBase"/>
14     public unsafe class UInt64ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods :
15         ↪ UInt64ExternalLinksRecursionlessSizeBalancedTreeMethodsBase
16     {
17         /// <summary>
18         /// <para>

```

```

19  /// Initializes a new <see
    ↪ cref="UInt64ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods"/> 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
    ↪ UInt64ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods(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>

```

```

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].SizeAsTarget = 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->RootAsTarget;
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].Target;
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         => firstTarget < secondTarget || firstTarget == secondTarget && firstSource <
239         ↳ secondSource;
240
241     /// <summary>
242     /// <para>
243     /// 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         => firstTarget > secondTarget || firstTarget == secondTarget && firstSource >
268         ↪ secondSource;
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.LeftAsTarget = Zero;
285         link.RightAsTarget = Zero;
286         link.SizeAsTarget = Zero;
287     }
288 }

```

1.69 ./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>

```

```

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 UInt64 ExternalLinksTargetsSizeBalancedTreeMethods(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>

```

```

175 [MethodImpl(MethodImplOptions.AggressiveInlining)]
176 protected override void SetSize(TLink node, TLink size) =>
    ↳ LinksIndexParts[node].SizeAsTarget = 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() => 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 FirstIsToTheLeftOfSecond(TLink firstSource, TLink firstTarget,
    ↳ TLink secondSource, TLink secondTarget)
236     => firstTarget < secondTarget || firstTarget == secondTarget && firstSource <
    ↳ secondSource;
237
238 /// <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         => firstTarget > secondTarget || firstTarget == secondTarget && firstSource >
268         ↪ secondSource;
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.LeftAsTarget = Zero;
285         link.RightAsTarget = Zero;
286         link.SizeAsTarget = Zero;
287     }
288 }

```

1.70 ./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
27         /// <summary>
28         /// <para>
29         /// The links index parts.
30         /// </para>
31         /// <para></para>
32         /// </summary>
33         protected new readonly RawLinkIndexPart<TLink>* LinksIndexParts;
34
35         /// <summary>
36         /// <para>
37         /// The header.
38         /// </para>
39         /// <para></para>
40         /// </summary>

```

```

37     /// </summary>
38     protected new readonly LinksHeader<TLink>* Header;
39
40     /// <summary>
41     /// <para>
42     /// Initializes a new <see
43     ↪ cref="UInt64InternalLinksRecursionlessSizeBalancedTreeMethodsBase"/> 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
65     ↪ UInt64InternalLinksRecursionlessSizeBalancedTreeMethodsBase(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>

```



```

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

```

```

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 }

```

1.71 ./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     /// <para></para>
14     /// </summary>
15     /// <seealso cref="InternalLinksSizeBalancedTreeMethodsBase{TLink}"/>
16     public unsafe abstract class UInt64InternalLinksSizeBalancedTreeMethodsBase :
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="UInt64InternalLinksSizeBalancedTreeMethodsBase"/>
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)]

```

```

63     protected UInt64InternalLinksSizeBalancedTreeMethodsBase(LinksConstants<TLink>
        ↳ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
        ↳ linksIndexParts, LinksHeader<TLink>* header)
64         : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts, (byte*)header)
65     {
66         LinksDataParts = linksDataParts;
67         LinksIndexParts = linksIndexParts;
68         Header = header;
69     }
70
71     /// <summary>
72     /// <para>
73     /// Gets the 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
    ↪ 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

```

```

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
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>

```



```

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>

```

```

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     /// <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 bool</para>
401     /// <para></para>
402     /// </returns>
403     [MethodImpl(MethodImplOptions.AggressiveInlining)]
404     protected override bool FirstIsToLeftOfSecond(TLink first, TLink second) =>
405         ↪ GetKeyPartValue(first) < GetKeyPartValue(second);
406
407     /// <summary>
408     /// <para>
409     /// Determines whether this instance first is to the right of second.
410     /// </para>
411     /// <para></para>
412     /// </summary>
413     /// <param name="first">
414     /// <para>The first.</para>
415     /// <para></para>
416     /// </param>
417     /// <param name="second">
418     /// <para>The second.</para>
419     /// <para></para>
420     /// </param>
421     /// <returns>
422     /// <para>The bool</para>
423     /// <para></para>
424     /// </returns>
425     [MethodImpl(MethodImplOptions.AggressiveInlining)]
426     protected override bool FirstIsToTheRightOfSecond(TLink first, TLink second) =>
427         ↪ GetKeyPartValue(first) > GetKeyPartValue(second);
428 }

```

1.72 ./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     private readonly RawLinkDataPart<TLink>* _linksDataParts;
18     private readonly RawLinkIndexPart<TLink>* _linksIndexParts;
19
20     /// <summary>
21     /// <para>
22     /// Initializes a new <see cref="UInt64InternalLinksSourcesLinkedListMethods"/> instance.
23     /// </para>
24     /// <para></para>
25     /// </summary>
26     /// <param name="constants">
27     /// <para>A constants.</para>
28     /// <para></para>
29     /// </param>
30     /// <param name="linksDataParts">
31     /// <para>A links data parts.</para>
32     /// <para></para>
33     /// </param>
34     /// <param name="linksIndexParts">
35     /// <para>A links index parts.</para>
36     /// <para></para>
37     /// </param>
38     [MethodImpl(MethodImplOptions.AggressiveInlining)]
39     public UInt64InternalLinksSourcesLinkedListMethods(LinksConstants<TLink> constants,
    ↳ RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>* linksIndexParts)
    : base(constants, (byte*)linksDataParts, (byte*)linksIndexParts)
40     {
41     }
42     _linksDataParts = linksDataParts;
43     _linksIndexParts = linksIndexParts;
44 }
45
46     /// <summary>
47     /// <para>
48     /// Gets the link data part reference using the specified link.
49     /// </para>
50     /// <para></para>
51     /// </summary>
52     /// <param name="link">
53     /// <para>The link.</para>
54     /// <para></para>
55     /// </param>
56     /// <returns>
57     /// <para>A ref raw link data part of t link</para>
58     /// <para></para>
59     /// </returns>
60     [MethodImpl(MethodImplOptions.AggressiveInlining)]
61     protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
    ↳ ref _linksDataParts[link];
62
63     /// <summary>
64     /// <para>
65     /// Gets the link index part reference using the specified link.
66     /// </para>
67     /// <para></para>
68     /// </summary>
69     /// <param name="link">
70     /// <para>The link.</para>
71     /// <para></para>
72     /// </param>
73     /// <returns>
74     /// <para>A ref raw link index part of t link</para>
75     /// <para></para>
76     /// </returns>
77     [MethodImpl(MethodImplOptions.AggressiveInlining)]
78     protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink link) =>
    ↳ ref _linksIndexParts[link];
79 }
80 }

```

1.73 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64InternalLinksSourcesRecursionlessSizeBalance

```

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">
38        /// <para>A header.</para>
39        /// <para></para>
40        /// </param>
41        [MethodImpl(MethodImplOptions.AggressiveInlining)]
42        public
43        ↪ UInt64InternalLinksSourcesRecursionlessSizeBalancedTreeMethods(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>
61        /// </returns>
62        [MethodImpl(MethodImplOptions.AggressiveInlining)]
63        protected override ref TLink GetLeftReference(TLink node) => ref
64        ↪ LinksIndexParts[node].LeftAsSource;
65
66        /// <summary>
67        /// <para>
68        /// Gets the right reference using the specified node.
69        /// </para>
70        /// <para></para>
71        /// </summary>
72        /// <param name="node">
73        /// <para>The node.</para>
74        /// <para></para>
75        /// </param>
76        /// <returns>
77        /// <para>The ref link</para>
78        /// <para></para>
79        /// </returns>
80        [MethodImpl(MethodImplOptions.AggressiveInlining)]
81        protected override ref TLink GetRightReference(TLink node) => ref
82        ↪ LinksIndexParts[node].RightAsSource;
83
84        /// <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>

```

```

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) => 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     /// <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 }

```

1.74 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64InternalLinksSourcesSizeBalancedTreeMethods

```

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 :
16         ↪ UInt64InternalLinksSizeBalancedTreeMethodsBase
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see cref="UInt64InternalLinksSourcesSizeBalancedTreeMethods"/>
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>

```

```

35     /// <param name="header">
36     /// <para>A header.</para>
37     /// </para>
38     /// </param>
39     [MethodImpl(MethodImplOptions.AggressiveInlining)]
40     public UInt64InternalLinksSourcesSizeBalancedTreeMethods(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     /// </summary>
47     /// <param name="node">
48     /// <para>The node.</para>
49     /// </para>
50     /// </param>
51     /// <returns>
52     /// <para>The ref link</para>
53     /// </returns>
54     [MethodImpl(MethodImplOptions.AggressiveInlining)]
55     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     /// </summary>
64     /// <param name="node">
65     /// <para>The node.</para>
66     /// </para>
67     /// </param>
68     /// <returns>
69     /// <para>The ref link</para>
70     /// </returns>
71     [MethodImpl(MethodImplOptions.AggressiveInlining)]
72     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     /// </summary>
81     /// <param name="node">
82     /// <para>The node.</para>
83     /// </para>
84     /// </param>
85     /// <returns>
86     /// <para>The link</para>
87     /// </returns>
88     [MethodImpl(MethodImplOptions.AggressiveInlining)]
89     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     /// </summary>
98     /// <param name="node">
99     /// <para>The node.</para>
100    /// </para>
101    /// </param>
102    /// <returns>
103    /// <para>The link</para>
104    /// </returns>
105    [MethodImpl(MethodImplOptions.AggressiveInlining)]
106
107

```



```

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 }

```

1.75 ./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 :
        ↳ UInt64InternalLinksRecursionlessSizeBalancedTreeMethodsBase
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see
20         ↳ cref="UInt64InternalLinksTargetsRecursionlessSizeBalancedTreeMethods"/> instance.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         /// <param name="constants">
25         /// <para>A constants.</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>

```

```

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
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>

```

```

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 using the specified node.
183     /// </para>
184     /// <para></para>
185     /// </summary>
186     /// <param name="node">
187     /// <para>The node.</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 node) => LinksIndexParts[node].RootAsTarget;
196
197     /// <summary>
198     /// <para>
199     /// Gets the base part value using the specified node.
200     /// </para>
201     /// <para></para>
202     /// </summary>
203     /// <param name="node">
204     /// <para>The node.</para>
205     /// <para></para>
206     /// </param>
207     /// <returns>
208     /// <para>The link</para>
209     /// <para></para>
210     /// </returns>
211     [MethodImpl(MethodImplOptions.AggressiveInlining)]
212     protected override TLink GetBasePartValue(TLink node) => LinksDataParts[node].Target;
213
214     /// <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 }

```

1.76 ./csharp/Platform.Data.Doublets/Memory/Split/Specific/UInt64InternalLinksTargetsSizeBalancedTreeMethod

```

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 :
16         ↪ UInt64InternalLinksSizeBalancedTreeMethodsBase
17     {
18         /// <summary>
19         /// <para>

```

```

19     /// Initializes a new <see cref="UInt64InternalLinksTargetsSizeBalancedTreeMethods"/>
20     ↪ instance.
21     /// </para>
22     /// </summary>
23     /// <param name="constants">
24     /// <para>A constants.</para>
25     /// </param>
26     /// <param name="linksDataParts">
27     /// <para>A links data parts.</para>
28     /// </param>
29     /// <param name="linksIndexParts">
30     /// <para>A links index parts.</para>
31     /// </param>
32     /// <param name="header">
33     /// <para>A header.</para>
34     /// </param>
35     [MethodImpl(MethodImplOptions.AggressiveInlining)]
36     public UInt64InternalLinksTargetsSizeBalancedTreeMethods(LinksConstants<TLink>
37     ↪ constants, RawLinkDataPart<TLink>* linksDataParts, RawLinkIndexPart<TLink>*
38     ↪ linksIndexParts, LinksHeader<TLink>* header) : base(constants, linksDataParts,
39     ↪ 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     /// </param>
49     /// <returns>
50     /// <para>The ref ulong</para>
51     /// </returns>
52     [MethodImpl(MethodImplOptions.AggressiveInlining)]
53     protected override ref ulong GetLeftReference(ulong node) => ref
54     ↪ LinksIndexParts[node].LeftAsTarget;
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     /// </param>
64     /// <returns>
65     /// <para>The ref ulong</para>
66     /// </returns>
67     [MethodImpl(MethodImplOptions.AggressiveInlining)]
68     protected override ref ulong GetRightReference(ulong node) => ref
69     ↪ LinksIndexParts[node].RightAsTarget;
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     /// </param>
79     /// <returns>
80     /// <para>The link</para>
81     /// </returns>
82     [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>

```



```

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].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;

```

```

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) =>
        ↪ SearchCore(GetTreeRoot(target), source);
267 }
268 }

```

1.77 ./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         private readonly Func<ILinksTreeMethods<TLink>> _createInternalSourceTreeMethods;
22         private readonly Func<ILinksTreeMethods<TLink>> _createExternalSourceTreeMethods;
23         private readonly Func<ILinksTreeMethods<TLink>> _createInternalTargetTreeMethods;
24         private readonly Func<ILinksTreeMethods<TLink>> _createExternalTargetTreeMethods;
25         private LinksHeader<ulong>* _header;
26         private RawLinkDataPart<ulong>* _linksDataParts;
27         private RawLinkIndexPart<ulong>* _linksIndexParts;
28
29         /// <summary>
30         /// <para>
31         /// Initializes a new <see cref="UInt64SplitMemoryLinks"/> instance.
32         /// </para>
33         /// <para></para>
34         /// </summary>
35         /// <param name="dataMemory">
36         /// <para>A data memory.</para>
37         /// <para></para>
38         /// </param>
39         /// <param name="indexMemory">
40         /// <para>A index memory.</para>
41         /// <para></para>
42         /// </param>
43         [MethodImpl(MethodImplOptions.AggressiveInlining)]
44         public UInt64SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
            ↪ indexMemory) : this(dataMemory, indexMemory, DefaultLinksSizeStep) { }
45
46         /// <summary>
47         /// <para>
48         /// Initializes a new <see cref="UInt64SplitMemoryLinks"/> instance.
49         /// </para>
50         /// <para></para>

```

```

51     /// </summary>
52     /// <param name="dataMemory">
53     /// <para>A data memory.</para>
54     /// </para>
55     /// </param>
56     /// <param name="indexMemory">
57     /// <para>A index memory.</para>
58     /// </para>
59     /// </param>
60     /// <param name="memoryReservationStep">
61     /// <para>A memory reservation step.</para>
62     /// </para>
63     /// </param>
64     [MethodImpl(MethodImplOptions.AggressiveInlining)]
65     public UInt64SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
        ↳ indexMemory, long memoryReservationStep) : this(dataMemory, indexMemory,
        ↳ memoryReservationStep, Default<LinksConstants<TLink>>.Instance,
        ↳ IndexTreeType.Default, useLinkedList: true) { }

66
67     /// <summary>
68     /// <para>
69     /// Initializes a new <see cref="UInt64SplitMemoryLinks"/> instance.
70     /// </para>
71     /// </para>
72     /// </summary>
73     /// <param name="dataMemory">
74     /// <para>A data memory.</para>
75     /// </para>
76     /// </param>
77     /// <param name="indexMemory">
78     /// <para>A index memory.</para>
79     /// </para>
80     /// </param>
81     /// <param name="memoryReservationStep">
82     /// <para>A memory reservation step.</para>
83     /// </para>
84     /// </param>
85     /// <param name="constants">
86     /// <para>A constants.</para>
87     /// </para>
88     /// </param>
89     [MethodImpl(MethodImplOptions.AggressiveInlining)]
90     public UInt64SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
        ↳ indexMemory, long memoryReservationStep, LinksConstants<TLink> constants) :
        ↳ this(dataMemory, indexMemory, memoryReservationStep, constants,
        ↳ IndexTreeType.Default, useLinkedList: true) { }

91
92     /// <summary>
93     /// <para>
94     /// Initializes a new <see cref="UInt64SplitMemoryLinks"/> instance.
95     /// </para>
96     /// </para>
97     /// </summary>
98     /// <param name="dataMemory">
99     /// <para>A data memory.</para>
100    /// </para>
101    /// </param>
102    /// <param name="indexMemory">
103    /// <para>A index memory.</para>
104    /// </para>
105    /// </param>
106    /// <param name="memoryReservationStep">
107    /// <para>A memory reservation step.</para>
108    /// </para>
109    /// </param>
110    /// <param name="constants">
111    /// <para>A constants.</para>
112    /// </para>
113    /// </param>
114    /// <param name="indexTreeType">
115    /// <para>A index tree type.</para>
116    /// </para>
117    /// </param>
118    /// <param name="useLinkedList">
119    /// <para>A use linked list.</para>
120    /// </para>
121    /// </param>

```

```

122 [MethodImpl(MethodImplOptions.AggressiveInlining)]
123 public UInt64SplitMemoryLinks(IResizableDirectMemory dataMemory, IResizableDirectMemory
    ↳ indexMemory, long memoryReservationStep, LinksConstants<TLink> constants,
    ↳ IndexTreeType indexTreeType, bool useLinkedList) : base(dataMemory, indexMemory,
    ↳ memoryReservationStep, constants, useLinkedList)
124 {
125     if (indexTreeType == IndexTreeType.SizeBalancedTree)
126     {
127         _createInternalSourceTreeMethods = () => new
            ↳ UInt64InternalLinksSourcesSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
128         _createExternalSourceTreeMethods = () => new
            ↳ UInt64ExternalLinksSourcesSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
129         _createInternalTargetTreeMethods = () => new
            ↳ UInt64InternalLinksTargetsSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
130         _createExternalTargetTreeMethods = () => new
            ↳ UInt64ExternalLinksTargetsSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
131     }
132     else
133     {
134         _createInternalSourceTreeMethods = () => new
            ↳ UInt64InternalLinksSourcesRecursionlessSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
135         _createExternalSourceTreeMethods = () => new
            ↳ UInt64ExternalLinksSourcesRecursionlessSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
136         _createInternalTargetTreeMethods = () => new
            ↳ UInt64InternalLinksTargetsRecursionlessSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
137         _createExternalTargetTreeMethods = () => new
            ↳ UInt64ExternalLinksTargetsRecursionlessSizeBalancedTreeMethods(Constants,
            ↳ _linksDataParts, _linksIndexParts, _header);
138     }
139     Init(dataMemory, indexMemory);
140 }
141
142 /// <summary>
143 /// <para>
144 /// Sets the pointers using the specified data memory.
145 /// </para>
146 /// <para></para>
147 /// </summary>
148 /// <param name="dataMemory">
149 /// <para>The data memory.</para>
150 /// <para></para>
151 /// </param>
152 /// <param name="indexMemory">
153 /// <para>The index memory.</para>
154 /// <para></para>
155 /// </param>
156 [MethodImpl(MethodImplOptions.AggressiveInlining)]
157 protected override void SetPointers(IResizableDirectMemory dataMemory,
    ↳ IResizableDirectMemory indexMemory)
158 {
159     _linksDataParts = (RawLinkDataPart<TLink>*)dataMemory.Pointer;
160     _linksIndexParts = (RawLinkIndexPart<TLink>*)indexMemory.Pointer;
161     _header = (LinksHeader<TLink>*)indexMemory.Pointer;
162     if (_useLinkedList)
163     {
164         InternalSourcesListMethods = new
            ↳ UInt64InternalLinksSourcesLinkedListMethods(Constants, _linksDataParts,
            ↳ _linksIndexParts);
165     }
166     else
167     {
168         InternalSourcesTreeMethods = _createInternalSourceTreeMethods();
169     }
170     ExternalSourcesTreeMethods = _createExternalSourceTreeMethods();
171     InternalTargetsTreeMethods = _createInternalTargetTreeMethods();
172     ExternalTargetsTreeMethods = _createExternalTargetTreeMethods();
173     UnusedLinksListMethods = new UInt64UnusedLinksListMethods(_linksDataParts, _header);
174 }
175
176 /// <summary>

```

```

177     /// <para>
178     /// Resets the pointers.
179     /// </para>
180     /// <para></para>
181     /// </summary>
182     [MethodImpl(MethodImplOptions.AggressiveInlining)]
183     protected override void ResetPointers()
184     {
185         base.ResetPointers();
186         _linksDataParts = null;
187         _linksIndexParts = null;
188         _header = null;
189     }
190
191     /// <summary>
192     /// <para>
193     /// Gets the header reference.
194     /// </para>
195     /// <para></para>
196     /// </summary>
197     /// <returns>
198     /// <para>A ref links header of t link</para>
199     /// <para></para>
200     /// </returns>
201     [MethodImpl(MethodImplOptions.AggressiveInlining)]
202     protected override ref LinksHeader<TLink> GetHeaderReference() => ref *_header;
203
204     /// <summary>
205     /// <para>
206     /// Gets the link data part reference using the specified link index.
207     /// </para>
208     /// <para></para>
209     /// </summary>
210     /// <param name="linkIndex">
211     /// <para>The link index.</para>
212     /// <para></para>
213     /// </param>
214     /// <returns>
215     /// <para>A ref raw link data part of t link</para>
216     /// <para></para>
217     /// </returns>
218     [MethodImpl(MethodImplOptions.AggressiveInlining)]
219     protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink linkIndex)
220     ↪ => ref _linksDataParts[linkIndex];
221
222     /// <summary>
223     /// <para>
224     /// Gets the link index part reference using the specified link index.
225     /// </para>
226     /// <para></para>
227     /// </summary>
228     /// <param name="linkIndex">
229     /// <para>The link index.</para>
230     /// <para></para>
231     /// </param>
232     /// <returns>
233     /// <para>A ref raw link index part of t link</para>
234     /// <para></para>
235     /// </returns>
236     [MethodImpl(MethodImplOptions.AggressiveInlining)]
237     protected override ref RawLinkIndexPart<TLink> GetLinkIndexPartReference(TLink
238     ↪ linkIndex) => ref _linksIndexParts[linkIndex];
239
240     /// <summary>
241     /// <para>
242     /// Determines whether this instance are equal.
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>

```

```

253     /// <para>The bool</para>
254     /// <para></para>
255     /// </returns>
256     [MethodImpl(MethodImplOptions.AggressiveInlining)]
257     protected override bool AreEqual(ulong first, ulong second) => first == second;
258
259     /// <summary>
260     /// <para>
261     /// Determines whether this instance less than.
262     /// </para>
263     /// <para></para>
264     /// </summary>
265     /// <param name="first">
266     /// <para>The first.</para>
267     /// <para></para>
268     /// </param>
269     /// <param name="second">
270     /// <para>The second.</para>
271     /// <para></para>
272     /// </param>
273     /// <returns>
274     /// <para>The bool</para>
275     /// <para></para>
276     /// </returns>
277     [MethodImpl(MethodImplOptions.AggressiveInlining)]
278     protected override bool LessThan(ulong first, ulong second) => first < second;
279
280     /// <summary>
281     /// <para>
282     /// Determines whether this instance less or equal than.
283     /// </para>
284     /// <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 LessOrEqualThan(ulong first, ulong second) => first <= second;
300
301     /// <summary>
302     /// <para>
303     /// Determines whether this instance greater 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 GreaterThan(ulong first, ulong second) => first > second;
321
322     /// <summary>
323     /// <para>
324     /// Determines whether this instance greater 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 GreaterOrEqualThan(ulong first, ulong second) => first >= second;
342
343     /// <summary>
344     /// <para>
345     /// Gets the zero.
346     /// </para>
347     /// <para></para>
348     /// </summary>
349     /// <returns>
350     /// <para>The ulong</para>
351     /// <para></para>
352     /// </returns>
353     [MethodImpl(MethodImplOptions.AggressiveInlining)]
354     protected override ulong GetZero() => 0UL;
355
356     /// <summary>
357     /// <para>
358     /// Gets the one.
359     /// </para>
360     /// <para></para>
361     /// </summary>
362     /// <returns>
363     /// <para>The ulong</para>
364     /// <para></para>
365     /// </returns>
366     [MethodImpl(MethodImplOptions.AggressiveInlining)]
367     protected override ulong GetOne() => 1UL;
368
369     /// <summary>
370     /// <para>
371     /// Converts the to int 64 using the specified value.
372     /// </para>
373     /// <para></para>
374     /// </summary>
375     /// <param name="value">
376     /// <para>The value.</para>
377     /// <para></para>
378     /// </param>
379     /// <returns>
380     /// <para>The long</para>
381     /// <para></para>
382     /// </returns>
383     [MethodImpl(MethodImplOptions.AggressiveInlining)]
384     protected override long ConvertToInt64(ulong value) => (long)value;
385
386     /// <summary>
387     /// <para>
388     /// Converts the to address using the specified value.
389     /// </para>
390     /// <para></para>
391     /// </summary>
392     /// <param name="value">
393     /// <para>The value.</para>
394     /// <para></para>
395     /// </param>
396     /// <returns>
397     /// <para>The ulong</para>
398     /// <para></para>
399     /// </returns>
400     [MethodImpl(MethodImplOptions.AggressiveInlining)]
401     protected override ulong ConvertToAddress(long value) => (ulong)value;
402
403     /// <summary>
404     /// <para>
405     /// Adds the first.
406     /// </para>
407     /// <para></para>
408     /// </summary>

```

```

409     /// <param name="first">
410     /// <para>The first.</para>
411     /// <para></para>
412     /// </param>
413     /// <param name="second">
414     /// <para>The second.</para>
415     /// <para></para>
416     /// </param>
417     /// <returns>
418     /// <para>The ulong</para>
419     /// <para></para>
420     /// </returns>
421     [MethodImpl(MethodImplOptions.AggressiveInlining)]
422     protected override ulong Add(ulong first, ulong second) => first + second;
423
424     /// <summary>
425     /// <para>
426     /// Subtracts the first.
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 ulong</para>
440     /// <para></para>
441     /// </returns>
442     [MethodImpl(MethodImplOptions.AggressiveInlining)]
443     protected override ulong Subtract(ulong first, ulong second) => first - second;
444
445     /// <summary>
446     /// <para>
447     /// Increments the link.
448     /// </para>
449     /// <para></para>
450     /// </summary>
451     /// <param name="link">
452     /// <para>The link.</para>
453     /// <para></para>
454     /// </param>
455     /// <returns>
456     /// <para>The ulong</para>
457     /// <para></para>
458     /// </returns>
459     [MethodImpl(MethodImplOptions.AggressiveInlining)]
460     protected override ulong Increment(ulong link) => ++link;
461
462     /// <summary>
463     /// <para>
464     /// Decrements the link.
465     /// </para>
466     /// <para></para>
467     /// </summary>
468     /// <param name="link">
469     /// <para>The link.</para>
470     /// <para></para>
471     /// </param>
472     /// <returns>
473     /// <para>The ulong</para>
474     /// <para></para>
475     /// </returns>
476     [MethodImpl(MethodImplOptions.AggressiveInlining)]
477     protected override ulong Decrement(ulong link) => --link;
478 }
479 }

```

1.78 ./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        private readonly RawLinkDataPart<ulong>* _links;
19        private readonly LinksHeader<ulong>* _header;
20
21        /// <summary>
22        /// <para>
23        /// Initializes a new <see cref="UInt64UnusedLinksListMethods"/> instance.
24        /// </para>
25        /// <para></para>
26        /// </summary>
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 UInt64UnusedLinksListMethods(RawLinkDataPart<ulong>* links, LinksHeader<ulong>*
37        ↪ header)
38        : base((byte*)links, (byte*)header)
39        {
40            _links = links;
41            _header = header;
42        }
43
44        /// <summary>
45        /// <para>
46        /// Gets the link data part reference using the specified link.
47        /// </para>
48        /// <para></para>
49        /// </summary>
50        /// <param name="link">
51        /// <para>The link.</para>
52        /// <para></para>
53        /// </param>
54        /// <returns>
55        /// <para>A ref raw link data part of t link</para>
56        /// <para></para>
57        /// </returns>
58        [MethodImpl(MethodImplOptions.AggressiveInlining)]
59        protected override ref RawLinkDataPart<TLink> GetLinkDataPartReference(TLink link) =>
60        ↪ ref _links[link];
61
62        /// <summary>
63        /// <para>
64        /// Gets the header reference.
65        /// </para>
66        /// <para></para>
67        /// </summary>
68        /// <returns>
69        /// <para>A ref links header of t link</para>
70        /// <para></para>
71        /// </returns>
72        [MethodImpl(MethodImplOptions.AggressiveInlining)]
73        protected override ref LinksHeader<TLink> GetHeaderReference() => ref *_header;
74    }
75 }

```

1.79 ./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.Delegates;

```

```

8 using Platform.Numbers;
9 using static System.Runtime.CompilerServices.Unsafe;
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 links avl balanced tree methods base.
18     /// </para>
19     /// <para></para>
20     /// </summary>
21     /// <seealso cref="SizedAndThreadedAVLBalancedTreeMethods{TLink}"/>
22     /// <seealso cref="ILinksTreeMethods{TLink}"/>
23     public unsafe abstract class LinksAvlBalancedTreeMethodsBase<TLink> :
24         ↳ SizedAndThreadedAVLBalancedTreeMethods<TLink>, ILinksTreeMethods<TLink>
25     {
26         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
27             ↳ UncheckedConverter<TLink, long>.Default;
28         private static readonly UncheckedConverter<TLink, int> _addressToInt32Converter =
29             ↳ UncheckedConverter<TLink, int>.Default;
30         private static readonly UncheckedConverter<bool, TLink> _boolToAddressConverter =
31             ↳ UncheckedConverter<bool, TLink>.Default;
32         private static readonly UncheckedConverter<TLink, bool> _addressToBoolConverter =
33             ↳ UncheckedConverter<TLink, bool>.Default;
34         private static readonly UncheckedConverter<int, TLink> _int32ToAddressConverter =
35             ↳ UncheckedConverter<int, TLink>.Default;
36
37         /// <summary>
38         /// <para>
39         /// The break.
40         /// </para>
41         /// <para></para>
42         /// </summary>
43         protected readonly TLink Break;
44
45         /// <summary>
46         /// <para>
47         /// The continue.
48         /// </para>
49         /// <para></para>
50         /// </summary>
51         protected readonly TLink Continue;
52
53         /// <summary>
54         /// <para>
55         /// The links.
56         /// </para>
57         /// <para></para>
58         /// </summary>
59         protected readonly byte* Links;
60
61         /// <summary>
62         /// <para>
63         /// The header.
64         /// </para>
65         /// <para></para>
66         /// </summary>
67         protected readonly byte* Header;
68
69         /// <summary>
70         /// <para>
71         /// Initializes a new <see cref="LinksAvlBalancedTreeMethodsBase"/> instance.
72         /// </para>
73         /// <para></para>
74         /// </summary>
75         /// <param name="constants">
76         /// <para>A constants.</para>
77         /// <para></para>
78         /// </param>
79         /// <param name="links">
80         /// <para>A links.</para>
81         /// <para></para>
82         /// </param>
83         /// <param name="header">
84         /// <para>A header.</para>
85         /// <para></para>
86         /// </param>
87         [MethodImpl(MethodImplOptions.AggressiveInlining)]
88         protected LinksAvlBalancedTreeMethodsBase(LinksConstants<TLink> constants, byte* links,
89             ↳ 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 FirstIsToLeftOfSecond(TLink first, TLink second)
246    {
247        ref var firstLink = ref GetLinkReference(first);
248        ref var secondLink = ref GetLinkReference(second);
249        return FirstIsToLeftOfSecond(firstLink.Source, firstLink.Target,
250            ↪ secondLink.Source, secondLink.Target);
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    /// <summary>
279    /// <para>
280    /// Gets the size value using the specified 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 link</para>
290    /// <para></para>
291    /// </returns>
292    [MethodImpl(MethodImplOptions.AggressiveInlining)]
293    protected virtual TLink GetSizeValue(TLink value) => Bit<TLink>.PartialRead(value, 5,
294        ↪ -5);
295    /// <summary>
296    /// <para>
297    /// Sets the size value using the specified stored value.
298    /// </para>
299    /// <para></para>
300    /// </summary>
301    /// <param name="storedValue">
302    /// <para>The stored value.</para>
303    /// <para></para>
304    /// </param>
305    /// <param name="size">

```

```

306 /// <para>The size.</para>
307 /// <para></para>
308 /// </param>
309 [MethodImpl(MethodImplOptions.AggressiveInlining)]
310 protected virtual void SetSizeValue(ref TLink storedValue, TLink size) => storedValue =
    ↪ Bit<TLink>.PartialWrite(storedValue, size, 5, -5);

311
312 /// <summary>
313 /// <para>
314 /// Determines whether this instance get left is child value.
315 /// </para>
316 /// <para></para>
317 /// </summary>
318 /// <param name="value">
319 /// <para>The value.</para>
320 /// <para></para>
321 /// </param>
322 /// <returns>
323 /// <para>The bool</para>
324 /// <para></para>
325 /// </returns>
326 [MethodImpl(MethodImplOptions.AggressiveInlining)]
327 protected virtual bool GetLeftIsChildValue(TLink value)
328 {
329     unchecked
330     {
331         return _addressToBoolConverter.Convert(Bit<TLink>.PartialRead(value, 4, 1));
332         //return !EqualityComparer.Equals(Bit<TLink>.PartialRead(value, 4, 1), default);
333     }
334 }
335
336 /// <summary>
337 /// <para>
338 /// Sets the left is child value using the specified stored value.
339 /// </para>
340 /// <para></para>
341 /// </summary>
342 /// <param name="storedValue">
343 /// <para>The stored value.</para>
344 /// <para></para>
345 /// </param>
346 /// <param name="value">
347 /// <para>The value.</para>
348 /// <para></para>
349 /// </param>
350 [MethodImpl(MethodImplOptions.AggressiveInlining)]
351 protected virtual void SetLeftIsChildValue(ref TLink storedValue, bool value)
352 {
353     unchecked
354     {
355         var previousValue = storedValue;
356         var modified = Bit<TLink>.PartialWrite(previousValue,
    ↪ _boolToAddressConverter.Convert(value), 4, 1);
357         storedValue = modified;
358     }
359 }
360
361 /// <summary>
362 /// <para>
363 /// Determines whether this instance get right is child value.
364 /// </para>
365 /// <para></para>
366 /// </summary>
367 /// <param name="value">
368 /// <para>The value.</para>
369 /// <para></para>
370 /// </param>
371 /// <returns>
372 /// <para>The bool</para>
373 /// <para></para>
374 /// </returns>
375 [MethodImpl(MethodImplOptions.AggressiveInlining)]
376 protected virtual bool GetRightIsChildValue(TLink value)
377 {
378     unchecked
379     {
380         return _addressToBoolConverter.Convert(Bit<TLink>.PartialRead(value, 3, 1));
381         //return !EqualityComparer.Equals(Bit<TLink>.PartialRead(value, 3, 1), default);

```

```

382     }
383 }
384
385 /// <summary>
386 /// <para>
387 /// Sets the right is child value using the specified stored value.
388 /// </para>
389 /// <para></para>
390 /// </summary>
391 /// <param name="storedValue">
392 /// <para>The stored value.</para>
393 /// <para></para>
394 /// </param>
395 /// <param name="value">
396 /// <para>The value.</para>
397 /// <para></para>
398 /// </param>
399 [MethodImpl(MethodImplOptions.AggressiveInlining)]
400 protected virtual void SetRightIsChildValue(ref TLink storedValue, bool value)
401 {
402     unchecked
403     {
404         var previousValue = storedValue;
405         var modified = Bit<TLink>.PartialWrite(previousValue,
406             ↪ _boolToAddressConverter.Convert(value), 3, 1);
407         storedValue = modified;
408     }
409 }
410
411 /// <summary>
412 /// <para>
413 /// Determines whether this instance is child.
414 /// </para>
415 /// <para></para>
416 /// </summary>
417 /// <param name="parent">
418 /// <para>The parent.</para>
419 /// <para></para>
420 /// </param>
421 /// <param name="possibleChild">
422 /// <para>The possible child.</para>
423 /// <para></para>
424 /// </param>
425 /// <returns>
426 /// <para>The bool</para>
427 /// <para></para>
428 /// </returns>
429 [MethodImpl(MethodImplOptions.AggressiveInlining)]
430 protected bool IsChild(TLink parent, TLink possibleChild)
431 {
432     var parentSize = GetSize(parent);
433     var childSize = GetSizeOrZero(possibleChild);
434     return GreaterThanZero(childSize) && LessOrEqualThan(childSize, parentSize);
435 }
436
437 /// <summary>
438 /// <para>
439 /// Gets the balance value using the specified stored value.
440 /// </para>
441 /// <para></para>
442 /// </summary>
443 /// <param name="storedValue">
444 /// <para>The stored value.</para>
445 /// <para></para>
446 /// </param>
447 /// <returns>
448 /// <para>The sbyte</para>
449 /// <para></para>
450 /// </returns>
451 [MethodImpl(MethodImplOptions.AggressiveInlining)]
452 protected virtual sbyte GetBalanceValue(TLink storedValue)
453 {
454     unchecked
455     {
456         var value = _addressToInt32Converter.Convert(Bit<TLink>.PartialRead(storedValue,
457             ↪ 0, 3));
458         value |= 0xF8 * ((value & 4) >> 2); // if negative, then continue ones to the
459             ↪ end of sbyte

```

```

457         return (sbyte)value;
458     }
459 }
460
461 /// <summary>
462 /// <para>
463 /// Sets the balance value using the specified stored value.
464 /// </para>
465 /// <para></para>
466 /// </summary>
467 /// <param name="storedValue">
468 /// <para>The stored value.</para>
469 /// <para></para>
470 /// </param>
471 /// <param name="value">
472 /// <para>The value.</para>
473 /// <para></para>
474 /// </param>
475 [MethodImpl(MethodImplOptions.AggressiveInlining)]
476 protected virtual void SetBalanceValue(ref TLink storedValue, sbyte value)
477 {
478     unchecked
479     {
480         var packagedValue = _int32ToAddressConverter.Convert((byte)value >> 5 & 4 |
481             ↪ value & 3);
482         var modified = Bit<TLink>.PartialWrite(storedValue, packagedValue, 0, 3);
483         storedValue = modified;
484     }
485 }
486
487 /// <summary>
488 /// <para>
489 /// The zero.
490 /// </para>
491 /// <para></para>
492 /// </summary>
493 public TLink this[TLink index]
494 {
495     [MethodImpl(MethodImplOptions.AggressiveInlining)]
496     get
497     {
498         var root = GetTreeRoot();
499         if (GreaterOrEqualThan(index, GetSize(root)))
500         {
501             return Zero;
502         }
503         while (!EqualToZero(root))
504         {
505             var left = GetLeftOrDefault(root);
506             var leftSize = GetSizeOrZero(left);
507             if (LessThan(index, leftSize))
508             {
509                 root = left;
510                 continue;
511             }
512             if (AreEqual(index, leftSize))
513             {
514                 return root;
515             }
516             root = GetRightOrDefault(root);
517             index = Subtract(index, Increment(leftSize));
518         }
519         return Zero; // TODO: Impossible situation exception (only if tree structure
520             ↪ broken)
521     }
522 }
523
524 /// <summary>
525 /// Выполняет поиск и возвращает индекс связи с указанными Source (началом) и Target
526 ↪ (концом).
527 /// </summary>
528 /// <param name="source">Индекс связи, которая является началом на искомой связи.</param>
529 /// <param name="target">Индекс связи, которая является концом на искомой связи.</param>
530 /// <returns>Индекс искомой связи.</returns>
531 [MethodImpl(MethodImplOptions.AggressiveInlining)]
532 public TLink Search(TLink source, TLink target)
533 {
534     var root = GetTreeRoot();

```



```

532 while (!EqualToZero(root))
533 {
534     ref var rootLink = ref GetLinkReference(root);
535     var rootSource = rootLink.Source;
536     var rootTarget = rootLink.Target;
537     if (FirstIsToTheLeftOfSecond(source, target, rootSource, rootTarget)) //
538         ↪ node.Key < root.Key
539     {
540         root = GetLeftOrDefault(root);
541     }
542     else if (FirstIsToTheRightOfSecond(source, target, rootSource, rootTarget)) //
543         ↪ node.Key > root.Key
544     {
545         root = GetRightOrDefault(root);
546     }
547     else // node.Key == root.Key
548     {
549         return root;
550     }
551 }
552 return Zero;
553 }
554
555 // TODO: Return indices range instead of references count
556 /// <summary>
557 /// <para>
558 /// Counts the usages using the specified link.
559 /// </para>
560 /// <para></para>
561 /// </summary>
562 /// <param name="link">
563 /// <para>The link.</para>
564 /// <para></para>
565 /// </param>
566 /// <returns>
567 /// <para>The link</para>
568 /// <para></para>
569 /// </returns>
570 [MethodImpl(MethodImplOptions.AggressiveInlining)]
571 public TLink CountUsages(TLink link)
572 {
573     var root = GetTreeRoot();
574     var total = GetSize(root);
575     var totalRightIgnore = Zero;
576     while (!EqualToZero(root))
577     {
578         var @base = GetBasePartValue(root);
579         if (LessOrEqualThan(@base, link))
580         {
581             root = GetRightOrDefault(root);
582         }
583         else
584         {
585             totalRightIgnore = Add(totalRightIgnore, Increment(GetRightSize(root)));
586             root = GetLeftOrDefault(root);
587         }
588     }
589     root = GetTreeRoot();
590     var totalLeftIgnore = Zero;
591     while (!EqualToZero(root))
592     {
593         var @base = GetBasePartValue(root);
594         if (GreaterOrEqualThan(@base, link))
595         {
596             root = GetLeftOrDefault(root);
597         }
598         else
599         {
600             totalLeftIgnore = Add(totalLeftIgnore, Increment(GetLeftSize(root)));
601             root = GetRightOrDefault(root);
602         }
603     }
604     return Subtract(Subtract(total, totalRightIgnore), totalLeftIgnore);
605 }
606
607 /// <summary>
608 /// <para>

```

```

608     /// Eaches the usage using the specified link.
609     /// </para>
610     /// <para></para>
611     /// </summary>
612     /// <param name="link">
613     /// <para>The link.</para>
614     /// <para></para>
615     /// </param>
616     /// <param name="handler">
617     /// <para>The handler.</para>
618     /// <para></para>
619     /// </param>
620     /// <returns>
621     /// <para>The continue.</para>
622     /// <para></para>
623     /// </returns>
624     [MethodImpl(MethodImplOptions.AggressiveInlining)]
625     public TLink EachUsage(TLink link, ReadHandler<TLink> handler)
626     {
627         var root = GetTreeRoot();
628         if (EqualToZero(root))
629         {
630             return Continue;
631         }
632         TLink first = Zero, current = root;
633         while (!EqualToZero(current))
634         {
635             var @base = GetBasePartValue(current);
636             if (GreaterOrEqualThan(@base, link))
637             {
638                 if (AreEqual(@base, link))
639                 {
640                     first = current;
641                 }
642                 current = GetLeftOrDefault(current);
643             }
644             else
645             {
646                 current = GetRightOrDefault(current);
647             }
648         }
649         if (!EqualToZero(first))
650         {
651             current = first;
652             while (true)
653             {
654                 if (AreEqual(handler(GetLinkValues(current)), Break))
655                 {
656                     return Break;
657                 }
658                 current = GetNext(current);
659                 if (EqualToZero(current) || !AreEqual(GetBasePartValue(current), link))
660                 {
661                     break;
662                 }
663             }
664         }
665         return Continue;
666     }
667
668     /// <summary>
669     /// <para>
670     /// Prints the node value using the specified node.
671     /// </para>
672     /// <para></para>
673     /// </summary>
674     /// <param name="node">
675     /// <para>The node.</para>
676     /// <para></para>
677     /// </param>
678     /// <param name="sb">
679     /// <para>The sb.</para>
680     /// <para></para>
681     /// </param>
682     [MethodImpl(MethodImplOptions.AggressiveInlining)]
683     protected override void PrintNodeValue(TLink node, StringBuilder sb)
684     {
685         ref var link = ref GetLinkReference(node);

```

```

686         sb.Append(' ');
687         sb.Append(link.Source);
688         sb.Append('-');
689         sb.Append('>');
690         sb.Append(link.Target);
691     }
692 }
693 }

```

1.80 ./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 Platform.Delegates;
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 recursionless size balanced tree methods base.
17     /// </para>
18     /// <para></para>
19     /// </summary>
20     /// <seealso cref="RecursionlessSizeBalancedTreeMethods{TLink}"/>
21     /// <seealso cref="ILinksTreeMethods{TLink}"/>
22     public unsafe abstract class LinksRecursionlessSizeBalancedTreeMethodsBase<TLink> :
23     ↪ RecursionlessSizeBalancedTreeMethods<TLink>, ILinksTreeMethods<TLink>
24     {
25         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
26         ↪ UncheckedConverter<TLink, long>.Default;
27
28         /// <summary>
29         /// <para>
30         /// The break.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         protected readonly TLink Break;
35
36         /// <summary>
37         /// <para>
38         /// The continue.
39         /// </para>
40         /// <para></para>
41         /// </summary>
42         protected readonly TLink Continue;
43
44         /// <summary>
45         /// <para>
46         /// The links.
47         /// </para>
48         /// <para></para>
49         /// </summary>
50         protected readonly byte* Links;
51
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"/>
63         ↪ instance.
64         /// </para>
65         /// <para></para>
66         /// </summary>
67         /// <param name="constants">
68         /// <para>A constants.</para>
69         /// <para></para>
70         /// </param>
71         /// <param name="links">
72         /// <para>A links.</para>
73         /// </param>
74     }
75 }

```

```

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

```

```

143     /// Determines whether this instance first is to the left of second.
144     /// </para>
145     /// <para></para>
146     /// </summary>
147     /// <param name="source">
148     /// <para>The source.</para>
149     /// <para></para>
150     /// </param>
151     /// <param name="target">
152     /// <para>The target.</para>
153     /// <para></para>
154     /// </param>
155     /// <param name="rootSource">
156     /// <para>The root source.</para>
157     /// <para></para>
158     /// </param>
159     /// <param name="rootTarget">
160     /// <para>The root target.</para>
161     /// <para></para>
162     /// </param>
163     /// <returns>
164     /// <para>The bool</para>
165     /// <para></para>
166     /// </returns>
167     [MethodImpl(MethodImplOptions.AggressiveInlining)]
168     protected abstract bool FirstIsToTheLeftOfSecond(TLink source, TLink target, TLink
        ↪ rootSource, TLink rootTarget);
169
170     /// <summary>
171     /// <para>
172     /// Gets the header reference.
173     /// </para>
174     /// <para></para>
175     /// </summary>
176     /// <returns>
177     /// <para>A ref links header of t link</para>
178     /// <para></para>
179     /// </returns>
180     [MethodImpl(MethodImplOptions.AggressiveInlining)]
181     protected virtual ref LinksHeader<TLink> GetHeaderReference() => ref
        ↪ AsRef<LinksHeader<TLink>>(Header);
182
183     /// <summary>
184     /// <para>
185     /// Gets the link reference using the specified link.
186     /// </para>
187     /// <para></para>
188     /// </summary>
189     /// <param name="link">
190     /// <para>The link.</para>
191     /// <para></para>
192     /// </param>
193     /// <returns>
194     /// <para>A ref raw link of t link</para>
195     /// <para></para>
196     /// </returns>
197     [MethodImpl(MethodImplOptions.AggressiveInlining)]
198     protected virtual ref RawLink<TLink> GetLinkReference(TLink link) => ref
        ↪ AsRef<RawLink<TLink>>(Links + (RawLink<TLink>.SizeInBytes *
        ↪ _addressToInt64Converter.Convert(link)));
199
200     /// <summary>
201     /// <para>
202     /// Gets the link values using the specified link index.
203     /// </para>
204     /// <para></para>
205     /// </summary>
206     /// <param name="linkIndex">
207     /// <para>The link index.</para>
208     /// <para></para>
209     /// </param>
210     /// <returns>
211     /// <para>A list of t link</para>
212     /// <para></para>
213     /// </returns>
214     [MethodImpl(MethodImplOptions.AggressiveInlining)]
215     protected virtual IList<TLink> GetLinkValues(TLink linkIndex)

```

```

216 {
217     ref var link = ref GetLinkReference(linkIndex);
218     return new Link<TLink>(linkIndex, link.Source, link.Target);
219 }
220
221 /// <summary>
222 /// <para>
223 /// Determines whether this instance first is to the left of second.
224 /// </para>
225 /// <para></para>
226 /// </summary>
227 /// <param name="first">
228 /// <para>The first.</para>
229 /// <para></para>
230 /// </param>
231 /// <param name="second">
232 /// <para>The second.</para>
233 /// <para></para>
234 /// </param>
235 /// <returns>
236 /// <para>The bool</para>
237 /// <para></para>
238 /// </returns>
239 [MethodImpl(MethodImplOptions.AggressiveInlining)]
240 protected override bool FirstIsToLeftOfSecond(TLink first, TLink second)
241 {
242     ref var firstLink = ref GetLinkReference(first);
243     ref var secondLink = ref GetLinkReference(second);
244     return FirstIsToLeftOfSecond(firstLink.Source, firstLink.Target,
245         ↪ secondLink.Source, secondLink.Target);
246 }
247
248 /// <summary>
249 /// <para>
250 /// Determines whether this instance first is to the right of second.
251 /// </para>
252 /// <para></para>
253 /// </summary>
254 /// <param name="first">
255 /// <para>The first.</para>
256 /// <para></para>
257 /// </param>
258 /// <param name="second">
259 /// <para>The second.</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 first, TLink second)
268 {
269     ref var firstLink = ref GetLinkReference(first);
270     ref var secondLink = ref GetLinkReference(second);
271     return FirstIsToTheRightOfSecond(firstLink.Source, firstLink.Target,
272         ↪ secondLink.Source, secondLink.Target);
273 }
274
275 /// <summary>
276 /// <para>
277 /// The zero.
278 /// </para>
279 /// <para></para>
280 /// </summary>
281 public TLink this[TLink index]
282 {
283     [MethodImpl(MethodImplOptions.AggressiveInlining)]
284     get
285     {
286         var root = GetTreeRoot();
287         if (GreaterOrEqualThan(index, GetSize(root)))
288         {
289             return Zero;
290         }
291         while (!EqualToZero(root))
292         {
293             var left = GetLeftOrDefault(root);

```

```

292         var leftSize = GetSizeOrZero(left);
293         if (LessThan(index, leftSize))
294         {
295             root = left;
296             continue;
297         }
298         if (AreEqual(index, leftSize))
299         {
300             return root;
301         }
302         root = GetRightOrDefault(root);
303         index = Subtract(index, Increment(leftSize));
304     }
305     return Zero; // TODO: Impossible situation exception (only if tree structure
306                  ↳ broken)
307 }
308
309 /// <summary>
310 /// Выполняет поиск и возвращает индекс связи с указанными Source (началом) и Target
311 ↳ (концом).
312 /// </summary>
313 /// <param name="source">Индекс связи, которая является началом на искомой связи.</param>
314 /// <param name="target">Индекс связи, которая является концом на искомой связи.</param>
315 /// <returns>Индекс искомой связи.</returns>
316 [MethodImpl(MethodImplOptions.AggressiveInlining)]
317 public TLink Search(TLink source, TLink target)
318 {
319     var root = GetTreeRoot();
320     while (!EqualToZero(root))
321     {
322         ref var rootLink = ref GetLinkReference(root);
323         var rootSource = rootLink.Source;
324         var rootTarget = rootLink.Target;
325         if (FirstIsToTheLeftOfSecond(source, target, rootSource, rootTarget)) //
326             ↳ node.Key < root.Key
327         {
328             root = GetLeftOrDefault(root);
329         }
330         else if (FirstIsToTheRightOfSecond(source, target, rootSource, rootTarget)) //
331             ↳ node.Key > root.Key
332         {
333             root = GetRightOrDefault(root);
334         }
335         else // node.Key == root.Key
336         {
337             return root;
338         }
339     }
340     return Zero;
341 }
342
343 // TODO: Return indices range instead of references count
344 /// <summary>
345 /// <para>
346 /// Counts the usages using the specified link.
347 /// </para>
348 /// <para></para>
349 /// </summary>
350 /// <param name="link">
351 /// <para>The link.</para>
352 /// <para></para>
353 /// </param>
354 /// <returns>
355 /// <para>The link</para>
356 /// <para></para>
357 /// </returns>
358 [MethodImpl(MethodImplOptions.AggressiveInlining)]
359 public TLink CountUsages(TLink link)
360 {
361     var root = GetTreeRoot();
362     var total = GetSize(root);
363     var totalRightIgnore = Zero;
364     while (!EqualToZero(root))
365     {
366         var @base = GetBasePartValue(root);
367         if (LessOrEqualThan(@base, link))
368         {

```

```

366         root = GetRightOrDefault(root);
367     }
368     else
369     {
370         totalRightIgnore = Add(totalRightIgnore, Increment(GetRightSize(root)));
371         root = GetLeftOrDefault(root);
372     }
373 }
374 root = GetTreeRoot();
375 var totalLeftIgnore = Zero;
376 while (!EqualToZero(root))
377 {
378     var @base = GetBasePartValue(root);
379     if (GreaterOrEqualThan(@base, link))
380     {
381         root = GetLeftOrDefault(root);
382     }
383     else
384     {
385         totalLeftIgnore = Add(totalLeftIgnore, Increment(GetLeftSize(root)));
386         root = GetRightOrDefault(root);
387     }
388 }
389 return Subtract(Subtract(total, totalRightIgnore), totalLeftIgnore);
390 }
391
392 /// <summary>
393 /// <para>
394 /// Eaches the usage using the specified base.
395 /// </para>
396 /// <para></para>
397 /// </summary>
398 /// <param name="@base">
399 /// <para>The base.</para>
400 /// <para></para>
401 /// </param>
402 /// <param name="handler">
403 /// <para>The handler.</para>
404 /// <para></para>
405 /// </param>
406 /// <returns>
407 /// <para>The link</para>
408 /// <para></para>
409 /// </returns>
410 [MethodImpl(MethodImplOptions.AggressiveInlining)]
411 public TLink EachUsage(TLink @base, ReadHandler<TLink> handler) => EachUsageCore(@base,
    ↳ GetTreeRoot(), handler);
412
413 // TODO: 1. Move target, handler to separate object. 2. Use stack or walker 3. Use
414 ↳ low-level MSIL stack.
415 [MethodImpl(MethodImplOptions.AggressiveInlining)]
416 private TLink EachUsageCore(TLink @base, TLink link, ReadHandler<TLink> handler)
417 {
418     var @continue = Continue;
419     if (EqualToZero(link))
420     {
421         return @continue;
422     }
423     var linkBasePart = GetBasePartValue(link);
424     var @break = Break;
425     if (GreaterThan(linkBasePart, @base))
426     {
427         if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
428         {
429             return @break;
430         }
431     }
432     else if (LessThan(linkBasePart, @base))
433     {
434         if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
435         {
436             return @break;
437         }
438     }
439     else //if (linkBasePart == @base)
440     {
441         if (AreEqual(handler(GetLinkValues(link)), @break))
442         {

```



```

442         return @break;
443     }
444     if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
445     {
446         return @break;
447     }
448     if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
449     {
450         return @break;
451     }
452 }
453 return @continue;
454 }
455
456 /// <summary>
457 /// <para>
458 /// Prints the node value using the specified node.
459 /// </para>
460 /// <para></para>
461 /// </summary>
462 /// <param name="node">
463 /// <para>The node.</para>
464 /// <para></para>
465 /// </param>
466 /// <param name="sb">
467 /// <para>The sb.</para>
468 /// <para></para>
469 /// </param>
470 [MethodImpl(MethodImplOptions.AggressiveInlining)]
471 protected override void PrintNodeValue(TLink node, StringBuilder sb)
472 {
473     ref var link = ref GetLinkReference(node);
474     sb.Append(' ');
475     sb.Append(link.Source);
476     sb.Append('-');
477     sb.Append('>');
478     sb.Append(link.Target);
479 }
480 }
481 }

```

1.81 ./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 Platform.Delegates;
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 size balanced tree methods base.
17     /// </para>
18     /// <para></para>
19     /// </summary>
20     /// <seealso cref="SizeBalancedTreeMethods{TLink}" />
21     /// <seealso cref="ILinksTreeMethods{TLink}" />
22     public unsafe abstract class LinksSizeBalancedTreeMethodsBase<TLink> :
23     ↪ SizeBalancedTreeMethods<TLink>, ILinksTreeMethods<TLink>
24     {
25         private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
26         ↪ UncheckedConverter<TLink, long>.Default;
27
28         /// <summary>
29         /// <para>
30         /// The break.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         protected readonly TLink Break;
35         /// <summary>
36         /// <para>
37         /// The continue.

```

```

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

```

```

113     /// <para>
114     /// Determines whether this instance first is to the right of second.
115     /// </para>
116     /// <para></para>
117     /// </summary>
118     /// <param name="source">
119     /// <para>The source.</para>
120     /// <para></para>
121     /// </param>
122     /// <param name="target">
123     /// <para>The target.</para>
124     /// <para></para>
125     /// </param>
126     /// <param name="rootSource">
127     /// <para>The root source.</para>
128     /// <para></para>
129     /// </param>
130     /// <param name="rootTarget">
131     /// <para>The root target.</para>
132     /// <para></para>
133     /// </param>
134     /// <returns>
135     /// <para>The bool</para>
136     /// <para></para>
137     /// </returns>
138     [MethodImpl(MethodImplOptions.AggressiveInlining)]
139     protected abstract bool FirstIsToTheRightOfSecond(TLink source, TLink target, TLink
        ↪ rootSource, TLink rootTarget);

140     /// <summary>
141     /// <para>
142     /// Determines whether this instance first is to the left of second.
143     /// </para>
144     /// <para></para>
145     /// </summary>
146     /// <param name="source">
147     /// <para>The source.</para>
148     /// <para></para>
149     /// </param>
150     /// <param name="target">
151     /// <para>The target.</para>
152     /// <para></para>
153     /// </param>
154     /// <param name="rootSource">
155     /// <para>The root source.</para>
156     /// <para></para>
157     /// </param>
158     /// <param name="rootTarget">
159     /// <para>The root target.</para>
160     /// <para></para>
161     /// </param>
162     /// <returns>
163     /// <para>The bool</para>
164     /// <para></para>
165     /// </returns>
166     [MethodImpl(MethodImplOptions.AggressiveInlining)]
167     protected abstract bool FirstIsToTheLeftOfSecond(TLink source, TLink target, TLink
        ↪ rootSource, TLink rootTarget);

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 t link</para>
177     /// <para></para>
178     /// </returns>
179     [MethodImpl(MethodImplOptions.AggressiveInlining)]
180     protected virtual ref LinksHeader<TLink> GetHeaderReference() => ref
        ↪ AsRef<LinksHeader<TLink>>(Header);

182     /// <summary>
183     /// <para>
184     /// Gets the link reference using the specified link.
185     /// </para>
186     /// <para></para>
187     /// </summary>

```

```

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

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

219     /// <summary>
220     /// <para>
221     /// Determines whether this instance first is to the left of second.
222     /// </para>
223     /// <para></para>
224     /// </summary>
225     /// <param name="first">
226     /// <para>The first.</para>
227     /// <para></para>
228     /// </param>
229     /// <param name="second">
230     /// <para>The second.</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 FirstIsToLeftOfSecond(TLink first, TLink second)
239     {
240         ref var firstLink = ref GetLinkReference(first);
241         ref var secondLink = ref GetLinkReference(second);
242         return FirstIsToLeftOfSecond(firstLink.Source, firstLink.Target,
        ↪ secondLink.Source, secondLink.Target);
243     }

244     /// <summary>
245     /// <para>
246     /// Determines whether this instance first is to the right of second.
247     /// </para>
248     /// <para></para>
249     /// </summary>
250     /// <param name="first">
251     /// <para>The first.</para>
252     /// <para></para>
253     /// </param>
254     /// <param name="second">
255     /// <para>The second.</para>
256     /// <para></para>
257     /// </param>
258     /// <returns>
259     /// <para>The bool</para>
260     /// <para></para>
261     /// </returns>
262     [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

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

```

```

336     }
337     return Zero;
338 }
339
340 // TODO: Return indices range instead of references count
341 /// <summary>
342 /// <para>
343 /// Counts the usages using the specified link.
344 /// </para>
345 /// <para></para>
346 /// </summary>
347 /// <param name="link">
348 /// <para>The link.</para>
349 /// <para></para>
350 /// </param>
351 /// <returns>
352 /// <para>The link</para>
353 /// <para></para>
354 /// </returns>
355 [MethodImpl(MethodImplOptions.AggressiveInlining)]
356 public TLink CountUsages(TLink link)
357 {
358     var root = GetTreeRoot();
359     var total = GetSize(root);
360     var totalRightIgnore = Zero;
361     while (!EqualToZero(root))
362     {
363         var @base = GetBasePartValue(root);
364         if (LessOrEqualThan(@base, link))
365         {
366             root = GetRightOrDefault(root);
367         }
368         else
369         {
370             totalRightIgnore = Add(totalRightIgnore, Increment(GetRightSize(root)));
371             root = GetLeftOrDefault(root);
372         }
373     }
374     root = GetTreeRoot();
375     var totalLeftIgnore = Zero;
376     while (!EqualToZero(root))
377     {
378         var @base = GetBasePartValue(root);
379         if (GreaterOrEqualThan(@base, link))
380         {
381             root = GetLeftOrDefault(root);
382         }
383         else
384         {
385             totalLeftIgnore = Add(totalLeftIgnore, Increment(GetLeftSize(root)));
386             root = GetRightOrDefault(root);
387         }
388     }
389     return Subtract(Subtract(total, totalRightIgnore), totalLeftIgnore);
390 }
391
392 /// <summary>
393 /// <para>
394 /// Eaches the usage using the specified base.
395 /// </para>
396 /// <para></para>
397 /// </summary>
398 /// <param name="@base">
399 /// <para>The base.</para>
400 /// <para></para>
401 /// </param>
402 /// <param name="handler">
403 /// <para>The handler.</para>
404 /// <para></para>
405 /// </param>
406 /// <returns>
407 /// <para>The link</para>
408 /// <para></para>
409 /// </returns>
410 [MethodImpl(MethodImplOptions.AggressiveInlining)]
411 public TLink EachUsage(TLink @base, ReadHandler<TLink> handler) => EachUsageCore(@base,
    ↪ GetTreeRoot(), handler);
412

```

```

413 // TODO: 1. Move target, handler to separate object. 2. Use stack or walker 3. Use
414     ↳ low-level MSIL stack.
415 [MethodImpl(MethodImplOptions.AggressiveInlining)]
416 private TLink EachUsageCore(TLink @base, TLink link, ReadHandler<TLink> handler)
417 {
418     var @continue = Continue;
419     if (EqualToZero(link))
420     {
421         return @continue;
422     }
423     var linkBasePart = GetBasePartValue(link);
424     var @break = Break;
425     if (GreaterThan(linkBasePart, @base))
426     {
427         if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
428         {
429             return @break;
430         }
431     }
432     else if (LessThan(linkBasePart, @base))
433     {
434         if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
435         {
436             return @break;
437         }
438     }
439     else //if (linkBasePart == @base)
440     {
441         if (AreEqual(handler(GetLinkValues(link)), @break))
442         {
443             return @break;
444         }
445         if (AreEqual(EachUsageCore(@base, GetLeftOrDefault(link), handler), @break))
446         {
447             return @break;
448         }
449         if (AreEqual(EachUsageCore(@base, GetRightOrDefault(link), handler), @break))
450         {
451             return @break;
452         }
453     }
454     return @continue;
455 }
456
457 /// <summary>
458 /// <para>
459 /// Prints the node value using the specified node.
460 /// </para>
461 /// <para></para>
462 /// </summary>
463 /// <param name="node">
464 /// <para>The node.</para>
465 /// <para></para>
466 /// </param>
467 /// <param name="sb">
468 /// <para>The sb.</para>
469 /// <para></para>
470 /// </param>
471 [MethodImpl(MethodImplOptions.AggressiveInlining)]
472 protected override void PrintNodeValue(TLink node, StringBuilder sb)
473 {
474     ref var link = ref GetLinkReference(node);
475     sb.Append(' ');
476     sb.Append(link.Source);
477     sb.Append('-');
478     sb.Append('>');
479     sb.Append(link.Target);
480 }
481 }

```

1.82 ./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> :
    ↳ LinksAvlBalancedTreeMethodsBase<TLink>
15 {
16     /// <summary>
17     /// <para>
18     /// Initializes a new <see cref="LinksSourcesAvlBalancedTreeMethods"/> 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 LinksSourcesAvlBalancedTreeMethods(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).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    /// <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).RightAsSource = 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) =>
157        ↪ GetSizeValue(GetLinkReference(node).SizeAsSource);
158
159    /// <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) => SetSizeValue(ref
        ↳ GetLinkReference(node).SizeAsSource, size);

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

189
190     /// <summary>
191     /// <para>
192     /// Sets the left is child using the specified node.
193     /// </para>
194     /// <para></para>
195     /// </summary>
196     /// <param name="node">
197     /// <para>The node.</para>
198     /// <para></para>
199     /// </param>
200     /// <param name="value">
201     /// <para>The value.</para>
202     /// <para></para>
203     /// </param>
204     [MethodImpl(MethodImplOptions.AggressiveInlining)]
205     protected override void SetLeftIsChild(TLink node, bool value) =>
        ↳ 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) =>
        ↳ GetRightIsChildValue(GetLinkReference(node).SizeAsSource);

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(TLink node, bool value) =>
240        ↪ SetRightIsChildValue(ref GetLinkReference(node).SizeAsSource, 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).SizeAsSource);
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).SizeAsSource, 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().RootAsSource;
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>
305    [MethodImpl(MethodImplOptions.AggressiveInlining)]
306    protected override TLink GetBasePartValue(TLink link) => GetLinkReference(link).Source;

```

```

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,
    ↪ TLink secondSource, TLink secondTarget) => LessThan(firstSource, secondSource) ||
    ↪ (AreEqual(firstSource, secondSource) && LessThan(firstTarget, secondTarget));

333    /// <summary>
334    /// <para>
335    /// Determines whether this instance first is to the right of second.
336    /// </para>
337    /// <para></para>
338    /// </summary>
339    /// <param name="firstSource">
340    /// <para>The first source.</para>
341    /// <para></para>
342    /// </param>
343    /// <param name="firstTarget">
344    /// <para>The first target.</para>
345    /// <para></para>
346    /// </param>
347    /// <param name="secondSource">
348    /// <para>The second source.</para>
349    /// <para></para>
350    /// </param>
351    /// <param name="secondTarget">
352    /// <para>The second target.</para>
353    /// <para></para>
354    /// </param>
355    /// <returns>
356    /// <para>The bool</para>
357    /// <para></para>
358    /// </returns>
359    [MethodImpl(MethodImplOptions.AggressiveInlining)]
360    protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
    ↪ TLink secondSource, TLink secondTarget) => GreaterThan(firstSource, secondSource) ||
    ↪ (AreEqual(firstSource, secondSource) && GreaterThan(firstTarget, secondTarget));

362    /// <summary>
363    /// <para>
364    /// Clears the node using the specified node.
365    /// </para>
366    /// <para></para>
367    /// </summary>
368    /// <param name="node">
369    /// <para>The node.</para>
370    /// <para></para>
371    /// </param>
372    [MethodImpl(MethodImplOptions.AggressiveInlining)]
373    protected override void ClearNode(TLink node)
374    {
375        ref var link = ref GetLinkReference(node);
376        link.LeftAsSource = Zero;
377        link.RightAsSource = Zero;
378        link.SizeAsSource = Zero;
379    }

```

```

380     }
381 }
382 }

```

1.83 ./csharp/Platform.Data.Doublets/Memory/United/Generic/LinksSourcesRecursionlessSizeBalancedTreeMeth

```

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> :
15         ↳ LinksRecursionlessSizeBalancedTreeMethodsBase<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="LinksSourcesRecursionlessSizeBalancedTreeMethods"/>
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 LinksSourcesRecursionlessSizeBalancedTreeMethods(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).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)]

```

```

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) =>
    ↪     GetLinkReference(node).RightAsSource = right;
138
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).SizeAsSource;
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).SizeAsSource = 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().RootAsSource;
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).Source;
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>

```

```

221     /// <param name="secondTarget">
222     /// <para>The second target.</para>
223     /// </para>
224     /// </param>
225     /// <returns>
226     /// <para>The bool</para>
227     /// </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     /// <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>
243     /// <param name="firstTarget">
244     /// <para>The first target.</para>
245     /// </para>
246     /// <param name="secondSource">
247     /// <para>The second source.</para>
248     /// </para>
249     /// <param name="secondTarget">
250     /// <para>The second target.</para>
251     /// </para>
252     /// </param>
253     /// <returns>
254     /// <para>The bool</para>
255     /// </para>
256     /// </returns>
257     [MethodImpl(MethodImplOptions.AggressiveInlining)]
258     protected override bool FirstIsToTheRightOfSecond(TLink firstSource, TLink firstTarget,
259     ↪ TLink secondSource, TLink secondTarget) => GreaterThan(firstSource, secondSource) ||
260     ↪ (AreEqual(firstSource, secondSource) && GreaterThan(firstTarget, secondTarget));
261
262     /// <summary>
263     /// <para>
264     /// <para>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>
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 }

```

1.84 ./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     /// <para>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> :
    ↳ LinksSizeBalancedTreeMethodsBase<TLink>
15  {
16      /// <summary>
17      /// <para>
18      /// Initializes a new <see cref="LinksSourcesSizeBalancedTreeMethods"/> 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 LinksSourcesSizeBalancedTreeMethods(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).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    /// <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).RightAsSource = 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).SizeAsSource;
157
158    /// <summary>
159    /// <para>
160    /// Sets the size using the specified node.
161    /// </para>
162    /// <para></para>
163    /// </summary>
164    /// <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).SizeAsSource = 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().RootAsSource;
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).Source;
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(firstSource, secondSource) ||
233        ↪ (AreEqual(firstSource, secondSource) && LessThan(firstTarget, secondTarget));
234
235    /// <summary>
236    /// <para>
237    /// Determines whether this instance first is to the right of second.

```

```

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(firstSource, secondSource) ||
        ↪ (AreEqual(firstSource, secondSource) && GreaterThan(firstTarget, secondTarget));

260
261     /// <summary>
262     /// <para>
263     /// Clears the node 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     [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 }

```

1.85 ./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> :
        ↪ LinksAvlBalancedTreeMethodsBase<TLink>
15     {
16         /// <summary>
17         /// <para>
18         /// Initializes a new <see cref="LinksTargetsAvlBalancedTreeMethods"/> 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 LinksTargetsAvlBalancedTreeMethods(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) =>
157        ↪ GetSizeValue(GetLinkReference(node).SizeAsTarget);
158
159    /// <summary>
160    /// <para>
161    /// Sets the size using the specified node.
162    /// </para>
163    /// <para></para>
164    /// </summary>
165    /// <param name="node">
166    /// <para>The node.</para>
167    /// <para></para>
168    /// </param>
169    /// <param name="size">
170    /// <para>The size.</para>
171    /// <para></para>
172    /// </param>
173    [MethodImpl(MethodImplOptions.AggressiveInlining)]
174    protected override void SetSize(TLink node, TLink size) => SetSizeValue(ref
175        ↪ GetLinkReference(node).SizeAsTarget, size);
176
177    /// <summary>
178    /// <para>
179    /// Determines whether this instance get left is child.
180    /// </para>
181    /// <para></para>
182    /// </summary>
183    /// <param name="node">

```

```

180    /// <para>The node.</para>
181    /// <para></para>
182    /// </param>
183    /// <returns>
184    /// <para>The bool</para>
185    /// <para></para>
186    /// </returns>
187    [MethodImpl(MethodImplOptions.AggressiveInlining)]
188    protected override bool GetLeftIsChild(TLink node) =>
189        ↪ GetLeftIsChildValue(GetLinkReference(node).SizeAsTarget);
190
191    /// <summary>
192    /// <para>
193    /// Sets the left is child using the specified node.
194    /// </para>
195    /// </summary>
196    /// <param name="node">
197    /// <para>The node.</para>
198    /// <para></para>
199    /// </param>
200    /// <param name="value">
201    /// <para>The value.</para>
202    /// <para></para>
203    /// </param>
204    [MethodImpl(MethodImplOptions.AggressiveInlining)]
205    protected override void SetLeftIsChild(TLink node, bool value) =>
206        ↪ SetLeftIsChildValue(ref GetLinkReference(node).SizeAsTarget, value);
207
208    /// <summary>
209    /// <para>
210    /// Determines whether this instance get right is child.
211    /// </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).SizeAsTarget);
224
225    /// <summary>
226    /// <para>
227    /// Sets the right is child using the specified node.
228    /// </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    /// </summary>
247    /// <param name="node">
248    /// <para>The node.</para>
249    /// <para></para>
250    /// </param>
251    /// <returns>
252    /// <para>The sbyte</para>
253    /// <para></para>

```

```

254     /// </returns>
255     [MethodImpl(MethodImplOptions.AggressiveInlining)]
256     protected override sbyte GetBalance(TLink node) =>
257         ↪ GetBalanceValue(GetLinkReference(node).SizeAsTarget);
258
259     /// <summary>
260     /// <para>
261     /// Sets the balance using the specified node.
262     /// </para>
263     /// <para></para>
264     /// </summary>
265     /// <param name="node">
266     /// <para>The node.</para>
267     /// <para></para>
268     /// </param>
269     /// <param name="value">
270     /// <para>The value.</para>
271     /// <para></para>
272     /// </param>
273     [MethodImpl(MethodImplOptions.AggressiveInlining)]
274     protected override void SetBalance(TLink node, sbyte value) => SetBalanceValue(ref
275         ↪ GetLinkReference(node).SizeAsTarget, value);
276
277     /// <summary>
278     /// <para>
279     /// Gets the tree root.
280     /// </para>
281     /// <para></para>
282     /// </summary>
283     /// <returns>
284     /// <para>The link</para>
285     /// <para></para>
286     /// </returns>
287     [MethodImpl(MethodImplOptions.AggressiveInlining)]
288     protected override TLink GetTreeRoot() => GetHeaderReference().RootAsTarget;
289
290     /// <summary>
291     /// <para>
292     /// Gets the base part value using the specified link.
293     /// </para>
294     /// <para></para>
295     /// </summary>
296     /// <param name="link">
297     /// <para>The link.</para>
298     /// <para></para>
299     /// </param>
300     /// <returns>
301     /// <para>The link</para>
302     /// <para></para>
303     /// </returns>
304     [MethodImpl(MethodImplOptions.AggressiveInlining)]
305     protected override TLink GetBasePartValue(TLink link) => GetLinkReference(link).Target;
306
307     /// <summary>
308     /// <para>
309     /// Determines whether this instance first is to the left of second.
310     /// </para>
311     /// <para></para>
312     /// </summary>
313     /// <param name="firstSource">
314     /// <para>The first source.</para>
315     /// <para></para>
316     /// </param>
317     /// <param name="firstTarget">
318     /// <para>The first target.</para>
319     /// <para></para>
320     /// </param>
321     /// <param name="secondSource">
322     /// <para>The second source.</para>
323     /// <para></para>
324     /// </param>
325     /// <param name="secondTarget">
326     /// <para>The second target.</para>
327     /// <para></para>
328     /// </param>
329     /// <returns>
330     /// <para>The bool</para>
331     /// <para></para>

```



```

330     /// </returns>
331     [MethodImpl(MethodImplOptions.AggressiveInlining)]
332     protected override bool FirstIsToTheLeftOfSecond(TLink firstSource, TLink firstTarget,
    ↪ TLink secondSource, TLink secondTarget) => LessThan(firstTarget, secondTarget) ||
    ↪ (AreEqual(firstTarget, secondTarget) && LessThan(firstSource, secondSource));
333
334     /// <summary>
335     /// <para>
336     /// Determines whether this instance first is to the right of second.
337     /// </para>
338     /// <para></para>
339     /// </summary>
340     /// <param name="firstSource">
341     /// <para>The first source.</para>
342     /// <para></para>
343     /// </param>
344     /// <param name="firstTarget">
345     /// <para>The first target.</para>
346     /// <para></para>
347     /// </param>
348     /// <param name="secondSource">
349     /// <para>The second source.</para>
350     /// <para></para>
351     /// </param>
352     /// <param name="secondTarget">
353     /// <para>The second target.</para>
354     /// <para></para>
355     /// </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(firstTarget, secondTarget) ||
    ↪ (AreEqual(firstTarget, secondTarget) && GreaterThan(firstSource, secondSource));
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.LeftAsTarget = Zero;
378         link.RightAsTarget = Zero;
379         link.SizeAsTarget = Zero;
380     }
381 }
382 }

```

1.86 ./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> :
    ↪ LinksRecursionlessSizeBalancedTreeMethodsBase<TLink>
15    {
16        /// <summary>
17        /// <para>
18        /// Initializes a new <see cref="LinksTargetsRecursionlessSizeBalancedTreeMethods" />
    ↪ 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 LinksTargetsRecursionlessSizeBalancedTreeMethods(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
158    /// <summary>
159    /// <para>
160    /// Sets the size using the specified node.
161    /// </para>
162    /// <para></para>
163    /// </summary>
164    /// <param name="node">
165    /// <para>The node.</para>
166    /// <para></para>
167    /// </param>
168    /// <param name="size">
169    /// <para>The size.</para>
170    /// <para></para>
171    /// </param>

```

```

170 [MethodImpl(MethodImplOptions.AggressiveInlining)]
171 protected override void SetSize(TLink node, TLink size) =>
    ↳ GetLinkReference(node).SizeAsTarget = size;
172
173 /// <summary>
174 /// <para>
175 /// Gets the tree root.
176 /// </para>
177 /// <para></para>
178 /// </summary>
179 /// <returns>
180 /// <para>The link</para>
181 /// <para></para>
182 /// </returns>
183 [MethodImpl(MethodImplOptions.AggressiveInlining)]
184 protected override TLink GetTreeRoot() => GetHeaderReference().RootAsTarget;
185
186 /// <summary>
187 /// <para>
188 /// Gets the base part value using the specified link.
189 /// </para>
190 /// <para></para>
191 /// </summary>
192 /// <param name="link">
193 /// <para>The link.</para>
194 /// <para></para>
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).Target;
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,
    ↳ TLink secondSource, TLink secondTarget) => LessThan(firstTarget, secondTarget) ||
    ↳ (AreEqual(firstTarget, secondTarget) && LessThan(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(TLink firstSource, TLink firstTarget,
        ↪ TLink secondSource, TLink secondTarget) => GreaterThan(firstTarget, secondTarget) ||
        ↪ (AreEqual(firstTarget, secondTarget) && GreaterThan(firstSource, secondSource));

260
261     /// <summary>
262     /// <para>
263     /// Clears the node 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     [MethodImpl(MethodImplOptions.AggressiveInlining)]
272     protected override void ClearNode(TLink node)
273     {
274         ref var link = ref GetLinkReference(node);
275         link.LeftAsTarget = Zero;
276         link.RightAsTarget = Zero;
277         link.SizeAsTarget = Zero;
278     }
279 }
280 }

```

1.87 ./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
53     ↪ GetLinkReference(node).LeftAsTarget;
54
55     /// <summary>
56     /// <para>
57     /// Gets the right reference using the specified node.
58     /// </para>
59     /// <para></para>
60     /// </summary>
61     /// <param name="node">
62     /// <para>The node.</para>
63     /// <para></para>
64     /// </param>
65     /// <returns>
66     /// <para>The ref link</para>
67     /// <para></para>
68     /// </returns>
69     [MethodImpl(MethodImplOptions.AggressiveInlining)]
70     protected override ref TLink GetRightReference(TLink node) => ref
71     ↪ GetLinkReference(node).RightAsTarget;
72
73     /// <summary>
74     /// <para>
75     /// Gets the left using the specified node.
76     /// </para>
77     /// <para></para>
78     /// </summary>
79     /// <param name="node">
80     /// <para>The node.</para>
81     /// <para></para>
82     /// </param>
83     /// <returns>
84     /// <para>The link</para>
85     /// <para></para>
86     /// </returns>
87     [MethodImpl(MethodImplOptions.AggressiveInlining)]
88     protected override TLink GetLeft(TLink node) => GetLinkReference(node).LeftAsTarget;
89
90     /// <summary>
91     /// <para>
92     /// Gets the right using the specified node.
93     /// </para>
94     /// <para></para>
95     /// </summary>
96     /// <param name="node">
97     /// <para>The node.</para>
98     /// <para></para>
99     /// </param>
100    /// <returns>
101    /// <para>The link</para>
102    /// <para></para>
103    /// </returns>
104    [MethodImpl(MethodImplOptions.AggressiveInlining)]
105    protected override TLink GetRight(TLink node) => GetLinkReference(node).RightAsTarget;
106
107    /// <summary>
108    /// <para>
109    /// Sets the left using the specified node.
110    /// </para>
111    /// <para></para>
112    /// </summary>
113    /// <param name="node">
114    /// <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     /// </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).RightAsTarget = 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></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     /// </summary>
179     /// <returns>
180     /// <para>The link</para>
181     /// <para></para>
182     /// </returns>
183     [MethodImpl(MethodImplOptions.AggressiveInlining)]
184     protected override TLink GetTreeRoot() => GetHeaderReference().RootAsTarget;
185
186     /// <summary>
187     /// <para>

```

```

188     /// Gets the base part value using the specified link.
189     /// </para>
190     /// <para></para>
191     /// </summary>
192     /// <param name="link">
193     /// <para>The link.</para>
194     /// <para></para>
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).Target;
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(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));

```



```

261     /// <summary>
262     /// <para>
263     /// Clears the node 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     [MethodImpl(MethodImplOptions.AggressiveInlining)]
272     protected override void ClearNode(TLink node)
273     {
274         ref var link = ref GetLinkReference(node);
275         link.LeftAsTarget = Zero;
276         link.RightAsTarget = Zero;
277         link.SizeAsTarget = Zero;
278     }
279 }
280 }

```

1.88 ./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         private readonly Func<ILinksTreeMethods<TLink>> _createSourceTreeMethods;
21         private readonly Func<ILinksTreeMethods<TLink>> _createTargetTreeMethods;
22         private byte* _header;
23         private byte* _links;
24
25         /// <summary>
26         /// <para>
27         /// Initializes a new <see cref="UnitedMemoryLinks" /> instance.
28         /// </para>
29         /// <para></para>
30         /// </summary>
31         /// <param name="address">
32         /// <para>A address.</para>
33         /// <para></para>
34         /// </param>
35         [MethodImpl(MethodImplOptions.AggressiveInlining)]
36         public UnitedMemoryLinks(string address) : this(address, DefaultLinksSizeStep) { }
37
38         /// <summary>
39         /// Создаёт экземпляр базы данных Links в файле по указанному адресу, с указанным
40         ↪ минимальным шагом расширения базы данных.
41         /// </summary>
42         /// <param name="address">Полный путь к файлу базы данных.</param>
43         /// <param name="memoryReservationStep">Минимальный шаг расширения базы данных в
44         ↪ байтах.</param>
45         [MethodImpl(MethodImplOptions.AggressiveInlining)]
46         public UnitedMemoryLinks(string address, long memoryReservationStep) : this(new
47         ↪ FileMappedResizableDirectMemory(address, memoryReservationStep),
48         ↪ memoryReservationStep) { }
49
50         /// <summary>
51         /// <para>
52         /// Initializes a new <see cref="UnitedMemoryLinks" /> instance.
53         /// </para>
54         /// <para></para>
55         /// </summary>
56         /// <param name="memory">
57         /// <para>A memory.</para>
58         /// <para></para>
59         /// </param>

```

```

54  /// <para></para>
55  /// </param>
56  [MethodImpl(MethodImplOptions.AggressiveInlining)]
57  public UnitedMemoryLinks(IResizableDirectMemory memory) : this(memory,
    ↳ DefaultLinksSizeStep) { }

58
59  /// <summary>
60  /// <para>
61  /// Initializes a new <see cref="UnitedMemoryLinks"/> instance.
62  /// </para>
63  /// <para></para>
64  /// </summary>
65  /// <param name="memory">
66  /// <para>A memory.</para>
67  /// <para></para>
68  /// </param>
69  /// <param name="memoryReservationStep">
70  /// <para>A memory reservation step.</para>
71  /// <para></para>
72  /// </param>
73  [MethodImpl(MethodImplOptions.AggressiveInlining)]
74  public UnitedMemoryLinks(IResizableDirectMemory memory, long memoryReservationStep) :
    ↳ this(memory, memoryReservationStep, Default<LinksConstants<TLink>>.Instance,
    ↳ IndexTreeType.Default) { }

75
76  /// <summary>
77  /// <para>
78  /// Initializes a new <see cref="UnitedMemoryLinks"/> instance.
79  /// </para>
80  /// <para></para>
81  /// </summary>
82  /// <param name="memory">
83  /// <para>A memory.</para>
84  /// <para></para>
85  /// </param>
86  /// <param name="memoryReservationStep">
87  /// <para>A memory reservation step.</para>
88  /// <para></para>
89  /// </param>
90  /// <param name="constants">
91  /// <para>A constants.</para>
92  /// <para></para>
93  /// </param>
94  /// <param name="indexTreeType">
95  /// <para>A index tree type.</para>
96  /// <para></para>
97  /// </param>
98  [MethodImpl(MethodImplOptions.AggressiveInlining)]
99  public UnitedMemoryLinks(IResizableDirectMemory memory, long memoryReservationStep,
    ↳ LinksConstants<TLink> constants, IndexTreeType indexTreeType) : base(memory,
    ↳ memoryReservationStep, constants)
100 {
101     if (indexTreeType == IndexTreeType.SizedAndThreadedAVLBalancedTree)
102     {
103         _createSourceTreeMethods = () => new
            ↳ LinksSourcesAvlBalancedTreeMethods<TLink>(Constants, _links, _header);
104         _createTargetTreeMethods = () => new
            ↳ LinksTargetsAvlBalancedTreeMethods<TLink>(Constants, _links, _header);
105     }
106     else
107     {
108         _createSourceTreeMethods = () => new
            ↳ LinksSourcesSizeBalancedTreeMethods<TLink>(Constants, _links, _header);
109         _createTargetTreeMethods = () => new
            ↳ LinksTargetsSizeBalancedTreeMethods<TLink>(Constants, _links, _header);
110     }
111     Init(memory, memoryReservationStep);
112 }

113
114 /// <summary>
115 /// <para>
116 /// Sets the pointers using the specified memory.
117 /// </para>
118 /// <para></para>
119 /// </summary>
120 /// <param name="memory">
121 /// <para>The memory.</para>

```

```

122     /// <para></para>
123     /// </param>
124     [MethodImpl(MethodImplOptions.AggressiveInlining)]
125     protected override void SetPointers(IResizableDirectMemory memory)
126     {
127         _links = (byte*)memory.Pointer;
128         _header = _links;
129         SourcesTreeMethods = _createSourceTreeMethods();
130         TargetsTreeMethods = _createTargetTreeMethods();
131         UnusedLinksListMethods = new UnusedLinksListMethods<TLink>(_links, _header);
132     }
133
134     /// <summary>
135     /// <para>
136     /// Resets the pointers.
137     /// </para>
138     /// <para></para>
139     /// </summary>
140     [MethodImpl(MethodImplOptions.AggressiveInlining)]
141     protected override void ResetPointers()
142     {
143         base.ResetPointers();
144         _links = null;
145         _header = null;
146     }
147
148     /// <summary>
149     /// <para>
150     /// Gets the header reference.
151     /// </para>
152     /// <para></para>
153     /// </summary>
154     /// <returns>
155     /// <para>A ref links header of t link</para>
156     /// <para></para>
157     /// </returns>
158     [MethodImpl(MethodImplOptions.AggressiveInlining)]
159     protected override ref LinksHeader<TLink> GetHeaderReference() => ref
160         ↳ AsRef<LinksHeader<TLink>>(_header);
161
162     /// <summary>
163     /// <para>
164     /// Gets the link reference using the specified link index.
165     /// </para>
166     /// <para></para>
167     /// </summary>
168     /// <param name="linkIndex">
169     /// <para>The link index.</para>
170     /// </param>
171     /// <returns>
172     /// <para>A ref raw link of t link</para>
173     /// <para></para>
174     /// </returns>
175     [MethodImpl(MethodImplOptions.AggressiveInlining)]
176     protected override ref RawLink<TLink> GetLinkReference(TLink linkIndex) => ref
177         ↳ AsRef<RawLink<TLink>>(_links + (LinkSizeInBytes * Convert.ToInt64(linkIndex)));
178 }

```

1.89 ./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 using Platform.Delegates;
11
12 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
13
14 namespace Platform.Data.Doublets.Memory.United.Generic
15 {
16     /// <summary>
17     /// <para>
18     /// Represents the united memory links base.

```

```

19 /// </para>
20 /// <para></para>
21 /// </summary>
22 /// <seealso cref="DisposableBase"/>
23 /// <seealso cref="ILinks{TLink}"/>
24 public abstract class UnitedMemoryLinksBase<TLink> : DisposableBase, ILinks<TLink>
25 {
26     private static readonly EqualityComparer<TLink> _equalityComparer =
27         EqualityComparer<TLink>.Default;
28     private static readonly Comparer<TLink> _comparer = Comparer<TLink>.Default;
29     private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
30         UncheckedConverter<TLink, long>.Default;
31     private static readonly UncheckedConverter<long, TLink> _int64ToAddressConverter =
32         UncheckedConverter<long, TLink>.Default;
33     private static readonly TLink _zero = default;
34     private static readonly TLink _one = Arithmetic.Increment(_zero);
35
36     /// <summary>Возвращает размер одной связи в байтах.</summary>
37     /// <remarks>
38     /// Используется только во вне класса, не рекомендуется использовать внутри.
39     /// Так как во вне не обязательно будет доступен unsafe C#.
40     /// </remarks>
41     public static readonly long LinkSizeInBytes = RawLink<TLink>.SizeInBytes;
42
43     /// <summary>
44     /// <para>
45     /// The size in bytes.
46     /// </para>
47     /// <para></para>
48     /// </summary>
49     public static readonly long LinkHeaderSizeInBytes = LinksHeader<TLink>.SizeInBytes;
50
51     /// <summary>
52     /// <para>
53     /// The link size in bytes.
54     /// </para>
55     /// <para></para>
56     /// </summary>
57     public static readonly long DefaultLinksSizeStep = LinkSizeInBytes * 1024 * 1024;
58
59     /// <summary>
60     /// <para>
61     /// The memory.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     protected readonly IResizableDirectMemory _memory;
66
67     /// <summary>
68     /// <para>
69     /// The memory reservation step.
70     /// </para>
71     /// <para></para>
72     /// </summary>
73     protected readonly long _memoryReservationStep;
74
75     /// <summary>
76     /// <para>
77     /// The targets tree methods.
78     /// </para>
79     /// <para></para>
80     /// </summary>
81     protected ILinksTreeMethods<TLink> TargetsTreeMethods;
82
83     /// <summary>
84     /// <para>
85     /// The sources tree methods.
86     /// </para>
87     /// <para></para>
88     /// </summary>
89     protected ILinksTreeMethods<TLink> SourcesTreeMethods;
90
91     /// TODO: Возможно чтобы гарантированно проверять на то, является ли связь удалённой,
92     /// → нужно использовать не список а дерево, так как так можно быстрее проверить на
93     /// → наличие связи внутри
94     /// <summary>
95     /// <para>
96     /// The unused links list methods.
97     /// </para>
98     /// <para></para>
99     /// </summary>
100     protected ILinksListMethods<TLink> UnusedLinksListMethods;

```

```

93
94 /// <summary>
95 /// Возвращает общее число связей находящихся в хранилище.
96 /// </summary>
97 protected virtual TLink Total
98 {
99     [MethodImpl(MethodImplOptions.AggressiveInlining)]
100     get
101     {
102         ref var header = ref GetHeaderReference();
103         return Subtract(header.AllocatedLinks, header.FreeLinks);
104     }
105 }
106
107 /// <summary>
108 /// <para>
109 /// Gets the constants value.
110 /// </para>
111 /// <para></para>
112 /// </summary>
113 public virtual LinksConstants<TLink> Constants
114 {
115     [MethodImpl(MethodImplOptions.AggressiveInlining)]
116     get;
117 }
118
119 /// <summary>
120 /// <para>
121 /// Initializes a new <see cref="UnitedMemoryLinksBase"/> instance.
122 /// </para>
123 /// <para></para>
124 /// </summary>
125 /// <param name="memory">
126 /// <para>A memory.</para>
127 /// <para></para>
128 /// </param>
129 /// <param name="memoryReservationStep">
130 /// <para>A memory reservation step.</para>
131 /// <para></para>
132 /// </param>
133 /// <param name="constants">
134 /// <para>A constants.</para>
135 /// <para></para>
136 /// </param>
137 [MethodImpl(MethodImplOptions.AggressiveInlining)]
138 protected UnitedMemoryLinksBase(IResizableDirectMemory memory, long
139     ↪ memoryReservationStep, LinksConstants<TLink> constants)
140 {
141     _memory = memory;
142     _memoryReservationStep = memoryReservationStep;
143     Constants = constants;
144 }
145
146 /// <summary>
147 /// <para>
148 /// Initializes a new <see cref="UnitedMemoryLinksBase"/> instance.
149 /// </para>
150 /// <para></para>
151 /// </summary>
152 /// <param name="memory">
153 /// <para>A memory.</para>
154 /// <para></para>
155 /// </param>
156 /// <param name="memoryReservationStep">
157 /// <para>A memory reservation step.</para>
158 /// <para></para>
159 /// </param>
160 [MethodImpl(MethodImplOptions.AggressiveInlining)]
161 protected UnitedMemoryLinksBase(IResizableDirectMemory memory, long
162     ↪ memoryReservationStep) : this(memory, memoryReservationStep,
163     ↪ Default<LinksConstants<TLink>>.Instance) { }
164
165 /// <summary>
166 /// <para>
167 /// Inits the memory.
168 /// </para>
169 /// <para></para>
170 /// </summary>

```

```

168 /// <param name="memory">
169 /// <para>The memory.</para>
170 /// <para></para>
171 /// </param>
172 /// <param name="memoryReservationStep">
173 /// <para>The memory reservation step.</para>
174 /// <para></para>
175 /// </param>
176 [MethodImpl(MethodImplOptions.AggressiveInlining)]
177 protected virtual void Init(IResizableDirectMemory memory, long memoryReservationStep)
178 {
179     if (memory.ReservedCapacity < memoryReservationStep)
180     {
181         memory.ReservedCapacity = memoryReservationStep;
182     }
183     SetPointers(memory);
184     ref var header = ref GetHeaderReference();
185     // Гарантия корректности _memory.UsedCapacity относительно _header->AllocatedLinks
186     memory.UsedCapacity = (ConvertToInt64(header.AllocatedLinks) * LinkSizeInBytes) +
187         ↳ LinkHeaderSizeInBytes;
188     // Гарантия корректности _header->ReservedLinks относительно _memory.ReservedCapacity
189     header.ReservedLinks = ConvertToAddress((memory.ReservedCapacity -
190         ↳ LinkHeaderSizeInBytes) / LinkSizeInBytes);
191 }
192
193 /// <summary>
194 /// <para>
195 /// Counts the substitution.
196 /// </para>
197 /// <para></para>
198 /// </summary>
199 /// <param name="restriction">
200 /// <para>The substitution.</para>
201 /// <para></para>
202 /// </param>
203 /// <exception cref="NotSupportedException">
204 /// <para>Другие размеры и способы ограничений не поддерживаются.</para>
205 /// <para></para>
206 /// </exception>
207 /// <returns>
208 /// <para>The link</para>
209 /// <para></para>
210 /// </returns>
211 [MethodImpl(MethodImplOptions.AggressiveInlining)]
212 public virtual TLink Count(IList<TLink> restriction)
213 {
214     // Если нет ограничений, тогда возвращаем общее число связей находящихся в хранилище.
215     if (restriction.Count == 0)
216     {
217         return Total;
218     }
219     var constants = Constants;
220     var any = constants.Any;
221     var index = restriction[constants.IndexPart];
222     if (restriction.Count == 1)
223     {
224         if (AreEqual(index, any))
225         {
226             return Total;
227         }
228         return Exists(index) ? GetOne() : GetZero();
229     }
230     if (restriction.Count == 2)
231     {
232         var value = restriction[1];
233         if (AreEqual(index, any))
234         {
235             if (AreEqual(value, any))
236             {
237                 return Total; // Any - как отсутствие ограничения
238             }
239             return Add(SourcesTreeMethods.CountUsages(value),
240                 ↳ TargetsTreeMethods.CountUsages(value));
241         }
242         else
243         {
244             if (!Exists(index))
245             {

```

```

243         return GetZero();
244     }
245     if (AreEqual(value, any))
246     {
247         return GetOne();
248     }
249     ref var storedLinkValue = ref GetLinkReference(index);
250     if (AreEqual(storedLinkValue.Source, value) ||
        ⇨ AreEqual(storedLinkValue.Target, value))
251     {
252         return GetOne();
253     }
254     return GetZero();
255 }
256
257 if (restriction.Count == 3)
258 {
259     var source = restriction[constants.SourcePart];
260     var target = restriction[constants.TargetPart];
261     if (AreEqual(index, any))
262     {
263         if (AreEqual(source, any) && AreEqual(target, any))
264         {
265             return Total;
266         }
267         else if (AreEqual(source, any))
268         {
269             return TargetsTreeMethods.CountUsages(target);
270         }
271         else if (AreEqual(target, any))
272         {
273             return SourcesTreeMethods.CountUsages(source);
274         }
275         else //if(source != Any && target != Any)
276         {
277             // Эквивалент Exists(source, target) => Count(Any, source, target) > 0
278             var link = SourcesTreeMethods.Search(source, target);
279             return AreEqual(link, constants.Null) ? GetZero() : GetOne();
280         }
281     }
282     else
283     {
284         if (!Exists(index))
285         {
286             return GetZero();
287         }
288         if (AreEqual(source, any) && AreEqual(target, any))
289         {
290             return GetOne();
291         }
292         ref var storedLinkValue = ref GetLinkReference(index);
293         if (!AreEqual(source, any) && !AreEqual(target, any))
294         {
295             if (AreEqual(storedLinkValue.Source, source) &&
                ⇨ AreEqual(storedLinkValue.Target, target))
296             {
297                 return GetOne();
298             }
299             return GetZero();
300         }
301         var value = default(TLink);
302         if (AreEqual(source, any))
303         {
304             value = target;
305         }
306         if (AreEqual(target, any))
307         {
308             value = source;
309         }
310         if (AreEqual(storedLinkValue.Source, value) ||
            ⇨ AreEqual(storedLinkValue.Target, value))
311         {
312             return GetOne();
313         }
314         return GetZero();
315     }
316 }

```

```

317         throw new NotSupportedException("Другие размеры и способы ограничений не
318         ↪ поддерживаются.");
319     }
320     /// <summary>
321     /// <para>
322     /// Eaches the handler.
323     /// </para>
324     /// <para></para>
325     /// </summary>
326     /// <param name="handler">
327     /// <para>The handler.</para>
328     /// <para></para>
329     /// </param>
330     /// <param name="restriction">
331     /// <para>The substitution.</para>
332     /// <para></para>
333     /// </param>
334     /// <exception cref="NotSupportedException">
335     /// <para>Другие размеры и способы ограничений не поддерживаются.</para>
336     /// <para></para>
337     /// </exception>
338     /// <returns>
339     /// <para>The link</para>
340     /// <para></para>
341     /// </returns>
342     [MethodImpl(MethodImplOptions.AggressiveInlining)]
343     public virtual TLink Each(ICollection<TLink> restriction, ReadHandler<TLink> handler)
344     {
345         var constants = Constants;
346         var @break = constants.Break;
347         if (restriction.Count == 0)
348         {
349             for (var link = GetOne(); LessOrEqualThan(link,
350                 ↪ GetHeaderReference().AllocatedLinks); link = Increment(link))
351             {
352                 if (Exists(link) && AreEqual(handler(GetLinkStruct(link)), @break))
353                 {
354                     return @break;
355                 }
356             }
357             return @break;
358         }
359         var @continue = constants.Continue;
360         var any = constants.Any;
361         var index = restriction[constants.IndexPart];
362         if (restriction.Count == 1)
363         {
364             if (AreEqual(index, any))
365             {
366                 return Each(Array.Empty<TLink>(), handler);
367             }
368             if (!Exists(index))
369             {
370                 return @continue;
371             }
372             return handler(GetLinkStruct(index));
373         }
374         if (restriction.Count == 2)
375         {
376             var value = restriction[1];
377             if (AreEqual(index, any))
378             {
379                 if (AreEqual(value, any))
380                 {
381                     return Each(Array.Empty<TLink>(), handler);
382                 }
383                 if (AreEqual(Each(new Link<TLink>(index, value, any), handler), @break))
384                 {
385                     return @break;
386                 }
387                 return Each(new Link<TLink>(index, any, value), handler);
388             }
389             else
390             {
391                 if (!Exists(index))
392                 {
393                     return @continue;

```



```

393     }
394     if (AreEqual(value, any))
395     {
396         return handler(GetLinkStruct(index));
397     }
398     ref var storedLinkValue = ref GetLinkReference(index);
399     if (AreEqual(storedLinkValue.Source, value) ||
400         AreEqual(storedLinkValue.Target, value))
401     {
402         return handler(GetLinkStruct(index));
403     }
404     return @continue;
405 }
406
407 if (restriction.Count == 3)
408 {
409     var source = restriction[constants.SourcePart];
410     var target = restriction[constants.TargetPart];
411     if (AreEqual(index, any))
412     {
413         if (AreEqual(source, any) && AreEqual(target, any))
414         {
415             return Each(Array.Empty<TLink>(), handler);
416         }
417         else if (AreEqual(source, any))
418         {
419             return TargetsTreeMethods.EachUsage(target, handler);
420         }
421         else if (AreEqual(target, any))
422         {
423             return SourcesTreeMethods.EachUsage(source, handler);
424         }
425         else //if(source != Any && target != Any)
426         {
427             var link = SourcesTreeMethods.Search(source, target);
428             return AreEqual(link, constants.Null) ? @continue :
429                 ↪ handler(GetLinkStruct(link));
430         }
431     }
432     else
433     {
434         if (!Exists(index))
435         {
436             return @continue;
437         }
438         if (AreEqual(source, any) && AreEqual(target, any))
439         {
440             return handler(GetLinkStruct(index));
441         }
442         ref var storedLinkValue = ref GetLinkReference(index);
443         if (!AreEqual(source, any) && !AreEqual(target, any))
444         {
445             if (AreEqual(storedLinkValue.Source, source) &&
446                 AreEqual(storedLinkValue.Target, target))
447             {
448                 return handler(GetLinkStruct(index));
449             }
450             return @continue;
451         }
452         var value = default(TLink);
453         if (AreEqual(source, any))
454         {
455             value = target;
456         }
457         if (AreEqual(target, any))
458         {
459             value = source;
460         }
461         if (AreEqual(storedLinkValue.Source, value) ||
462             AreEqual(storedLinkValue.Target, value))
463         {
464             return handler(GetLinkStruct(index));
465         }
466         return @continue;
467     }
468 }
469
470 throw new NotSupportedException("Другие размеры и способы ограничений не
471     ↪ поддерживаются.");

```

```

469 }
470
471 /// <remarks>
472 /// TODO: Возможно можно перемещать значения, если указан индекс, но значение существует
473   ↳ в другом месте (но не в менеджере памяти, а в логике Links)
474 /// </remarks>
475 [MethodImpl(MethodImplOptions.AggressiveInlining)]
476 public virtual TLink Update(ICollection<TLink> restriction, ICollection<TLink> substitution,
477   ↳ WriteHandler<TLink> handler)
478 {
479     var constants = Constants;
480     var @null = constants.Null;
481     var linkIndex = restriction[constants.IndexPart];
482     var before = GetLinkStruct(linkIndex);
483     ref var link = ref GetLinkReference(linkIndex);
484     ref var header = ref GetHeaderReference();
485     ref var firstAsSource = ref header.RootAsSource;
486     ref var firstAsTarget = ref header.RootAsTarget;
487     // Будет корректно работать только в том случае, если пространство выделенной связи
488     ↳ предварительно заполнено нулями
489     if (!AreEqual(link.Source, @null))
490     {
491         SourcesTreeMethods.Detach(ref firstAsSource, linkIndex);
492     }
493     if (!AreEqual(link.Target, @null))
494     {
495         TargetsTreeMethods.Detach(ref firstAsTarget, linkIndex);
496     }
497     link.Source = substitution[constants.SourcePart];
498     link.Target = substitution[constants.TargetPart];
499     if (!AreEqual(link.Source, @null))
500     {
501         SourcesTreeMethods.Attach(ref firstAsSource, linkIndex);
502     }
503     if (!AreEqual(link.Target, @null))
504     {
505         TargetsTreeMethods.Attach(ref firstAsTarget, linkIndex);
506     }
507     return handler != null ? handler(before, GetLinkStruct(linkIndex)) :
508       ↳ Constants.Continue;
509 }
510
511 /// <remarks>
512 /// TODO: Возможно нужно будет заполнение нулями, если внешнее API ими не заполняет
513   ↳ пространство
514 /// </remarks>
515 [MethodImpl(MethodImplOptions.AggressiveInlining)]
516 public virtual TLink Create(ICollection<TLink> substitution, WriteHandler<TLink> handler)
517 {
518     ref var header = ref GetHeaderReference();
519     var freeLink = header.FirstFreeLink;
520     if (!AreEqual(freeLink, Constants.Null))
521     {
522         UnusedLinksListMethods.Detach(freeLink);
523     }
524     else
525     {
526         var maximumPossibleInnerReference = Constants.InternalReferencesRange.Maximum;
527         if (GreaterThan(header.AllocatedLinks, maximumPossibleInnerReference))
528         {
529             throw new LinksLimitReachedException<TLink>(maximumPossibleInnerReference);
530         }
531         if (GreaterOrEqualThan(header.AllocatedLinks, Decrement(header.ReservedLinks)))
532         {
533             _memory.ReservedCapacity += _memory.ReservationStep;
534             SetPointers(_memory);
535             header = ref GetHeaderReference();
536             header.ReservedLinks = ConvertToAddress(_memory.ReservedCapacity /
537               ↳ LinkSizeInBytes);
538         }
539         freeLink = header.AllocatedLinks = Increment(header.AllocatedLinks);
540         _memory.UsedCapacity += LinkSizeInBytes;
541     }
542     return handler != null ? handler(null, new Link<TLink>(freeLink, Constants.Null,
543       ↳ Constants.Null)) : Constants.Continue;
544 }
545
546 /// <summary>

```

```

540 /// <para>
541 /// Deletes the substitution.
542 /// </para>
543 /// <para></para>
544 /// </summary>
545 /// <param name="restriction">
546 /// <para>The substitution.</para>
547 /// <para></para>
548 /// </param>
549 [MethodImpl(MethodImplOptions.AggressiveInlining)]
550 public virtual TLink Delete(IList<TLink> restriction, WriteHandler<TLink> handler)
551 {
552     ref var header = ref GetHeaderReference();
553     var link = restriction[Constants.IndexPart];
554     var before = GetLinkStruct(link);
555     if (LessThan(link, header.AllocatedLinks))
556     {
557         UnusedLinksListMethods.AttachAsFirst(link);
558         return handler != null ? handler(before, null) : Constants.Continue;
559     }
560     else if (AreEqual(link, header.AllocatedLinks))
561     {
562         header.AllocatedLinks = Decrement(header.AllocatedLinks);
563         _memory.UsedCapacity -= LinkSizeInBytes;
564         // Убираем все связи, находящиеся в списке свободных в конце файла, до тех пор,
565         // ↳ пока не дойдём до первой существующей связи
566         // Позволяет оптимизировать количество выделенных связей (AllocatedLinks)
567         while (GreaterThan(header.AllocatedLinks, GetZero()) &&
568             ↳ IsUnusedLink(header.AllocatedLinks))
569         {
570             UnusedLinksListMethods.Detach(header.AllocatedLinks);
571             header.AllocatedLinks = Decrement(header.AllocatedLinks);
572             _memory.UsedCapacity -= LinkSizeInBytes;
573         }
574         return handler != null ? handler(before, null) : Constants.Continue;
575     }
576     return Constants.Continue;
577 }
578
579 /// <summary>
580 /// <para>
581 /// Gets the link struct using the specified link index.
582 /// </para>
583 /// <para></para>
584 /// </summary>
585 /// <param name="linkIndex">
586 /// <para>The link index.</para>
587 /// <para></para>
588 /// </param>
589 /// <returns>
590 /// <para>A list of t link</para>
591 /// <para></para>
592 /// </returns>
593 [MethodImpl(MethodImplOptions.AggressiveInlining)]
594 public IList<TLink> GetLinkStruct(TLink linkIndex)
595 {
596     ref var link = ref GetLinkReference(linkIndex);
597     return new Link<TLink>(linkIndex, link.Source, link.Target);
598 }
599
600 /// <remarks>
601 /// TODO: Возможно это должно быть событием, вызываемым из IMemory, в том случае, если
602 /// ↳ адрес реально поменялся
603 ///
604 /// Указатель this.links может быть в том же месте,
605 /// так как 0-я связь не используется и имеет такой же размер как Header,
606 /// поэтому header размещается в том же месте, что и 0-я связь
607 /// </remarks>
608 [MethodImpl(MethodImplOptions.AggressiveInlining)]
609 protected abstract void SetPointers(IResizableDirectMemory memory);
610
611 /// <summary>
612 /// <para>
613 /// Resets the pointers.
614 /// </para>
615 /// <para></para>
616 /// </summary>
617 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

615 protected virtual void ResetPointers()
616 {
617     SourcesTreeMethods = null;
618     TargetsTreeMethods = null;
619     UnusedLinksListMethods = null;
620 }
621
622 /// <summary>
623 /// <para>
624 /// Gets the header reference.
625 /// </para>
626 /// <para></para>
627 /// </summary>
628 /// <returns>
629 /// <para>A ref links header of t link</para>
630 /// <para></para>
631 /// </returns>
632 [MethodImpl(MethodImplOptions.AggressiveInlining)]
633 protected abstract ref LinksHeader<TLink> GetHeaderReference();
634
635 /// <summary>
636 /// <para>
637 /// Gets the link reference using the specified link index.
638 /// </para>
639 /// <para></para>
640 /// </summary>
641 /// <param name="linkIndex">
642 /// <para>The link index.</para>
643 /// <para></para>
644 /// </param>
645 /// <returns>
646 /// <para>A ref raw link of t link</para>
647 /// <para></para>
648 /// </returns>
649 [MethodImpl(MethodImplOptions.AggressiveInlining)]
650 protected abstract ref RawLink<TLink> GetLinkReference(TLink linkIndex);
651
652 /// <summary>
653 /// <para>
654 /// Determines whether this instance exists.
655 /// </para>
656 /// <para></para>
657 /// </summary>
658 /// <param name="link">
659 /// <para>The link.</para>
660 /// <para></para>
661 /// </param>
662 /// <returns>
663 /// <para>The bool</para>
664 /// <para></para>
665 /// </returns>
666 [MethodImpl(MethodImplOptions.AggressiveInlining)]
667 protected virtual bool Exists(TLink link)
668     => GreaterOrEqualThan(link, Constants.InternalReferencesRange.Minimum)
669     && LessOrEqualThan(link, GetHeaderReference().AllocatedLinks)
670     && !IsUnusedLink(link);
671
672 /// <summary>
673 /// <para>
674 /// Determines whether this instance is unused link.
675 /// </para>
676 /// <para></para>
677 /// </summary>
678 /// <param name="linkIndex">
679 /// <para>The link index.</para>
680 /// <para></para>
681 /// </param>
682 /// <returns>
683 /// <para>The bool</para>
684 /// <para></para>
685 /// </returns>
686 [MethodImpl(MethodImplOptions.AggressiveInlining)]
687 protected virtual bool IsUnusedLink(TLink linkIndex)
688 {
689     if (!AreEqual(GetHeaderReference().FirstFreeLink, linkIndex)) // May be this check
690         ↪ is not needed
691     {
692         ref var link = ref GetLinkReference(linkIndex);

```

```

692         return AreEqual(link.SizeAsSource, default) && !AreEqual(link.Source, default);
693     }
694     else
695     {
696         return true;
697     }
698 }
699
700 /// <summary>
701 /// <para>
702 /// Gets the one.
703 /// </para>
704 /// <para></para>
705 /// </summary>
706 /// <returns>
707 /// <para>The link</para>
708 /// <para></para>
709 /// </returns>
710 [MethodImpl(MethodImplOptions.AggressiveInlining)]
711 protected virtual TLink GetOne() => _one;
712
713 /// <summary>
714 /// <para>
715 /// Gets the zero.
716 /// </para>
717 /// <para></para>
718 /// </summary>
719 /// <returns>
720 /// <para>The link</para>
721 /// <para></para>
722 /// </returns>
723 [MethodImpl(MethodImplOptions.AggressiveInlining)]
724 protected virtual TLink GetZero() => default;
725
726 /// <summary>
727 /// <para>
728 /// Determines whether this instance are equal.
729 /// </para>
730 /// <para></para>
731 /// </summary>
732 /// <param name="first">
733 /// <para>The first.</para>
734 /// <para></para>
735 /// </param>
736 /// <param name="second">
737 /// <para>The second.</para>
738 /// <para></para>
739 /// </param>
740 /// <returns>
741 /// <para>The bool</para>
742 /// <para></para>
743 /// </returns>
744 [MethodImpl(MethodImplOptions.AggressiveInlining)]
745 protected virtual bool AreEqual(TLink first, TLink second) =>
746     ↪ _equalityComparer.Equals(first, second);
747
748 /// <summary>
749 /// <para>
750 /// Determines whether this instance less than.
751 /// </para>
752 /// <para></para>
753 /// </summary>
754 /// <param name="first">
755 /// <para>The first.</para>
756 /// <para></para>
757 /// </param>
758 /// <param name="second">
759 /// <para>The second.</para>
760 /// <para></para>
761 /// </param>
762 /// <returns>
763 /// <para>The bool</para>
764 /// <para></para>
765 /// </returns>
766 [MethodImpl(MethodImplOptions.AggressiveInlining)]
767 protected virtual bool LessThan(TLink first, TLink second) => _comparer.Compare(first,
    ↪ second) < 0;

```

```

768     /// <summary>
769     /// <para>
770     /// Determines whether this instance less or equal than.
771     /// </para>
772     /// <para></para>
773     /// </summary>
774     /// <param name="first">
775     /// <para>The first.</para>
776     /// <para></para>
777     /// </param>
778     /// <param name="second">
779     /// <para>The second.</para>
780     /// <para></para>
781     /// </param>
782     /// <returns>
783     /// <para>The bool</para>
784     /// <para></para>
785     /// </returns>
786     [MethodImpl(MethodImplOptions.AggressiveInlining)]
787     protected virtual bool LessOrEqualThan(TLink first, TLink second) =>
788         ↪ _comparer.Compare(first, second) <= 0;
789
789     /// <summary>
790     /// <para>
791     /// Determines whether this instance greater than.
792     /// </para>
793     /// <para></para>
794     /// </summary>
795     /// <param name="first">
796     /// <para>The first.</para>
797     /// <para></para>
798     /// </param>
799     /// <param name="second">
800     /// <para>The second.</para>
801     /// <para></para>
802     /// </param>
803     /// <returns>
804     /// <para>The bool</para>
805     /// <para></para>
806     /// </returns>
807     [MethodImpl(MethodImplOptions.AggressiveInlining)]
808     protected virtual bool GreaterThan(TLink first, TLink second) =>
809         ↪ _comparer.Compare(first, second) > 0;
810
810     /// <summary>
811     /// <para>
812     /// Determines whether this instance greater or equal than.
813     /// </para>
814     /// <para></para>
815     /// </summary>
816     /// <param name="first">
817     /// <para>The first.</para>
818     /// <para></para>
819     /// </param>
820     /// <param name="second">
821     /// <para>The second.</para>
822     /// <para></para>
823     /// </param>
824     /// <returns>
825     /// <para>The bool</para>
826     /// <para></para>
827     /// </returns>
828     [MethodImpl(MethodImplOptions.AggressiveInlining)]
829     protected virtual bool GreaterOrEqualThan(TLink first, TLink second) =>
830         ↪ _comparer.Compare(first, second) >= 0;
831
831     /// <summary>
832     /// <para>
833     /// Converts the to int 64 using the specified value.
834     /// </para>
835     /// <para></para>
836     /// </summary>
837     /// <param name="value">
838     /// <para>The value.</para>
839     /// <para></para>
840     /// </param>
841     /// <returns>
842     /// <para>The long</para>

```

```

843     /// <para></para>
844     /// </returns>
845     [MethodImpl(MethodImplOptions.AggressiveInlining)]
846     protected virtual long ConvertToInt64(TLink value) =>
847         ↪ _addressToInt64Converter.Convert(value);
848
849     /// <summary>
850     /// <para>
851     /// Converts the to address using the specified value.
852     /// </para>
853     /// </summary>
854     /// <param name="value">
855     /// <para>The value.</para>
856     /// </para>
857     /// </param>
858     /// <returns>
859     /// <para>The link</para>
860     /// </para>
861     /// </returns>
862     [MethodImpl(MethodImplOptions.AggressiveInlining)]
863     protected virtual TLink ConvertToAddress(long value) =>
864         ↪ _int64ToAddressConverter.Convert(value);
865
866     /// <summary>
867     /// <para>
868     /// Adds the first.
869     /// </para>
870     /// </summary>
871     /// <param name="first">
872     /// <para>The first.</para>
873     /// </para>
874     /// </param>
875     /// <param name="second">
876     /// <para>The second.</para>
877     /// </para>
878     /// </param>
879     /// <returns>
880     /// <para>The link</para>
881     /// </para>
882     /// </returns>
883     [MethodImpl(MethodImplOptions.AggressiveInlining)]
884     protected virtual TLink Add(TLink first, TLink second) => Arithmetic<TLink>.Add(first,
885         ↪ second);
886
887     /// <summary>
888     /// <para>
889     /// Subtracts the first.
890     /// </para>
891     /// </summary>
892     /// <param name="first">
893     /// <para>The first.</para>
894     /// </para>
895     /// </param>
896     /// <param name="second">
897     /// <para>The second.</para>
898     /// </para>
899     /// </param>
900     /// <returns>
901     /// <para>The link</para>
902     /// </para>
903     /// </returns>
904     [MethodImpl(MethodImplOptions.AggressiveInlining)]
905     protected virtual TLink Subtract(TLink first, TLink second) =>
906         ↪ Arithmetic<TLink>.Subtract(first, second);
907
908     /// <summary>
909     /// <para>
910     /// Increments the link.
911     /// </para>
912     /// </summary>
913     /// <param name="link">
914     /// <para>The link.</para>
915     /// </para>
916     /// </param>

```

```

917     /// <returns>
918     /// <para>The link</para>
919     /// <para></para>
920     /// </returns>
921     [MethodImpl(MethodImplOptions.AggressiveInlining)]
922     protected virtual TLink Increment(TLink link) => Arithmetic<TLink>.Increment(link);
923
924     /// <summary>
925     /// <para>
926     /// Decrements the link.
927     /// </para>
928     /// <para></para>
929     /// </summary>
930     /// <param name="link">
931     /// <para>The link.</para>
932     /// <para></para>
933     /// </param>
934     /// <returns>
935     /// <para>The link</para>
936     /// <para></para>
937     /// </returns>
938     [MethodImpl(MethodImplOptions.AggressiveInlining)]
939     protected virtual TLink Decrement(TLink link) => Arithmetic<TLink>.Decrement(link);
940
941     #region Disposable
942
943     /// <summary>
944     /// <para>
945     /// Gets the allow multiple dispose calls value.
946     /// </para>
947     /// <para></para>
948     /// </summary>
949     protected override bool AllowMultipleDisposeCalls
950     {
951         [MethodImpl(MethodImplOptions.AggressiveInlining)]
952         get => true;
953     }
954
955     /// <summary>
956     /// <para>
957     /// Disposes the manual.
958     /// </para>
959     /// <para></para>
960     /// </summary>
961     /// <param name="manual">
962     /// <para>The manual.</para>
963     /// <para></para>
964     /// </param>
965     /// <param name="wasDisposed">
966     /// <para>The was disposed.</para>
967     /// <para></para>
968     /// </param>
969     [MethodImpl(MethodImplOptions.AggressiveInlining)]
970     protected override void Dispose(bool manual, bool wasDisposed)
971     {
972         if (!wasDisposed)
973         {
974             ResetPointers();
975             _memory.DisposeIfPossible();
976         }
977     }
978
979     #endregion
980 }
981 }

```

1.90 ./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      private static readonly UncheckedConverter<TLink, long> _addressToInt64Converter =
    ↳ UncheckedConverter<TLink, long>.Default;
21      private readonly byte* _links;
22      private readonly byte* _header;
23
24      /// <summary>
25      /// <para>
26      /// Initializes a new <see cref="UnusedLinksListMethods"/> instance.
27      /// </para>
28      /// <para></para>
29      /// </summary>
30      /// <param name="links">
31      /// <para>A links.</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 UnusedLinksListMethods(byte* links, byte* header)
40      {
41          _links = links;
42          _header = header;
43      }
44
45      /// <summary>
46      /// <para>
47      /// Gets the header reference.
48      /// </para>
49      /// <para></para>
50      /// </summary>
51      /// <returns>
52      /// <para>A ref links header of t link</para>
53      /// <para></para>
54      /// </returns>
55      [MethodImpl(MethodImplOptions.AggressiveInlining)]
56      protected virtual ref LinksHeader<TLink> GetHeaderReference() => ref
    ↳ AsRef<LinksHeader<TLink>>(_header);
57
58      /// <summary>
59      /// <para>
60      /// Gets the link 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 of t link</para>
70      /// <para></para>
71      /// </returns>
72      [MethodImpl(MethodImplOptions.AggressiveInlining)]
73      protected virtual ref RawLink<TLink> GetLinkReference(TLink link) => ref
    ↳ AsRef<RawLink<TLink>>(_links + (RawLink<TLink>.SizeInBytes *
    ↳ _addressToInt64Converter.Convert(link)));
74
75      /// <summary>
76      /// <para>
77      /// Gets the first.
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 GetFirst() => GetHeaderReference().FirstFreeLink;
87
88     /// <summary>
89     /// <para>
90     /// Gets the last.
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 override TLink GetLast() => GetHeaderReference().LastFreeLink;
100
101     /// <summary>
102     /// <para>
103     /// Gets the previous using the specified element.
104     /// </para>
105     /// <para></para>
106     /// </summary>
107     /// <param name="element">
108     /// <para>The element.</para>
109     /// <para></para>
110     /// </param>
111     /// <returns>
112     /// <para>The link</para>
113     /// <para></para>
114     /// </returns>
115     [MethodImpl(MethodImplOptions.AggressiveInlining)]
116     protected override TLink GetPrevious(TLink element) => GetLinkReference(element).Source;
117
118     /// <summary>
119     /// <para>
120     /// Gets the next using the specified element.
121     /// </para>
122     /// <para></para>
123     /// </summary>
124     /// <param name="element">
125     /// <para>The element.</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 GetNext(TLink element) => GetLinkReference(element).Target;
134
135     /// <summary>
136     /// <para>
137     /// Gets the size.
138     /// </para>
139     /// <para></para>
140     /// </summary>
141     /// <returns>
142     /// <para>The link</para>
143     /// <para></para>
144     /// </returns>
145     [MethodImpl(MethodImplOptions.AggressiveInlining)]
146     protected override TLink GetSize() => GetHeaderReference().FreeLinks;
147
148     /// <summary>
149     /// <para>
150     /// Sets the first using the specified element.
151     /// </para>
152     /// <para></para>
153     /// </summary>
154     /// <param name="element">
155     /// <para>The element.</para>
156     /// <para></para>
157     /// </param>
158     [MethodImpl(MethodImplOptions.AggressiveInlining)]
159     protected override void SetFirst(TLink element) => GetHeaderReference().FirstFreeLink =
        ↪ element;
160
161     /// <summary>
162     /// <para>

```

```

163     /// Sets the last using the specified element.
164     /// </para>
165     /// <para></para>
166     /// </summary>
167     /// <param name="element">
168     /// <para>The element.</para>
169     /// <para></para>
170     /// </param>
171     [MethodImpl(MethodImplOptions.AggressiveInlining)]
172     protected override void SetLast(TLink element) => GetHeaderReference().LastFreeLink =
        ↪ element;

173     /// <summary>
174     /// <para>
175     /// Sets the previous using the specified element.
176     /// </para>
177     /// <para></para>
178     /// </summary>
179     /// <param name="element">
180     /// <para>The element.</para>
181     /// <para></para>
182     /// </param>
183     /// <param name="previous">
184     /// <para>The previous.</para>
185     /// <para></para>
186     /// </param>
187     [MethodImpl(MethodImplOptions.AggressiveInlining)]
188     protected override void SetPrevious(TLink element, TLink previous) =>
189     ↪ GetLinkReference(element).Source = previous;

190     /// <summary>
191     /// <para>
192     /// Sets the next using the specified element.
193     /// </para>
194     /// <para></para>
195     /// </summary>
196     /// <param name="element">
197     /// <para>The element.</para>
198     /// <para></para>
199     /// </param>
200     /// <param name="next">
201     /// <para>The next.</para>
202     /// <para></para>
203     /// </param>
204     [MethodImpl(MethodImplOptions.AggressiveInlining)]
205     protected override void SetNext(TLink element, TLink next) =>
206     ↪ GetLinkReference(element).Target = next;

207     /// <summary>
208     /// <para>
209     /// Sets the size using the specified size.
210     /// </para>
211     /// <para></para>
212     /// </summary>
213     /// <param name="size">
214     /// <para>The size.</para>
215     /// <para></para>
216     /// </param>
217     [MethodImpl(MethodImplOptions.AggressiveInlining)]
218     protected override void SetSize(TLink size) => GetHeaderReference().FreeLinks = size;
219 }
220 }
221 }

```

1.91 ./csharp/Platform.Data.Doublets/Memory/United/RawLink.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.United
9  {
10     /// <summary>
11     /// <para>
12     /// The raw link.
13     /// </para>
14     /// <para></para>

```

```

15  /// </summary>
16  public struct RawLink<TLink> : IEquatable<RawLink<TLink>>
17  {
18      private static readonly EqualityComparer<TLink> _equalityComparer =
19          ↳ EqualityComparer<TLink>.Default;
20
21      /// <summary>
22      /// <para>
23      /// The size.
24      /// </para>
25      /// </summary>
26      public static readonly long SizeInBytes = Structure<RawLink<TLink>>.Size;
27
28      /// <summary>
29      /// <para>
30      /// The source.
31      /// </para>
32      /// <para></para>
33      /// </summary>
34      public TLink Source;
35      /// <summary>
36      /// <para>
37      /// The target.
38      /// </para>
39      /// <para></para>
40      /// </summary>
41      public TLink Target;
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 left as target.
66      /// </para>
67      /// <para></para>
68      /// </summary>
69      public TLink LeftAsTarget;
70      /// <summary>
71      /// <para>
72      /// The right as target.
73      /// </para>
74      /// <para></para>
75      /// </summary>
76      public TLink RightAsTarget;
77      /// <summary>
78      /// <para>
79      /// The size as target.
80      /// </para>
81      /// <para></para>
82      /// </summary>
83      public TLink SizeAsTarget;
84
85      /// <summary>
86      /// <para>
87      /// Determines whether this instance equals.
88      /// </para>
89      /// <para></para>
90      /// </summary>
91      /// <param name="obj">
92      /// <para>The obj.</para>

```

```

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

```

1.92 ./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"/>
35     ↪ instance.
36     /// </para>
37     /// <para></para>
38     /// </summary>
39     /// <param name="constants">
40     /// <para>A constants.</para>
41     /// <para></para>
42     /// </param>
43     /// <param name="links">
44     /// <para>A links.</para>
45     /// <para></para>
46     /// </param>
47     /// <param name="header">
48     /// <para>A header.</para>
49     /// <para></para>
50     /// </param>
51     protected UInt32LinksRecursionlessSizeBalancedTreeMethodsBase(LinksConstants<uint>
52     ↪ constants, RawLink<uint>* links, LinksHeader<uint>* header)
53     : base(constants, (byte*)links, (byte*)header)
54     {
55         Links = links;
56         Header = header;
57     }
58
59     /// <summary>
60     /// <para>
61     /// Gets the zero.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     /// <returns>
66     /// <para>The uint</para>
67     /// <para></para>
68     /// </returns>
69     [MethodImpl(MethodImplOptions.AggressiveInlining)]
70     protected override uint GetZero() => 0U;
71
72     /// <summary>
73     /// <para>
74     /// Determines whether this instance equal to zero.
75     /// </para>
76     /// <para></para>
77     /// </summary>
78     /// <param name="value">
79     /// <para>The value.</para>
80     /// <para></para>
81     /// </param>
82     /// <returns>
83     /// <para>The bool</para>
84     /// <para></para>
85     /// </returns>
86     [MethodImpl(MethodImplOptions.AggressiveInlining)]
87     protected override bool EqualToZero(uint value) => value == 0U;
88
89     /// <summary>
90     /// <para>
91     /// Determines whether this instance are equal.
92     /// </para>
93     /// <para></para>
94     /// </summary>
95     /// <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 FirstIsToLeftOfSecond(uint first, uint second)
356    {
357        ref var firstLink = ref Links[first];
358        ref var secondLink = ref Links[second];
359        return FirstIsToLeftOfSecond(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(uint first, uint 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 uint</para>
398    /// <para></para>
399    /// </returns>
400    [MethodImpl(MethodImplOptions.AggressiveInlining)]
    protected override ref LinksHeader<uint> GetHeaderReference() => ref *Header;

```

```

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 }

```

1.93 ./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.
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 UInt32LinksSizeBalancedTreeMethodsBase(LinksConstants<uint> constants,
53    ↪ RawLink<uint>* links, LinksHeader<uint>* header)
54        : base(constants, (byte*)links, (byte*)header)
55        {
56            Links = links;
57            Header = header;
58        }
59
60        /// <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 FirstIsToLeftOfSecond(uint first, uint second)
356     {
357         ref var firstLink = ref Links[first];
358         ref var secondLink = ref Links[second];
359         return FirstIsToLeftOfSecond(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>

```

```

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 }

```

1.94 ./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>

```



```

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     public UInt32LinksSourcesRecursionlessSizeBalancedTreeMethods(LinksConstants<uint>
        ↳ constants, RawLink<uint>* links, LinksHeader<uint>* 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 uint</para>
48     /// <para></para>
49     /// </returns>
50     [MethodImpl(MethodImplOptions.AggressiveInlining)]
51     protected override ref uint GetLeftReference(uint 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 uint</para>
65     /// <para></para>
66     /// </returns>
67     [MethodImpl(MethodImplOptions.AggressiveInlining)]
68     protected override ref uint GetRightReference(uint 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 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 FirstIsToTheLeftOfSecond(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">
249     /// <para>The second source.</para>
250     /// <para></para>
251     /// </param>

```

```

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     => firstSource > secondSource || (firstSource == secondSource && firstTarget >
        ↪ secondTarget);

261     /// <summary>
262     /// <para>
263     /// Clears the node 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     [MethodImpl(MethodImplOptions.AggressiveInlining)]
272     protected override void ClearNode(uint node)
273     {
274         ref var link = ref Links[node];
275         link.LeftAsSource = 0U;
276         link.RightAsSource = 0U;
277         link.SizeAsSource = 0U;
278     }
279 }
280 }
281 }

```

1.95 ./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    /// <para></para>
12    /// </summary>
13    /// <seealso cref="UInt32LinksSizeBalancedTreeMethodsBase"/>
14    public unsafe class UInt32LinksSourcesSizeBalancedTreeMethods :
        ↪ UInt32LinksSizeBalancedTreeMethodsBase
15    {
16        /// <summary>
17        /// <para>
18        /// Initializes a new <see cref="UInt32LinksSourcesSizeBalancedTreeMethods"/> 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        public UInt32LinksSourcesSizeBalancedTreeMethods(LinksConstants<uint> constants,
            ↪ RawLink<uint>* links, LinksHeader<uint>* header) : base(constants, links, header) { }

35        /// <summary>
36        /// <para>
37        /// Gets the left reference using the specified node.
38        /// </para>
39    }

```

```

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].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 uint</para>
65    /// <para></para>
66    /// </returns>
67    [MethodImpl(MethodImplOptions.AggressiveInlining)]
68    protected override ref uint GetRightReference(uint node) => ref
69    ↪ Links[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 uint</para>
83    /// <para></para>
84    /// </returns>
85    [MethodImpl(MethodImplOptions.AggressiveInlining)]
86    protected override uint GetLeft(uint node) => Links[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 uint</para>
100   /// <para></para>
101   /// </returns>
102   [MethodImpl(MethodImplOptions.AggressiveInlining)]
103   protected override uint GetRight(uint node) => Links[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     /// </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 FirstIsToTheLeftOfSecond(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">
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     ↪ => 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>

```

```

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 }

```

1.96 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt32LinksTargetsRecursionlessSizeBalancedTreeMethodsBase

```

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="UInt32LinksTargetsRecursionlessSizeBalancedTreeMethodsBase"/>
14     public unsafe class UInt32LinksTargetsRecursionlessSizeBalancedTreeMethods :
15         ↳ UInt32LinksTargetsRecursionlessSizeBalancedTreeMethodsBase
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see
20         ↳ cref="UInt32LinksTargetsRecursionlessSizeBalancedTreeMethods"/> 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 UInt32LinksTargetsRecursionlessSizeBalancedTreeMethods(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].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 uint</para>
69         /// <para></para>
70         /// </returns>
71         [MethodImpl(MethodImplOptions.AggressiveInlining)]
72         protected override ref uint GetRightReference(uint node) => ref Links[node].RightAsTarget;
73     }
74 }

```



```

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 FirstIsToTheLeftOfSecond(uint firstSource, uint firstTarget,
230     ↪ uint secondSource, uint 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(uint firstSource, uint firstTarget,
262     ↪ uint secondSource, uint 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(uint node)
278     {
279         ref var link = ref Links[node];
280         link.LeftAsTarget = 0U;
281         link.RightAsTarget = 0U;
282         link.SizeAsTarget = 0U;
283     }
284 }

```

```

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.
58        /// </para>
59        /// <para></para>
60        /// </summary>
61        /// <param name="node">
62        /// <para>The node.</para>
63        /// <para></para>
64        /// </param>
65        /// <returns>
66        /// <para>The ref uint</para>
67        /// <para></para>
68        /// </returns>
69        [MethodImpl(MethodImplOptions.AggressiveInlining)]
70        protected override ref uint GetRightReference(uint node) => ref
71            ↳ Links[node].RightAsTarget;
72
73        /// <summary>
74        /// <para>
75        /// Gets the left using the specified node.
76        /// </para>
77        /// <para></para>
78        /// </summary>
79        /// <param name="node">
80        /// <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,
230     ↪ uint secondSource, uint secondTarget)
231     => firstTarget < secondTarget || (firstTarget == secondTarget && firstSource <
232     ↪ 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,
260     ↪ uint secondSource, uint secondTarget)
261     => firstTarget > secondTarget || (firstTarget == secondTarget && firstSource >
262     ↪ secondSource);
263
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(uint node)
276     {
277         ref var link = ref Links[node];
278         link.LeftAsTarget = 0U;
279         link.RightAsTarget = 0U;
280         link.SizeAsTarget = 0U;
281     }
282 }

```

1.98 ./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         private readonly Func<ILinksTreeMethods<uint>> _createSourceTreeMethods;
21         private readonly Func<ILinksTreeMethods<uint>> _createTargetTreeMethods;
22         private LinksHeader<uint>* _header;
23         private RawLink<uint>* _links;
24     }
25 }

```

```

22     /// <summary>
23     /// <para>
24     /// Initializes a new <see cref="UInt32UnitedMemoryLinks"/> instance.
25     /// </para>
26     /// <para></para>
27     /// </summary>
28     /// <param name="address">
29     /// <para>A address.</para>
30     /// <para></para>
31     /// </param>
32     [MethodImpl(MethodImplOptions.AggressiveInlining)]
33     public UInt32UnitedMemoryLinks(string address) : this(address, DefaultLinksSizeStep) { }
34
35     /// <summary>
36     /// Создаёт экземпляр базы данных Links в файле по указанному адресу, с указанным
37     /// → минимальным шагом расширения базы данных.
38     /// </summary>
39     /// <param name="address">Полный путь к файлу базы данных.</param>
40     /// <param name="memoryReservationStep">Минимальный шаг расширения базы данных в
41     /// → байтах.</param>
42     [MethodImpl(MethodImplOptions.AggressiveInlining)]
43     public UInt32UnitedMemoryLinks(string address, long memoryReservationStep) : this(new
44     /// → FileMappedResizableDirectMemory(address, memoryReservationStep),
45     /// → memoryReservationStep) { }
46
47     /// <summary>
48     /// <para>
49     /// Initializes a new <see cref="UInt32UnitedMemoryLinks"/> instance.
50     /// </para>
51     /// <para></para>
52     /// </summary>
53     /// <param name="memory">
54     /// <para>A memory.</para>
55     /// <para></para>
56     /// </param>
57     [MethodImpl(MethodImplOptions.AggressiveInlining)]
58     public UInt32UnitedMemoryLinks(IResizableDirectMemory memory) : this(memory,
59     /// → DefaultLinksSizeStep) { }
60
61     /// <summary>
62     /// <para>
63     /// Initializes a new <see cref="UInt32UnitedMemoryLinks"/> instance.
64     /// </para>
65     /// <para></para>
66     /// </summary>
67     /// <param name="memory">
68     /// <para>A memory.</para>
69     /// <para></para>
70     /// </param>
71     /// <param name="memoryReservationStep">
72     /// <para>A memory reservation step.</para>
73     /// <para></para>
74     /// </param>
75     [MethodImpl(MethodImplOptions.AggressiveInlining)]
76     public UInt32UnitedMemoryLinks(IResizableDirectMemory memory, long
77     /// → memoryReservationStep) : this(memory, memoryReservationStep,
78     /// → Default<LinksConstants<uint>>.Instance, IndexTreeType.Default) { }
79
80     /// <summary>
81     /// <para>
82     /// Initializes a new <see cref="UInt32UnitedMemoryLinks"/> 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     /// <param name="constants">
95     /// <para>A constants.</para>
96     /// <para></para>
97     /// </param>
98     /// <param name="indexTreeType">

```



```

92  /// <para>A index tree type.</para>
93  /// <para></para>
94  /// </param>
95  [MethodImpl(MethodImplOptions.AggressiveInlining)]
96  public UInt32UnitedMemoryLinks(IResizableDirectMemory memory, long
    ↳ memoryReservationStep, LinksConstants<uint> constants, IndexTreeType indexTreeType)
    ↳ : base(memory, memoryReservationStep, constants)
97  {
98      if (indexTreeType == IndexTreeType.SizeBalancedTree)
99      {
100         _createSourceTreeMethods = () => new
            ↳ UInt32LinksSourcesSizeBalancedTreeMethods(Constants, _links, _header);
101         _createTargetTreeMethods = () => new
            ↳ UInt32LinksTargetsSizeBalancedTreeMethods(Constants, _links, _header);
102     }
103     else
104     {
105         _createSourceTreeMethods = () => new
            ↳ UInt32LinksSourcesRecursionlessSizeBalancedTreeMethods(Constants, _links,
            ↳ _header);
106         _createTargetTreeMethods = () => new
            ↳ UInt32LinksTargetsRecursionlessSizeBalancedTreeMethods(Constants, _links,
            ↳ _header);
107     }
108     Init(memory, memoryReservationStep);
109 }
110
111 /// <summary>
112 /// <para>
113 /// Sets the pointers using the specified memory.
114 /// </para>
115 /// <para></para>
116 /// </summary>
117 /// <param name="memory">
118 /// <para>The memory.</para>
119 /// <para></para>
120 /// </param>
121 [MethodImpl(MethodImplOptions.AggressiveInlining)]
122 protected override void SetPointers(IResizableDirectMemory memory)
123 {
124     _header = (LinksHeader<uint>*)memory.Pointer;
125     _links = (RawLink<uint>*)memory.Pointer;
126     SourcesTreeMethods = _createSourceTreeMethods();
127     TargetsTreeMethods = _createTargetTreeMethods();
128     UnusedLinksListMethods = new UInt32UnusedLinksListMethods(_links, _header);
129 }
130
131 /// <summary>
132 /// <para>
133 /// Resets the pointers.
134 /// </para>
135 /// <para></para>
136 /// </summary>
137 [MethodImpl(MethodImplOptions.AggressiveInlining)]
138 protected override void ResetPointers()
139 {
140     base.ResetPointers();
141     _links = null;
142     _header = null;
143 }
144
145 /// <summary>
146 /// <para>
147 /// Gets the header reference.
148 /// </para>
149 /// <para></para>
150 /// </summary>
151 /// <returns>
152 /// <para>A ref links header of uint</para>
153 /// <para></para>
154 /// </returns>
155 [MethodImpl(MethodImplOptions.AggressiveInlining)]
156 protected override ref LinksHeader<uint> GetHeaderReference() => ref *_header;
157
158 /// <summary>
159 /// <para>
160 /// Gets the link reference using the specified link index.
161 /// </para>

```

```

162    /// <para></para>
163    /// </summary>
164    /// <param name="linkIndex">
165    /// <para>The link index.</para>
166    /// <para></para>
167    /// </param>
168    /// <returns>
169    /// <para>A ref raw link of uint</para>
170    /// <para></para>
171    /// </returns>
172    [MethodImpl(MethodImplOptions.AggressiveInlining)]
173    protected override ref RawLink<uint> GetLinkReference(uint linkIndex) => ref
    ↪ _links[linkIndex];

174
175    /// <summary>
176    /// <para>
177    /// Determines whether this instance are equal.
178    /// </para>
179    /// <para></para>
180    /// </summary>
181    /// <param name="first">
182    /// <para>The first.</para>
183    /// <para></para>
184    /// </param>
185    /// <param name="second">
186    /// <para>The second.</para>
187    /// <para></para>
188    /// </param>
189    /// <returns>
190    /// <para>The bool</para>
191    /// <para></para>
192    /// </returns>
193    [MethodImpl(MethodImplOptions.AggressiveInlining)]
194    protected override bool AreEqual(uint first, uint second) => first == second;
195
196    /// <summary>
197    /// <para>
198    /// Determines whether this instance less than.
199    /// </para>
200    /// <para></para>
201    /// </summary>
202    /// <param name="first">
203    /// <para>The first.</para>
204    /// <para></para>
205    /// </param>
206    /// <param name="second">
207    /// <para>The second.</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 LessThan(uint first, uint second) => first < second;
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 LessOrEqualThan(uint first, uint second) => first <= second;
237
238    /// <summary>

```

```

239    /// <para>
240    /// Determines whether this instance greater than.
241    /// </para>
242    /// <para></para>
243    /// </summary>
244    /// <param name="first">
245    /// <para>The first.</para>
246    /// <para></para>
247    /// </param>
248    /// <param name="second">
249    /// <para>The second.</para>
250    /// <para></para>
251    /// </param>
252    /// <returns>
253    /// <para>The bool</para>
254    /// <para></para>
255    /// </returns>
256    [MethodImpl(MethodImplOptions.AggressiveInlining)]
257    protected override bool GreaterThan(uint first, uint second) => first > second;
258
259    /// <summary>
260    /// <para>
261    /// Determines whether this instance greater or equal than.
262    /// </para>
263    /// <para></para>
264    /// </summary>
265    /// <param name="first">
266    /// <para>The first.</para>
267    /// <para></para>
268    /// </param>
269    /// <param name="second">
270    /// <para>The second.</para>
271    /// <para></para>
272    /// </param>
273    /// <returns>
274    /// <para>The bool</para>
275    /// <para></para>
276    /// </returns>
277    [MethodImpl(MethodImplOptions.AggressiveInlining)]
278    protected override bool GreaterOrEqualThan(uint first, uint second) => first >= second;
279
280    /// <summary>
281    /// <para>
282    /// Gets the zero.
283    /// </para>
284    /// <para></para>
285    /// </summary>
286    /// <returns>
287    /// <para>The uint</para>
288    /// <para></para>
289    /// </returns>
290    [MethodImpl(MethodImplOptions.AggressiveInlining)]
291    protected override uint GetZero() => 0U;
292
293    /// <summary>
294    /// <para>
295    /// Gets the one.
296    /// </para>
297    /// <para></para>
298    /// </summary>
299    /// <returns>
300    /// <para>The uint</para>
301    /// <para></para>
302    /// </returns>
303    [MethodImpl(MethodImplOptions.AggressiveInlining)]
304    protected override uint GetOne() => 1U;
305
306    /// <summary>
307    /// <para>
308    /// Converts the to int 64 using the specified value.
309    /// </para>
310    /// <para></para>
311    /// </summary>
312    /// <param name="value">
313    /// <para>The value.</para>
314    /// <para></para>
315    /// </param>
316    /// <returns>

```

```

317     /// <para>The long</para>
318     /// <para></para>
319     /// </returns>
320     [MethodImpl(MethodImplOptions.AggressiveInlining)]
321     protected override long ConvertToInt64(uint value) => (long)value;
322
323     /// <summary>
324     /// <para>
325     /// Converts the to address using the specified value.
326     /// </para>
327     /// <para></para>
328     /// </summary>
329     /// <param name="value">
330     /// <para>The value.</para>
331     /// <para></para>
332     /// </param>
333     /// <returns>
334     /// <para>The uint</para>
335     /// <para></para>
336     /// </returns>
337     [MethodImpl(MethodImplOptions.AggressiveInlining)]
338     protected override uint ConvertToAddress(long value) => (uint)value;
339
340     /// <summary>
341     /// <para>
342     /// Adds the first.
343     /// </para>
344     /// <para></para>
345     /// </summary>
346     /// <param name="first">
347     /// <para>The first.</para>
348     /// <para></para>
349     /// </param>
350     /// <param name="second">
351     /// <para>The second.</para>
352     /// <para></para>
353     /// </param>
354     /// <returns>
355     /// <para>The uint</para>
356     /// <para></para>
357     /// </returns>
358     [MethodImpl(MethodImplOptions.AggressiveInlining)]
359     protected override uint Add(uint first, uint second) => first + second;
360
361     /// <summary>
362     /// <para>
363     /// Subtracts the first.
364     /// </para>
365     /// <para></para>
366     /// </summary>
367     /// <param name="first">
368     /// <para>The first.</para>
369     /// <para></para>
370     /// </param>
371     /// <param name="second">
372     /// <para>The second.</para>
373     /// <para></para>
374     /// </param>
375     /// <returns>
376     /// <para>The uint</para>
377     /// <para></para>
378     /// </returns>
379     [MethodImpl(MethodImplOptions.AggressiveInlining)]
380     protected override uint Subtract(uint first, uint second) => first - second;
381
382     /// <summary>
383     /// <para>
384     /// Increments the 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>The uint</para>
394     /// <para></para>

```

```

395     /// </returns>
396     [MethodImpl(MethodImplOptions.AggressiveInlining)]
397     protected override uint Increment(uint link) => ++link;
398
399     /// <summary>
400     /// <para>
401     /// Decrements the link.
402     /// </para>
403     /// <para></para>
404     /// </summary>
405     /// <param name="link">
406     /// <para>The link.</para>
407     /// <para></para>
408     /// </param>
409     /// <returns>
410     /// <para>The uint</para>
411     /// <para></para>
412     /// </returns>
413     [MethodImpl(MethodImplOptions.AggressiveInlining)]
414     protected override uint Decrement(uint link) => --link;
415 }
416 }

```

1.99 ./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         private readonly RawLink<uint>* _links;
18         private readonly LinksHeader<uint>* _header;
19
20         /// <summary>
21         /// <para>
22         /// Initializes a new <see cref="UInt32UnusedLinksListMethods"/> instance.
23         /// </para>
24         /// <para></para>
25         /// </summary>
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 UInt32UnusedLinksListMethods(RawLink<uint>* links, LinksHeader<uint>* header)
36             : base((byte*)links, (byte*)header)
37         {
38             _links = links;
39             _header = header;
40         }
41
42         /// <summary>
43         /// <para>
44         /// Gets the link reference using the specified link.
45         /// </para>
46         /// <para></para>
47         /// </summary>
48         /// <param name="link">
49         /// <para>The link.</para>
50         /// <para></para>
51         /// </param>
52         /// <returns>
53         /// <para>A ref raw link of uint</para>
54         /// <para></para>
55         /// </returns>

```

```

56     [MethodImpl(MethodImplOptions.AggressiveInlining)]
57     protected override ref RawLink<uint> GetLinkReference(uint link) => ref _links[link];
58
59     /// <summary>
60     /// <para>
61     /// Gets the header reference.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     /// <returns>
66     /// <para>A ref links header of uint</para>
67     /// <para></para>
68     /// </returns>
69     [MethodImpl(MethodImplOptions.AggressiveInlining)]
70     protected override ref LinksHeader<uint> GetHeaderReference() => ref *_header;
71 }
72 }

```

1.100 ./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>

```

```

59     /// <para>
60     /// Gets the zero.
61     /// </para>
62     /// <para></para>
63     /// </summary>
64     /// <returns>
65     /// <para>The ulong</para>
66     /// <para></para>
67     /// </returns>
68     [MethodImpl(MethodImplOptions.AggressiveInlining)]
69     protected override ulong GetZero() => OUL;
70
71     /// <summary>
72     /// <para>
73     /// Determines whether this instance equal to zero.
74     /// </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 == OUL;
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 > OUL;
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>

```

```

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,
            ↪ 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) =>
456         ↪ storedValue = storedValue & 4294967279UL | (As<bool, byte>(ref value) & 1UL) << 4;
457
458     /// <summary>
459     /// <para>
460     /// Determines whether this instance get right is child value.
461     /// </para>
462     /// <para></para>
463     /// </summary>
464     /// <param name="value">
465     /// <para>The value.</para>
466     /// <para></para>
467     /// </param>
468     /// <returns>
469     /// <para>The bool</para>
470     /// <para></para>
471     /// </returns>
472     [MethodImpl(MethodImplOptions.AggressiveInlining)]
473     protected override bool GetRightIsChildValue(ulong value) => (value & 8UL) >> 3 == 1UL;
474
475     /// <summary>
476     /// <para>
477     /// Sets the right is child value using the specified stored value.
478     /// </para>
479     /// <para></para>
480     /// </summary>
481     /// <param name="storedValue">
482     /// <para>The stored value.</para>
483     /// <para></para>
484     /// </param>
485     /// <param name="value">
486     /// <para>The value.</para>
487     /// <para></para>
488     /// </param>
489     [MethodImpl(MethodImplOptions.AggressiveInlining)]
490     protected override void SetRightIsChildValue(ref ulong storedValue, bool value) =>
491         ↪ storedValue = storedValue & 4294967287UL | (As<bool, byte>(ref value) & 1UL) << 3;
492
493     /// <summary>
494     /// <para>
495     /// Gets the balance value using the specified value.
496     /// </para>
497     /// <para></para>
498     /// </summary>
499     /// <param name="value">
500     /// <para>The value.</para>
501     /// <para></para>
502     /// </param>
503     /// <returns>
504     /// <para>The sbyte</para>
505     /// <para></para>
506     /// </returns>
507     [MethodImpl(MethodImplOptions.AggressiveInlining)]
508     protected override sbyte GetBalanceValue(ulong value) => unchecked((sbyte)(value & 7UL |
509         ↪ 0xF8UL * ((value & 4UL) >> 2))); // if negative, then continue ones to the end of
510         ↪ sbyte
511
512     /// <summary>
513     /// <para>
514     /// Sets the balance value using the specified stored value.
515     /// </para>
516     /// <para></para>
517     /// </summary>
518     /// <param name="storedValue">
519     /// <para>The stored value.</para>
520     /// <para></para>
521     /// </param>

```

```

517     /// </param>
518     /// <param name="value">
519     /// <para>The value.</para>
520     /// <para></para>
521     /// </param>
522     [MethodImpl(MethodImplOptions.AggressiveInlining)]
523     protected override void SetBalanceValue(ref ulong storedValue, sbyte value) =>
524     ↪ storedValue = unchecked(storedValue & 4294967288UL | (ulong)((byte)value >> 5 & 4 |
525     ↪ value & 3) & 7UL);
526
527     /// <summary>
528     /// <para>
529     /// Gets the header reference.
530     /// </para>
531     /// <para></para>
532     /// </summary>
533     /// <returns>
534     /// <para>A ref links header of ulong</para>
535     /// <para></para>
536     /// </returns>
537     [MethodImpl(MethodImplOptions.AggressiveInlining)]
538     protected override ref LinksHeader<ulong> GetHeaderReference() => ref *Header;
539
540     /// <summary>
541     /// <para>
542     /// Gets the link reference using the specified link.
543     /// </para>
544     /// <para></para>
545     /// </summary>
546     /// <param name="link">
547     /// <para>The link.</para>
548     /// <para></para>
549     /// </param>
550     /// <returns>
551     /// <para>A ref raw link of ulong</para>
552     /// <para></para>
553     /// </returns>
554     [MethodImpl(MethodImplOptions.AggressiveInlining)]
555     protected override ref RawLink<ulong> GetLinkReference(ulong link) => ref Links[link];
556 }
557 }

```

1.101 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt64LinksRecursionlessSizeBalancedTreeMeth

```

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
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="UInt64LinksRecursionlessSizeBalancedTreeMethodsBase"/>
37         ↪ 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 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
    ↪ 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    /// <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,
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 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 }

```

1.102 ./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 :
16    ↪ LinksSizeBalancedTreeMethodsBase<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="UInt64LinksSizeBalancedTreeMethodsBase"/> instance.
36        /// </para>
37        /// <para></para>
38        /// </summary>
39        /// <param name="constants">
40        /// <para>A constants.</para>
41        /// </param>
42        /// <param name="links">
43        /// <para>A links.</para>
44        /// </param>
45        /// <param name="header">
46        /// <para>A header.</para>
47        /// </param>
48        protected UInt64LinksSizeBalancedTreeMethodsBase(LinksConstants<ulong> constants,
49    ↪ RawLink<ulong>* links, LinksHeader<ulong>* header)
50    : 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 ulong</para>
64    /// <para></para>
65    /// </returns>
66    [MethodImpl(MethodImplOptions.AggressiveInlining)]
67    protected override ulong GetZero() => 0UL;
68
69    /// <summary>
70    /// <para>
71    /// Determines whether this instance equal to zero.
72    /// </para>
73    /// <para></para>
74    /// </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 == 0UL;
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
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.
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>

```

```

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 FirstIsToLeftOfSecond(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];

```

```

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 }

```

1.103 ./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 :
        ↪ UInt64LinksAvlBalancedTreeMethodsBase
15    {
16        /// <summary>
17        /// <para>
18        /// Initializes a new <see cref="UInt64LinksSourcesAvlBalancedTreeMethods"/> 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        public UInt64LinksSourcesAvlBalancedTreeMethods(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
52     ↪ Links[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 ulong</para>
66     /// <para></para>
67     /// </returns>
68     [MethodImpl(MethodImplOptions.AggressiveInlining)]
69     protected override ref ulong GetRightReference(ulong node) => ref
70     ↪ Links[node].RightAsSource;
71
72     /// <summary>
73     /// <para>
74     /// Gets the left using the specified node.
75     /// </para>
76     /// <para></para>
77     /// </summary>
78     /// <param name="node">
79     /// <para>The node.</para>
80     /// <para></para>
81     /// </param>
82     /// <returns>
83     /// <para>The ulong</para>
84     /// <para></para>
85     /// </returns>
86     [MethodImpl(MethodImplOptions.AggressiveInlining)]
87     protected override ulong GetLeft(ulong node) => Links[node].LeftAsSource;
88
89     /// <summary>
90     /// <para>
91     /// Gets the right using the specified node.
92     /// </para>
93     /// <para></para>
94     /// </summary>
95     /// <param name="node">
96     /// <para>The node.</para>
97     /// <para></para>
98     /// </param>
99     /// <returns>
100    /// <para>The ulong</para>
101    /// <para></para>
102    /// </returns>
103    [MethodImpl(MethodImplOptions.AggressiveInlining)]
104    protected override ulong GetRight(ulong node) => Links[node].RightAsSource;
105
106    /// <summary>
107    /// <para>
108    /// Sets the left using the specified node.
109    /// </para>
110    /// <para></para>
111    /// </summary>
112    /// <param name="node">
113    /// <para>The node.</para>

```

```

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) => GetSizeValue(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) => SetSizeValue(ref
        ↳ Links[node].SizeAsSource, 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].SizeAsSource);

```

```

188
189 // [MethodImpl(MethodImplOptions.AggressiveInlining)]
190 // protected override bool GetLeftIsChild(ulong node) => IsChild(node, GetLeft(node));
191
192 /// <summary>
193 /// <para>
194 /// Sets the left is child 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 /// <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);

```

```

262     /// <summary>
263     /// <para>
264     /// Sets the balance 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     /// <param name="value">
273     /// <para>The value.</para>
274     /// <para></para>
275     /// </param>
276     [MethodImpl(MethodImplOptions.AggressiveInlining)]
277     protected override void SetBalance(ulong node, sbyte value) => SetBalanceValue(ref
278     ↪ 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 FirstIsToTheLeftOfSecond(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,
           ↪ ulong secondSource, ulong secondTarget)
368         => firstSource > secondSource || (firstSource == secondSource && firstTarget >
           ↪ secondTarget);
369
370     /// <summary>
371     /// <para>
372     /// Clears the node using the specified node.
373     /// </para>
374     /// <para></para>
375     /// </summary>
376     /// <param name="node">
377     /// <para>The node.</para>
378     /// <para></para>
379     /// </param>
380     [MethodImpl(MethodImplOptions.AggressiveInlining)]
381     protected override void ClearNode(ulong node)
382     {
383         ref var link = ref Links[node];
384         link.LeftAsSource = OUL;
385         link.RightAsSource = OUL;
386         link.SizeAsSource = OUL;
387     }
388 }
389 }

```

1.104 ./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 :
           ↪ UInt64LinksRecursionlessSizeBalancedTreeMethodsBase
15     {
16         /// <summary>
17         /// <para>
18         /// Initializes a new <see
           ↪ cref="UInt64LinksSourcesRecursionlessSizeBalancedTreeMethods"/> 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    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 =
171         ↳ size;
172
173     /// <summary>
174     /// <para>
175     /// Gets the tree root.
176     /// </para>
177     /// <para></para>
178     /// </summary>
179     /// <returns>
180     /// <para>The ulong</para>
181     /// <para></para>
182     /// </returns>
183     [MethodImpl(MethodImplOptions.AggressiveInlining)]
184     protected override ulong GetTreeRoot() => Header->RootAsSource;
185
186     /// <summary>
187     /// <para>
188     /// Gets the base part value using the specified link.
189     /// </para>
190     /// <para></para>
191     /// </summary>
192     /// <param name="link">
193     /// <para>The link.</para>
194     /// <para></para>
195     /// </param>
196     /// <returns>
197     /// <para>The ulong</para>
198     /// <para></para>
199     /// </returns>
200     [MethodImpl(MethodImplOptions.AggressiveInlining)]
201     protected override ulong GetBasePartValue(ulong link) => Links[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 FirstIsToLeftOfSecond(ulong firstSource, ulong firstTarget,
231         ↳ ulong secondSource, ulong secondTarget)
232         => firstSource < secondSource || (firstSource == secondSource && firstTarget <
233             ↳ secondTarget);
234
235     /// <summary>
236     /// <para>
237     /// Determines whether this instance first is to the right of second.
238     /// </para>
239     /// <para></para>
240     /// </summary>
241     /// <param name="firstSource">
242     /// <para>The first source.</para>
243     /// <para></para>
244     /// </param>
245     /// <param name="firstTarget">
246     /// <para>The first target.</para>
247     /// <para></para>
248     /// </param>
249     /// <param name="secondSource">
250     /// <para>The second source.</para>
251     /// <para></para>
252     /// </param>
253     /// <param name="secondTarget">
254     /// <para>The second target.</para>
255     /// <para></para>
256     /// </param>
257     /// <returns>
258     /// <para>The bool</para>
259     /// <para></para>
260     /// </returns>
261     [MethodImpl(MethodImplOptions.AggressiveInlining)]
262     protected override bool FirstIsToRightOfSecond(ulong firstSource, ulong firstTarget,
263         ↳ ulong secondSource, ulong secondTarget)
264         => firstSource > secondSource || (firstSource == secondSource && firstTarget >
265             ↳ secondTarget);

```



```

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>

```

```
/// <para>  
/// Gets the base part value using the specified link.  
/// </para>  
/// <para></para>  
/// </summary>  
/// <param name="link">  
/// <para>The link.</para>  
/// <para></para>  
/// </param>  
/// <returns>  
/// <para>The ulong</para>  
/// <para></para>  
/// </returns>  
[MethodImpl(MethodImplOptions.AggressiveInlining)]  
protected override ulong GetBasePartValue(ulong link) => Links[link].Source;  
  
/// <summary>  
/// <para>  
/// Determines whether this instance first is to the left of second.  
/// </para>  
/// <para></para>  
/// </summary>  
/// <param name="firstSource">  
/// <para>The first source.</para>  
/// <para></para>  
/// </param>  
/// <param name="firstTarget">  
/// <para>The first target.</para>  
/// <para></para>  
/// </param>  
/// <param name="secondSource">  
/// <para>The second source.</para>  
/// <para></para>  
/// </param>  
/// <param name="secondTarget">  
/// <para>The second target.</para>  
/// <para></para>  
/// </param>  
/// <returns>  
/// <para>The bool</para>  
/// <para></para>  
/// </returns>  
[MethodImpl(MethodImplOptions.AggressiveInlining)]  
protected override bool FirstIsToTheLeftOfSecond(ulong firstSource, ulong firstTarget,  
↳ ulong secondSource, ulong secondTarget)  
    => firstSource < secondSource || (firstSource == secondSource && firstTarget <  
        ↳ secondTarget);  
  
/// <summary>  
/// <para>  
/// Determines whether this instance first is to the right of second.  
/// </para>  
/// <para></para>  
/// </summary>  
/// <param name="firstSource">  
/// <para>The first source.</para>  
/// <para></para>  
/// </param>  
/// <param name="firstTarget">  
/// <para>The first target.</para>  
/// <para></para>  
/// </param>  
/// <param name="secondSource">  
/// <para>The second source.</para>  
/// <para></para>  
/// </param>  
/// <param name="secondTarget">  
/// <para>The second target.</para>  
/// <para></para>  
/// </param>  
/// <returns>  
/// <para>The bool</para>  
/// <para></para>  
/// </returns>  
[MethodImpl(MethodImplOptions.AggressiveInlining)]  
protected override bool FirstIsToTheRightOfSecond(ulong firstSource, ulong firstTarget,  
↳ ulong secondSource, ulong secondTarget)
```

```

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

```

1.106 ./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     /// </summary>
12     /// <seealso cref="UInt64LinksAvlBalancedTreeMethodsBase"/>
13     public unsafe class UInt64LinksTargetsAvlBalancedTreeMethods :
14         ↪ UInt64LinksAvlBalancedTreeMethodsBase
15     {
16         /// <summary>
17         /// <para>
18         /// Initializes a new <see cref="UInt64LinksTargetsAvlBalancedTreeMethods"/> 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 UInt64LinksTargetsAvlBalancedTreeMethods(LinksConstants<ulong> constants,
31             ↪ RawLink<ulong>* links, LinksHeader<ulong>* header) : base(constants, links, header)
32         { }
33
34         /// <summary>
35         /// <para>
36         /// Gets the left reference using the specified node.
37         /// </para>
38         /// </summary>
39         /// <param name="node">
40         /// <para>The node.</para>
41         /// </param>
42         /// <returns>
43         /// <para>The ref ulong</para>
44         /// </returns>
45         [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     /// <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].SizeAsTarget);

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].SizeAsTarget, size);

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

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

```

```

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

```



```

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

```

```

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

```

1.107 ./csharp/Platform.Data.Doublets/Memory/United/Specific/UInt64LinksTargetsRecursionlessSizeBalancedTreeMethodsBase.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 recursionless size balanced tree methods.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="UInt64LinksTargetsRecursionlessSizeBalancedTreeMethodsBase"/>
14     public unsafe class UInt64LinksTargetsRecursionlessSizeBalancedTreeMethods :
15         ↪ UInt64LinksTargetsRecursionlessSizeBalancedTreeMethodsBase
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see
20         ↪ cref="UInt64LinksTargetsRecursionlessSizeBalancedTreeMethods"/> 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 UInt64LinksTargetsRecursionlessSizeBalancedTreeMethods(LinksConstants<ulong>
37             ↪ constants, RawLink<ulong>* links, LinksHeader<ulong>* header) : base(constants,
38             ↪ links, header) { }
39     }

```

```

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].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);

```

```

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.LeftAsTarget = OUL;
277         link.RightAsTarget = OUL;
278         link.SizeAsTarget = OUL;
279     }
280 }
281 }

```

1.108 ./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        /// <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 UInt64LinksTargetsSizeBalancedTreeMethods(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;

```

```

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>

```



```

    /// Determines whether this instance first is to the left of second.
    /// </para>
    /// <para></para>
    /// </summary>
    /// <param name="firstSource">
    /// <para>The first source.</para>
    /// <para></para>
    /// </param>
    /// <param name="firstTarget">
    /// <para>The first target.</para>
    /// <para></para>
    /// </param>
    /// <param name="secondSource">
    /// <para>The second source.</para>
    /// <para></para>
    /// </param>
    /// <param name="secondTarget">
    /// <para>The second target.</para>
    /// <para></para>
    /// </param>
    /// <returns>
    /// <para>The bool</para>
    /// <para></para>
    /// </returns>
    [MethodImpl(MethodImplOptions.AggressiveInlining)]
    protected override bool FirstIsToLeftOfSecond(ulong firstSource, ulong firstTarget,
        ↪ ulong secondSource, ulong secondTarget)
        => firstTarget < secondTarget || (firstTarget == secondTarget && firstSource <
        ↪ secondSource);

    /// <summary>
    /// <para>
    /// Determines whether this instance first is to the right of second.
    /// </para>
    /// <para></para>
    /// </summary>
    /// <param name="firstSource">
    /// <para>The first source.</para>
    /// <para></para>
    /// </param>
    /// <param name="firstTarget">
    /// <para>The first target.</para>
    /// <para></para>
    /// </param>
    /// <param name="secondSource">
    /// <para>The second source.</para>
    /// <para></para>
    /// </param>
    /// <param name="secondTarget">
    /// <para>The second target.</para>
    /// <para></para>
    /// </param>
    /// <returns>
    /// <para>The bool</para>
    /// <para></para>
    /// </returns>
    [MethodImpl(MethodImplOptions.AggressiveInlining)]
    protected override bool FirstIsToTheRightOfSecond(ulong firstSource, ulong firstTarget,
        ↪ ulong secondSource, ulong secondTarget)
        => firstTarget > secondTarget || (firstTarget == secondTarget && firstSource >
        ↪ secondSource);

    /// <summary>
    /// <para>
    /// Clears the node using the specified node.
    /// </para>
    /// <para></para>
    /// </summary>
    /// <param name="node">
    /// <para>The node.</para>
    /// <para></para>
    /// </param>
    [MethodImpl(MethodImplOptions.AggressiveInlining)]
    protected override void ClearNode(ulong node)
    {
        ref var link = ref Links[node];
        link.LeftAsTarget = OUL;
        link.RightAsTarget = OUL;
    }

```

```

278         link.SizeAsTarget = OUL;
279     }
280 }
281 }

```

1.109 ./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         private readonly Func<ILinksTreeMethods<ulong>> _createSourceTreeMethods;
22         private readonly Func<ILinksTreeMethods<ulong>> _createTargetTreeMethods;
23         private LinksHeader<ulong>* _header;
24         private RawLink<ulong>* _links;
25
26         /// <summary>
27         /// <para>
28         ///     Initializes a new <see cref="UInt64UnitedMemoryLinks"/> instance.
29         /// </para>
30         /// <para></para>
31         /// </summary>
32         /// <param name="address">
33         /// <para>A address.</para>
34         /// <para></para>
35         /// </param>
36         [MethodImpl(MethodImplOptions.AggressiveInlining)]
37         public UInt64UnitedMemoryLinks(string address) : this(address, DefaultLinksSizeStep) { }
38
39         /// <summary>
40         /// <para>Создаёт экземпляр базы данных Links в файле по указанному адресу, с указанным
41         ///     минимальным шагом расширения базы данных.
42         /// </para>
43         /// </summary>
44         /// <param name="address">Полный путь к файлу базы данных.</param>
45         /// <param name="memoryReservationStep">Минимальный шаг расширения базы данных в
46         ///     байтах.</param>
47         [MethodImpl(MethodImplOptions.AggressiveInlining)]
48         public UInt64UnitedMemoryLinks(string address, long memoryReservationStep) : this(new
49         FileMappedResizableDirectMemory(address, memoryReservationStep),
50         memoryReservationStep) { }
51
52         /// <summary>
53         /// <para>
54         ///     Initializes a new <see cref="UInt64UnitedMemoryLinks"/> instance.
55         /// </para>
56         /// <para></para>
57         /// </summary>
58         /// <param name="memory">
59         /// <para>A memory.</para>
60         /// <para></para>
61         /// </param>
62         [MethodImpl(MethodImplOptions.AggressiveInlining)]
63         public UInt64UnitedMemoryLinks(IResizableDirectMemory memory) : this(memory,
64         DefaultLinksSizeStep) { }

```

```

65     /// </param>
66     /// <param name="memoryReservationStep">
67     /// <para>A memory reservation step.</para>
68     /// <para></para>
69     /// </param>
70     [MethodImpl(MethodImplOptions.AggressiveInlining)]
71     public UInt64UnitedMemoryLinks(IResizableDirectMemory memory, long
        ↳ memoryReservationStep) : this(memory, memoryReservationStep,
        ↳ Default<LinksConstants<ulong>>.Instance, IndexTreeType.Default) { }

72
73     /// <summary>
74     /// <para>
75     /// Initializes a new <see cref="UInt64UnitedMemoryLinks"/> instance.
76     /// </para>
77     /// <para></para>
78     /// </summary>
79     /// <param name="memory">
80     /// <para>A memory.</para>
81     /// <para></para>
82     /// </param>
83     /// <param name="memoryReservationStep">
84     /// <para>A memory reservation step.</para>
85     /// <para></para>
86     /// </param>
87     /// <param name="constants">
88     /// <para>A constants.</para>
89     /// <para></para>
90     /// </param>
91     /// <param name="indexTreeType">
92     /// <para>A index tree type.</para>
93     /// <para></para>
94     /// </param>
95     [MethodImpl(MethodImplOptions.AggressiveInlining)]
96     public UInt64UnitedMemoryLinks(IResizableDirectMemory memory, long
        ↳ memoryReservationStep, LinksConstants<ulong> constants, IndexTreeType indexTreeType)
        ↳ : base(memory, memoryReservationStep, constants)
97     {
98         if (indexTreeType == IndexTreeType.SizedAndThreadedAVLBalancedTree)
99         {
100             _createSourceTreeMethods = () => new
                ↳ UInt64LinksSourcesAvlBalancedTreeMethods(Constants, _links, _header);
101             _createTargetTreeMethods = () => new
                ↳ UInt64LinksTargetsAvlBalancedTreeMethods(Constants, _links, _header);
102         }
103         else if (indexTreeType == IndexTreeType.SizeBalancedTree)
104         {
105             _createSourceTreeMethods = () => new
                ↳ UInt64LinksSourcesSizeBalancedTreeMethods(Constants, _links, _header);
106             _createTargetTreeMethods = () => new
                ↳ UInt64LinksTargetsSizeBalancedTreeMethods(Constants, _links, _header);
107         }
108         else
109         {
110             _createSourceTreeMethods = () => new
                ↳ UInt64LinksSourcesRecursionlessSizeBalancedTreeMethods(Constants, _links,
                ↳ _header);
111             _createTargetTreeMethods = () => new
                ↳ UInt64LinksTargetsRecursionlessSizeBalancedTreeMethods(Constants, _links,
                ↳ _header);
112         }
113         Init(memory, memoryReservationStep);
114     }

115
116     /// <summary>
117     /// <para>
118     /// Sets the pointers using the specified memory.
119     /// </para>
120     /// <para></para>
121     /// </summary>
122     /// <param name="memory">
123     /// <para>The memory.</para>
124     /// <para></para>
125     /// </param>
126     [MethodImpl(MethodImplOptions.AggressiveInlining)]
127     protected override void SetPointers(IResizableDirectMemory memory)
128     {
129         _header = (LinksHeader<ulong>*)memory.Pointer;

```

```

130     _links = (RawLink<ulong>*)memory.Pointer;
131     SourcesTreeMethods = _createSourceTreeMethods();
132     TargetsTreeMethods = _createTargetTreeMethods();
133     UnusedLinksListMethods = new UInt64UnusedLinksListMethods(_links, _header);
134 }
135
136 /// <summary>
137 /// <para>
138 /// Resets the pointers.
139 /// </para>
140 /// <para></para>
141 /// </summary>
142 [MethodImpl(MethodImplOptions.AggressiveInlining)]
143 protected override void ResetPointers()
144 {
145     base.ResetPointers();
146     _links = null;
147     _header = null;
148 }
149
150 /// <summary>
151 /// <para>
152 /// Gets the header reference.
153 /// </para>
154 /// <para></para>
155 /// </summary>
156 /// <returns>
157 /// <para>A ref links header of ulong</para>
158 /// <para></para>
159 /// </returns>
160 [MethodImpl(MethodImplOptions.AggressiveInlining)]
161 protected override ref LinksHeader<ulong> GetHeaderReference() => ref *_header;
162
163 /// <summary>
164 /// <para>
165 /// Gets the link reference using the specified link index.
166 /// </para>
167 /// <para></para>
168 /// </summary>
169 /// <param name="linkIndex">
170 /// <para>The link index.</para>
171 /// <para></para>
172 /// </param>
173 /// <returns>
174 /// <para>A ref raw link of ulong</para>
175 /// <para></para>
176 /// </returns>
177 [MethodImpl(MethodImplOptions.AggressiveInlining)]
178 protected override ref RawLink<ulong> GetLinkReference(ulong linkIndex) => ref
179     ↪ _links[linkIndex];
180
181 /// <summary>
182 /// <para>
183 /// Determines whether this instance are equal.
184 /// </para>
185 /// <para></para>
186 /// </summary>
187 /// <param name="first">
188 /// <para>The first.</para>
189 /// <para></para>
190 /// </param>
191 /// <param name="second">
192 /// <para>The second.</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 AreEqual(ulong first, ulong second) => first == second;
201
202 /// <summary>
203 /// <para>
204 /// Determines whether this instance less than.
205 /// </para>
206 /// <para></para>
207 /// </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 LessThan(ulong first, ulong second) => first < second;
221
222     /// <summary>
223     /// <para>
224     /// Determines whether this instance less or equal than.
225     /// </para>
226     /// <para></para>
227     /// </summary>
228     /// <param name="first">
229     /// <para>The first.</para>
230     /// <para></para>
231     /// </param>
232     /// <param name="second">
233     /// <para>The second.</para>
234     /// <para></para>
235     /// </param>
236     /// <returns>
237     /// <para>The bool</para>
238     /// <para></para>
239     /// </returns>
240     [MethodImpl(MethodImplOptions.AggressiveInlining)]
241     protected override bool LessOrEqualThan(ulong first, ulong second) => first <= second;
242
243     /// <summary>
244     /// <para>
245     /// Determines whether this instance greater than.
246     /// </para>
247     /// <para></para>
248     /// </summary>
249     /// <param name="first">
250     /// <para>The first.</para>
251     /// <para></para>
252     /// </param>
253     /// <param name="second">
254     /// <para>The second.</para>
255     /// <para></para>
256     /// </param>
257     /// <returns>
258     /// <para>The bool</para>
259     /// <para></para>
260     /// </returns>
261     [MethodImpl(MethodImplOptions.AggressiveInlining)]
262     protected override bool GreaterThan(ulong first, ulong second) => first > second;
263
264     /// <summary>
265     /// <para>
266     /// Determines whether this instance greater or equal than.
267     /// </para>
268     /// <para></para>
269     /// </summary>
270     /// <param name="first">
271     /// <para>The first.</para>
272     /// <para></para>
273     /// </param>
274     /// <param name="second">
275     /// <para>The second.</para>
276     /// <para></para>
277     /// </param>
278     /// <returns>
279     /// <para>The bool</para>
280     /// <para></para>
281     /// </returns>
282     [MethodImpl(MethodImplOptions.AggressiveInlining)]
283     protected override bool GreaterOrEqualThan(ulong first, ulong second) => first >= second;
284

```

```

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

```

```

363 [MethodImpl(MethodImplOptions.AggressiveInlining)]
364 protected override ulong Add(ulong first, ulong second) => first + second;
365
366 /// <summary>
367 /// <para>
368 /// Subtracts the first.
369 /// </para>
370 /// <para></para>
371 /// </summary>
372 /// <param name="first">
373 /// <para>The first.</para>
374 /// <para></para>
375 /// </param>
376 /// <param name="second">
377 /// <para>The second.</para>
378 /// <para></para>
379 /// </param>
380 /// <returns>
381 /// <para>The ulong</para>
382 /// <para></para>
383 /// </returns>
384 [MethodImpl(MethodImplOptions.AggressiveInlining)]
385 protected override ulong Subtract(ulong first, ulong second) => first - second;
386
387 /// <summary>
388 /// <para>
389 /// Increments the link.
390 /// </para>
391 /// <para></para>
392 /// </summary>
393 /// <param name="link">
394 /// <para>The link.</para>
395 /// <para></para>
396 /// </param>
397 /// <returns>
398 /// <para>The ulong</para>
399 /// <para></para>
400 /// </returns>
401 [MethodImpl(MethodImplOptions.AggressiveInlining)]
402 protected override ulong Increment(ulong link) => ++link;
403
404 /// <summary>
405 /// <para>
406 /// Decrements the link.
407 /// </para>
408 /// <para></para>
409 /// </summary>
410 /// <param name="link">
411 /// <para>The link.</para>
412 /// <para></para>
413 /// </param>
414 /// <returns>
415 /// <para>The ulong</para>
416 /// <para></para>
417 /// </returns>
418 [MethodImpl(MethodImplOptions.AggressiveInlining)]
419 protected override ulong Decrement(ulong link) => --link;
420 }
421 }

```

1.110 ./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        private readonly RawLink<ulong>* _links;
18        private readonly LinksHeader<ulong>* _header;

```

```

19
20     /// <summary>
21     /// <para>
22     /// Initializes a new <see cref="UInt64UnusedLinksListMethods"/> instance.
23     /// </para>
24     /// <para></para>
25     /// </summary>
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 UInt64UnusedLinksListMethods(RawLink<ulong>* links, LinksHeader<ulong>* header)
36         : base((byte*)links, (byte*)header)
37     {
38         _links = links;
39         _header = header;
40     }
41
42     /// <summary>
43     /// <para>
44     /// Gets the link reference using the specified link.
45     /// </para>
46     /// <para></para>
47     /// </summary>
48     /// <param name="link">
49     /// <para>The link.</para>
50     /// <para></para>
51     /// </param>
52     /// <returns>
53     /// <para>A ref raw link of ulong</para>
54     /// <para></para>
55     /// </returns>
56     [MethodImpl(MethodImplOptions.AggressiveInlining)]
57     protected override ref RawLink<ulong> GetLinkReference(ulong link) => ref _links[link];
58
59     /// <summary>
60     /// <para>
61     /// Gets the header reference.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     /// <returns>
66     /// <para>A ref links header of ulong</para>
67     /// <para></para>
68     /// </returns>
69     [MethodImpl(MethodImplOptions.AggressiveInlining)]
70     protected override ref LinksHeader<ulong> GetHeaderReference() => ref *_header;
71 }
72 }

```

1.111 ./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         private static readonly EqualityComparer<TLink> _equalityComparer =
21         ↪ EqualityComparer<TLink>.Default;
22
23         /// <summary>

```



```

22     /// <para>
23     /// Initializes a new <see cref="PropertiesOperator"/> instance.
24     /// </para>
25     /// <para></para>
26     /// </summary>
27     /// <param name="links">
28     /// <para>A links.</para>
29     /// <para></para>
30     /// </param>
31     [MethodImpl(MethodImplOptions.AggressiveInlining)]
32     public PropertiesOperator(ILinks<TLink> links) : base(links) { }
33
34     /// <summary>
35     /// <para>
36     /// Gets the value using the specified object.
37     /// </para>
38     /// <para></para>
39     /// </summary>
40     /// <param name="@object">
41     /// <para>The object.</para>
42     /// <para></para>
43     /// </param>
44     /// <param name="property">
45     /// <para>The property.</para>
46     /// <para></para>
47     /// </param>
48     /// <returns>
49     /// <para>The link</para>
50     /// <para></para>
51     /// </returns>
52     [MethodImpl(MethodImplOptions.AggressiveInlining)]
53     public TLink GetValue(TLink @object, TLink property)
54     {
55         var links = _links;
56         var objectProperty = links.SearchOrDefault(@object, property);
57         if (_equalityComparer.Equals(objectProperty, default))
58         {
59             return default;
60         }
61         var constants = links.Constants;
62         var any = constants.Any;
63         var query = new Link<TLink>(any, objectProperty, any);
64         var valueLink = links.SingleOrDefault(query);
65         if (valueLink == null)
66         {
67             return default;
68         }
69         return links.GetTarget(valueLink[constants.IndexPart]);
70     }
71
72     /// <summary>
73     /// <para>
74     /// Sets the value using the specified object.
75     /// </para>
76     /// <para></para>
77     /// </summary>
78     /// <param name="@object">
79     /// <para>The object.</para>
80     /// <para></para>
81     /// </param>
82     /// <param name="property">
83     /// <para>The property.</para>
84     /// <para></para>
85     /// </param>
86     /// <param name="value">
87     /// <para>The value.</para>
88     /// <para></para>
89     /// </param>
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     public void SetValue(TLink @object, TLink property, TLink value)
92     {
93         var links = _links;
94         var objectProperty = links.GetOrCreate(@object, property);
95         links.DeleteMany(links.AllIndices(links.Constants.Any, objectProperty));
96         links.GetOrCreate(objectProperty, value);
97     }
98 }
99 }

```

1.112 ./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         private static readonly EqualityComparer<TLink> _equalityComparer =
20             ↪ EqualityComparer<TLink>.Default;
21         private readonly TLink _propertyMarker;
22         private readonly TLink _propertyValueMarker;
23
24         /// <summary>
25         /// <para>
26         /// Initializes a new <see cref="PropertyOperator" /> instance.
27         /// </para>
28         /// <para></para>
29         /// </summary>
30         /// <param name="links">
31         /// <para>A links.</para>
32         /// <para></para>
33         /// </param>
34         /// <param name="propertyMarker">
35         /// <para>A property marker.</para>
36         /// <para></para>
37         /// </param>
38         /// <param name="propertyValueMarker">
39         /// <para>A property value marker.</para>
40         /// <para></para>
41         /// </param>
42         [MethodImpl(MethodImplOptions.AggressiveInlining)]
43         public PropertyOperator(ILinks<TLink> links, TLink propertyMarker, TLink
44             ↪ propertyValueMarker) : base(links)
45         {
46             _propertyMarker = propertyMarker;
47             _propertyValueMarker = propertyValueMarker;
48         }
49
50         /// <summary>
51         /// <para>
52         /// Gets the link.
53         /// </para>
54         /// <para></para>
55         /// </summary>
56         /// <param name="link">
57         /// <para>The link.</para>
58         /// <para></para>
59         /// </param>
60         /// <returns>
61         /// <para>The link</para>
62         /// <para></para>
63         /// </returns>
64         [MethodImpl(MethodImplOptions.AggressiveInlining)]
65         public TLink Get(TLink link)
66         {
67             {
68                 var property = _links.SearchOrDefault(link, _propertyMarker);
69                 return GetValue(GetContainer(property));
70             }
71         }
72         [MethodImpl(MethodImplOptions.AggressiveInlining)]
73         private TLink GetContainer(TLink property)
74         {
75             {
76                 var valueContainer = default(TLink);
77                 if (_equalityComparer.Equals(property, default))
78                 {
79                     return valueContainer;
80                 }
81                 var links = _links;

```

```

77     var constants = links.Constants;
78     var countinueConstant = constants.Continue;
79     var breakConstant = constants.Break;
80     var anyConstant = constants.Any;
81     var query = new Link<TLink>(anyConstant, property, anyConstant);
82     links.Each(candidate =>
83     {
84         var candidateTarget = links.GetTarget(candidate);
85         var valueTarget = links.GetTarget(candidateTarget);
86         if (_equalityComparer.Equals(valueTarget, _propertyValueMarker))
87         {
88             valueContainer = links.GetIndex(candidate);
89             return breakConstant;
90         }
91         return countinueConstant;
92     }, query);
93     return valueContainer;
94 }
95 [MethodImpl(MethodImplOptions.AggressiveInlining)]
96 private TLink GetValue(TLink container) => _equalityComparer.Equals(container, default)
97     ↪ ? default : _links.GetTarget(container);
98
99 /// <summary>
100 /// <para>
101 /// Sets the link.
102 /// </para>
103 /// </summary>
104 /// <param name="link">
105 /// <para>The link.</para>
106 /// </param>
107 /// <param name="value">
108 /// <para>The value.</para>
109 /// </param>
110
111 [MethodImpl(MethodImplOptions.AggressiveInlining)]
112 public void Set(TLink link, TLink value)
113 {
114     var links = _links;
115     var property = links.GetOrCreate(link, _propertyMarker);
116     var container = GetContainer(property);
117     if (_equalityComparer.Equals(container, default))
118     {
119         links.GetOrCreate(property, value);
120     }
121     else
122     {
123         links.Update(container, property, value);
124     }
125 }
126 }
127 }
128 }

```

1.113 ./csharp/Platform.Data.Doublets/Stacks/Stack.cs

```

1 using System.Collections;
2 using System.Collections.Generic;
3 using System.Runtime.CompilerServices;
4 using Platform.Collections.Stacks;
5
6 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
7
8 namespace Platform.Data.Doublets.Stacks
9 {
10     /// <summary>
11     /// <para>
12     /// Represents the stack.
13     /// </para>
14     /// </summary>
15     /// <seealso cref="LinksOperatorBase{TLink}" />
16     /// <seealso cref="IStack{TLink}" />
17     public class Stack<TLink> : LinksOperatorBase<TLink>, IStack<TLink>
18     {
19         private static readonly EqualityComparer<TLink> _equalityComparer =
20             ↪ EqualityComparer<TLink>.Default;
21         private readonly TLink _stack;
22
23         /// <summary>

```

```

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

```

```

102     /// </param>
103     [MethodImpl(MethodImplOptions.AggressiveInlining)]
104     public void Push(TLink element) => _links.Update(_stack, GetStackMarker(),
        ↪ _links.GetOrCreate(GetTop(), element));
105 }
106 }

```

1.114 ./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 }

```

1.115 ./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.Delegates;
6 using Platform.Threading.Synchronization;
7
8 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
9
10 namespace Platform.Data.Doublets
11 {
12     /// <remarks>
13     /// TODO: Autogeneration of synchronized wrapper (decorator).
14     /// TODO: Try to unfold code of each method using IL generation for performance improvements.
15     /// TODO: Or even to unfold multiple layers of implementations.
16     /// </remarks>
17     public class SynchronizedLinks<TLinkAddress> : ISynchronizedLinks<TLinkAddress>
18     {
19         /// <summary>
20         /// <para>
21         /// Gets the constants value.
22         /// </para>
23         /// <para></para>
24         /// </summary>

```

```

25 public LinksConstants<TLinkAddress> Constants
26 {
27     [MethodImpl(MethodImplOptions.AggressiveInlining)]
28     get;
29 }
30
31 /// <summary>
32 /// <para>
33 /// Gets the sync root value.
34 /// </para>
35 /// <para></para>
36 /// </summary>
37 public ISynchronization SyncRoot
38 {
39     [MethodImpl(MethodImplOptions.AggressiveInlining)]
40     get;
41 }
42
43 /// <summary>
44 /// <para>
45 /// Gets the sync value.
46 /// </para>
47 /// <para></para>
48 /// </summary>
49 public ILinks<TLinkAddress> Sync
50 {
51     [MethodImpl(MethodImplOptions.AggressiveInlining)]
52     get;
53 }
54
55 /// <summary>
56 /// <para>
57 /// Gets the unsync value.
58 /// </para>
59 /// <para></para>
60 /// </summary>
61 public ILinks<TLinkAddress> Unsync
62 {
63     [MethodImpl(MethodImplOptions.AggressiveInlining)]
64     get;
65 }
66
67 /// <summary>
68 /// <para>
69 /// Initializes a new <see cref="SynchronizedLinks"/> instance.
70 /// </para>
71 /// <para></para>
72 /// </summary>
73 /// <param name="links">
74 /// <para>A links.</para>
75 /// <para></para>
76 /// </param>
77 [MethodImpl(MethodImplOptions.AggressiveInlining)]
78 public SynchronizedLinks(ILinks<TLinkAddress> links) : this(new
    ↳ ReaderWriterLockSynchronization(), links) { }
79
80 /// <summary>
81 /// <para>
82 /// Initializes a new <see cref="SynchronizedLinks"/> instance.
83 /// </para>
84 /// <para></para>
85 /// </summary>
86 /// <param name="synchronization">
87 /// <para>A synchronization.</para>
88 /// <para></para>
89 /// </param>
90 /// <param name="links">
91 /// <para>A links.</para>
92 /// <para></para>
93 /// </param>
94 [MethodImpl(MethodImplOptions.AggressiveInlining)]
95 public SynchronizedLinks(ISynchronization synchronization, ILinks<TLinkAddress> links)
96 {
97     SyncRoot = synchronization;
98     Sync = this;
99     Unsync = links;
100     Constants = links.Constants;
101 }
102

```

```

103     /// <summary>
104     /// <para>
105     /// Counts the restriction.
106     /// </para>
107     /// <para></para>
108     /// </summary>
109     /// <param name="restriction">
110     /// <para>The restriction.</para>
111     /// <para></para>
112     /// </param>
113     /// <returns>
114     /// <para>The link address</para>
115     /// <para></para>
116     /// </returns>
117     [MethodImpl(MethodImplOptions.AggressiveInlining)]
118     public TLinkAddress Count(ICollection<TLinkAddress> restriction) =>
119         ↳ SyncRoot.ExecuteReadOperation(restriction, Unsync.Count);
120
121     /// <summary>
122     /// <para>
123     /// Eaches the handler.
124     /// </para>
125     /// <para></para>
126     /// </summary>
127     /// <param name="handler">
128     /// <para>The handler.</para>
129     /// <para></para>
130     /// </param>
131     /// <param name="restriction">
132     /// <para>The substitution.</para>
133     /// <para></para>
134     /// </param>
135     /// <returns>
136     /// <para>The link address</para>
137     /// <para></para>
138     /// </returns>
139     [MethodImpl(MethodImplOptions.AggressiveInlining)]
140     public TLinkAddress Each(ICollection<TLinkAddress> restriction, ReadHandler<TLinkAddress>
141         ↳ handler) => SyncRoot.ExecuteReadOperation(restriction, handler, Unsync.Each);
142
143     /// <summary>
144     /// <para>
145     /// Creates the substitution.
146     /// </para>
147     /// <para></para>
148     /// </summary>
149     /// <param name="substitution">
150     /// <para>The substitution.</para>
151     /// <para></para>
152     /// </param>
153     /// <returns>
154     /// <para>The link address</para>
155     /// <para></para>
156     /// </returns>
157     [MethodImpl(MethodImplOptions.AggressiveInlining)]
158     public TLinkAddress Create(ICollection<TLinkAddress> substitution, WriteHandler<TLinkAddress>
159         ↳ handler) => SyncRoot.ExecuteWriteOperation(substitution, handler, Unsync.Create);
160
161     /// <summary>
162     /// <para>
163     /// Updates the substitution.
164     /// </para>
165     /// <para></para>
166     /// </summary>
167     /// <param name="restriction">
168     /// <para>The substitution.</para>
169     /// <para></para>
170     /// </param>
171     /// <param name="substitution">
172     /// <para>The substitution.</para>
173     /// <para></para>
174     /// </param>
175     /// <returns>
176     /// <para>The link address</para>
177     /// <para></para>
178     /// </returns>
179     [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

177     public TLinkAddress Update(IList<TLinkAddress> restriction, IList<TLinkAddress>
        ↳ substitution, WriteHandler<TLinkAddress> handler) =>
        ↳ SyncRoot.ExecuteWriteOperation(restriction, substitution, handler, Unsync.Update);
178
179     /// <summary>
180     /// <para>
181     /// Deletes the substitution.
182     /// </para>
183     /// <para></para>
184     /// </summary>
185     /// <param name="restriction">
186     /// <para>The substitution.</para>
187     /// <para></para>
188     /// </param>
189     [MethodImpl(MethodImplOptions.AggressiveInlining)]
190     public TLinkAddress Delete(IList<TLinkAddress> restriction, WriteHandler<TLinkAddress>
        ↳ handler) => SyncRoot.ExecuteWriteOperation(restriction, handler, Unsync.Delete);
191
192     //public T Trigger(IList<T> restriction, Func<IList<T>, IList<T>, T> matchedHandler,
        ↳ IList<T> substitution, Func<IList<T>, IList<T>, T> substitutedHandler)
193     //{
194     //    if (restriction != null && substitution != null &&
        ↳ !substitution.EqualTo(restriction))
195     //        return SyncRoot.ExecuteWriteOperation(restriction, matchedHandler,
        ↳ substitution, substitutedHandler, Unsync.Trigger);
196
197     //    return SyncRoot.ExecuteReadOperation(restriction, matchedHandler, substitution,
        ↳ substitutedHandler, Unsync.Trigger);
198     //}
199 }
200 }

```

1.116 ./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 =
            ↳ Default<LinksConstants<ulong>>.Instance;
26
27         /// <summary>
28         /// <para>
29         /// Determines whether any link is any.
30         /// </para>
31         /// <para></para>
32         /// </summary>
33         /// <param name="links">
34         /// <para>The links.</para>
35         /// <para></para>
36         /// </param>
37         /// <param name="sequence">
38         /// <para>The sequence.</para>
39         /// <para></para>
40         /// </param>
41         /// <returns>
42         /// <para>The bool</para>
43         /// <para></para>
44         /// </returns>

```



```

45 [MethodImpl(MethodImplOptions.AggressiveInlining)]
46 public static bool AnyLinkIsAny(this ILinks<ulong> links, params ulong[] sequence)
47 {
48     if (sequence == null)
49     {
50         return false;
51     }
52     var constants = links.Constants;
53     for (var i = 0; i < sequence.Length; i++)
54     {
55         if (sequence[i] == constants.Any)
56         {
57             return true;
58         }
59     }
60     return false;
61 }
62
63 /// <summary>
64 /// <para>
65 /// Formats the structure using the specified links.
66 /// </para>
67 /// <para></para>
68 /// </summary>
69 /// <param name="links">
70 /// <para>The links.</para>
71 /// <para></para>
72 /// </param>
73 /// <param name="linkIndex">
74 /// <para>The link index.</para>
75 /// <para></para>
76 /// </param>
77 /// <param name="isElement">
78 /// <para>The is element.</para>
79 /// <para></para>
80 /// </param>
81 /// <param name="renderIndex">
82 /// <para>The render index.</para>
83 /// <para></para>
84 /// </param>
85 /// <param name="renderDebug">
86 /// <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,
95     ↪ Func<Link<ulong>, bool> isElement, bool renderIndex = false, bool renderDebug =
96     ↪ false)
97 {
98     var sb = new StringBuilder();
99     var visited = new HashSet<ulong>();
100     links.AppendStructure(sb, visited, linkIndex, isElement, (innerSb, link) =>
101         ↪ innerSb.Append(link.Index), renderIndex, renderDebug);
102     return sb.ToString();
103 }
104
105 /// <summary>
106 /// <para>
107 /// Formats the structure using the specified links.
108 /// </para>
109 /// <para></para>
110 /// </summary>
111 /// <param name="links">
112 /// <para>The links.</para>
113 /// <para></para>
114 /// </param>
115 /// <param name="linkIndex">
116 /// <para>The link index.</para>
117 /// <para></para>
118 /// </param>
119 /// <param name="isElement">
120 /// <para>The is element.</para>
121 /// <para></para>
122 /// </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,
223                     ↳ appendElement, renderIndex);
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             }
243             sb.Append(')');
244         }
245         else
246         {
247             if (renderDebug)
248             {
249                 sb.Append('*');
250             }
251             sb.Append(linkIndex);
252         }
253     }
254     else
255     {
256         if (renderDebug)
257         {
258             sb.Append('~');
259         }
260         sb.Append(linkIndex);
261     }
262 }
263 }

```

1.117 ./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.Delegates;
14 using Platform.Exceptions;
15
16 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
17
18 namespace Platform.Data.Doublets
19 {
20     /// <summary>
21     /// <para>
22     /// Represents the int 64 links transactions layer.
23     /// </para>
24     /// <para></para>
25     /// </summary>
26     /// <seealso cref="LinksDisposableDecoratorBase{ulong}" />
27     public class UInt64LinksTransactionsLayer : LinksDisposableDecoratorBase<ulong> //-V3073
28     {
29         /// <remarks>
30         /// Альтернативные варианты хранения трансформации (элемента транзакции):
31         ///
32         /// private enum TransitionType
33         /// {
34         ///     Creation,
35         ///     UpdateOf,
36         ///     UpdateTo,
37         ///     Deletion
38         /// }
39         ///
40         /// private struct Transition
41         /// {
42         ///     public ulong TransactionId;
43         ///     public UniqueTimestamp Timestamp;
44         ///     public TransactionItemType Type;
45         ///     public Link Source;
46         ///     public Link Linker;
47         ///     public Link Target;
48         /// }
49         ///
50         /// Или
51         ///
52         /// public struct TransitionHeader
53         /// {
54         ///     public ulong TransactionIdCombined;
55         ///     public ulong TimestampCombined;
56         ///
57         ///     public ulong TransactionId
58         ///     {
59         ///         get
60         ///         {
61         ///             return (ulong) mask & TransactionIdCombined;
62         ///         }
63         ///     }
64         ///
65         ///     public UniqueTimestamp Timestamp
66         ///     {
67         ///         get
68         ///         {
69         ///             return (UniqueTimestamp)mask & TransactionIdCombined;
70         ///         }
71         ///     }
72         ///
73         ///     public TransactionItemType Type
74         ///     {
75         ///         get
76         ///         {
77         ///             // Использовать по одному биту из TransactionId и Timestamp,
78         ///             // для значения в 2 бита, которое представляет тип операции

```

```

79         throw new NotImplementedException();
80     }
81 }
82 }
83
84 /// private struct Transition
85 {
86     public TransitionHeader Header;
87     public Link Source;
88     public Link Linker;
89     public Link Target;
90 }
91
92 /// </remarks>
93 public struct Transition : IEquatable<Transition>
94 {
95     /// <summary>
96     /// <para>
97     /// The size.
98     /// </para>
99     /// <para></para>
100    /// </summary>
101    public static readonly long Size = Structure<Transition>.Size;
102
103    /// <summary>
104    /// <para>
105    /// The transaction id.
106    /// </para>
107    /// <para></para>
108    /// </summary>
109    public readonly ulong TransactionId;
110
111    /// <summary>
112    /// <para>
113    /// The before.
114    /// </para>
115    /// <para></para>
116    /// </summary>
117    public readonly Link<ulong> Before;
118
119    /// <summary>
120    /// <para>
121    /// The after.
122    /// </para>
123    /// <para></para>
124    /// </summary>
125    public readonly Link<ulong> After;
126
127    /// <summary>
128    /// <para>
129    /// The timestamp.
130    /// </para>
131    /// <para></para>
132    /// </summary>
133    public readonly Timestamp Timestamp;
134
135    /// <summary>
136    /// <para>
137    /// Initializes a new <see cref="Transition"/> instance.
138    /// </para>
139    /// <para></para>
140    /// </summary>
141    /// <param name="uniqueTimestampFactory">
142    /// <para>A unique timestamp factory.</para>
143    /// <para></para>
144    /// </param>
145    /// <param name="transactionId">
146    /// <para>A transaction id.</para>
147    /// <para></para>
148    /// </param>
149    /// <param name="before">
150    /// <para>A before.</para>
151    /// <para></para>
152    /// </param>
153    /// <param name="after">
154    /// <para>A after.</para>
155    /// <para></para>
156    /// </param>
157    [MethodImpl(MethodImplOptions.AggressiveInlining)]
158    public Transition(UniqueTimestampFactory uniqueTimestampFactory, ulong
159        ↪ transactionId, Link<ulong> before, Link<ulong> after)

```

```

156     {
157         TransactionId = transactionId;
158         Before = before;
159         After = after;
160         Timestamp = uniqueTimestampFactory.Create();
161     }
162
163     public Transition(UniqueTimestampFactory uniqueTimestampFactory, ulong
    ↪ transactionId, IList<ulong> before, IList<ulong> after) :
    ↪ this(uniqueTimestampFactory, transactionId, new Link<ulong>(before), new
    ↪ Link<ulong>(after)) { }
164
165     /// <summary>
166     /// <para>
167     /// Initializes a new <see cref="Transition"/> instance.
168     /// </para>
169     /// <para></para>
170     /// </summary>
171     /// <param name="uniqueTimestampFactory">
172     /// <para>A unique timestamp factory.</para>
173     /// <para></para>
174     /// </param>
175     /// <param name="transactionId">
176     /// <para>A transaction id.</para>
177     /// <para></para>
178     /// </param>
179     /// <param name="before">
180     /// <para>A before.</para>
181     /// <para></para>
182     /// </param>
183     [MethodImpl(MethodImplOptions.AggressiveInlining)]
184     public Transition(UniqueTimestampFactory uniqueTimestampFactory, ulong
    ↪ transactionId, Link<ulong> before) : this(uniqueTimestampFactory, transactionId,
    ↪ before, default) { }
185
186     /// <summary>
187     /// <para>
188     /// Initializes a new <see cref="Transition"/> instance.
189     /// </para>
190     /// <para></para>
191     /// </summary>
192     /// <param name="uniqueTimestampFactory">
193     /// <para>A unique timestamp factory.</para>
194     /// <para></para>
195     /// </param>
196     /// <param name="transactionId">
197     /// <para>A transaction id.</para>
198     /// <para></para>
199     /// </param>
200     [MethodImpl(MethodImplOptions.AggressiveInlining)]
201     public Transition(UniqueTimestampFactory uniqueTimestampFactory, ulong
    ↪ transactionId) : this(uniqueTimestampFactory, transactionId, default, default) {
    ↪ }
202
203     /// <summary>
204     /// <para>
205     /// Returns the string.
206     /// </para>
207     /// <para></para>
208     /// </summary>
209     /// <returns>
210     /// <para>The string</para>
211     /// <para></para>
212     /// </returns>
213     [MethodImpl(MethodImplOptions.AggressiveInlining)]
214     public override string ToString() => $"{Timestamp} {TransactionId}: {Before} =>
    ↪ {After}";
215
216     /// <summary>
217     /// <para>
218     /// Determines whether this instance equals.
219     /// </para>
220     /// <para></para>
221     /// </summary>
222     /// <param name="obj">
223     /// <para>The obj.</para>
224     /// <para></para>
225     /// </param>

```

```

226     /// <returns>
227     /// <para>The bool</para>
228     /// <para></para>
229     /// </returns>
230     [MethodImpl(MethodImplOptions.AggressiveInlining)]
231     public override bool Equals(object obj) => obj is Transition transition ?
        ↳ Equals(transition) : false;

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

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

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

265
266     [MethodImpl(MethodImplOptions.AggressiveInlining)]
267     public static bool operator !=(Transition left, Transition right) => !(left ==
        ↳ right);

268 }

269
270 /// <remarks>
271 /// Другие варианты реализации транзакций (атомарности):
272 /// 1. Разделение хранения значения связи ((Source Target) или (Source Linker
    ↳ Target)) и индексов.
273 /// 2. Хранение трансформаций/операций в отдельном хранилище Links, но дополнительно
    ↳ потребуется решить вопрос
274 /// со ссылками на внешние идентификаторы, или как-то иначе решить вопрос с
    ↳ пересечениями идентификаторов.
275 ///
276 /// Где хранить промежуточный список транзакций?
277 ///
278 /// В оперативной памяти:
279 /// Минусы:
280 /// 1. Может усложнить систему, если она будет функционировать самостоятельно,
281 /// так как нужно отдельно выделять память под список трансформаций.
282 /// 2. Выделенной оперативной памяти может не хватить, в том случае,
283 /// если транзакция использует слишком много трансформаций.
284 /// -> Можно использовать жёсткий диск для слишком длинных транзакций.
285 /// -> Максимальный размер списка трансформаций можно ограничить / задать
    ↳ константой.
286 /// 3. При подтверждении транзакции (Commit) все трансформации записываются разом
    ↳ создавая задержку.
287 ///
288 /// На жёстком диске:
289 /// Минусы:
290 /// 1. Длительный отклик, на запись каждой трансформации.
291 /// 2. Лог транзакций дополнительно наполняется отменёнными транзакциями.
292 /// -> Это может решаться упаковкой/исключением дублирующих операций.
293 /// -> Также это может решаться тем, что короткие транзакции вообще

```

```

294     ///         не будут записываться в случае отката.
295     ///         3. Перед тем как выполнять отмену операций транзакции нужно дождаться пока все
    → операции (трансформации)
296     ///         будут записаны в лог.
297     ///
298     /// </remarks>
299     public class Transaction : DisposableBase
300     {
301         private readonly Queue<Transition> _transitions;
302         private readonly UInt64LinksTransactionsLayer _layer;
303         /// <summary>
304         /// <para>
305         /// Gets or sets the is committed value.
306         /// </para>
307         /// <para></para>
308         /// </summary>
309         public bool IsCommitted { get; private set; }
310         /// <summary>
311         /// <para>
312         /// Gets or sets the is reverted value.
313         /// </para>
314         /// <para></para>
315         /// </summary>
316         public bool IsReverted { get; private set; }
317
318         /// <summary>
319         /// <para>
320         /// Initializes a new <see cref="Transaction"/> instance.
321         /// </para>
322         /// <para></para>
323         /// </summary>
324         /// <param name="layer">
325         /// <para>A layer.</para>
326         /// <para></para>
327         /// </param>
328         /// <exception cref="NotSupportedException">
329         /// <para>Nested transactions not supported.</para>
330         /// <para></para>
331         /// </exception>
332         [MethodImpl(MethodImplOptions.AggressiveInlining)]
333         public Transaction(UInt64LinksTransactionsLayer layer)
334         {
335             _layer = layer;
336             if (_layer._currentTransactionId != 0)
337             {
338                 throw new NotSupportedException("Nested transactions not supported.");
339             }
340             IsCommitted = false;
341             IsReverted = false;
342             _transitions = new Queue<Transition>();
343             SetCurrentTransaction(layer, this);
344         }
345
346         /// <summary>
347         /// <para>
348         /// Commits this instance.
349         /// </para>
350         /// <para></para>
351         /// </summary>
352         [MethodImpl(MethodImplOptions.AggressiveInlining)]
353         public void Commit()
354         {
355             EnsureTransactionAllowsWriteOperations(this);
356             while (_transitions.Count > 0)
357             {
358                 var transition = _transitions.Dequeue();
359                 _layer._transitions.Enqueue(transition);
360             }
361             _layer._lastCommittedTransactionId = _layer._currentTransactionId;
362             IsCommitted = true;
363         }
364         [MethodImpl(MethodImplOptions.AggressiveInlining)]
365         private void Revert()
366         {
367             EnsureTransactionAllowsWriteOperations(this);
368             var transitionsToRevert = new Transition[_transitions.Count];
369             _transitions.CopyTo(transitionsToRevert, 0);
370             for (var i = transitionsToRevert.Length - 1; i >= 0; i--)

```



```

371     {
372         _layer.RevertTransition(transitionsToRevert[i]);
373     }
374     IsReverted = true;
375 }
376
377 /// <summary>
378 /// <para>
379 /// Sets the current transaction using the specified layer.
380 /// </para>
381 /// <para></para>
382 /// </summary>
383 /// <param name="layer">
384 /// <para>The layer.</para>
385 /// <para></para>
386 /// </param>
387 /// <param name="transaction">
388 /// <para>The transaction.</para>
389 /// <para></para>
390 /// </param>
391 [MethodImpl(MethodImplOptions.AggressiveInlining)]
392 public static void SetCurrentTransaction(UInt64LinksTransactionsLayer layer,
    ↪ Transaction transaction)
393 {
394     layer._currentTransactionId = layer._lastCommittedTransactionId + 1;
395     layer._currentTransactionTransitions = transaction._transitions;
396     layer._currentTransaction = transaction;
397 }
398
399 /// <summary>
400 /// <para>
401 /// Ensures the transaction allows write operations using the specified transaction.
402 /// </para>
403 /// <para></para>
404 /// </summary>
405 /// <param name="transaction">
406 /// <para>The transaction.</para>
407 /// <para></para>
408 /// </param>
409 /// <exception cref="InvalidOperationException">
410 /// <para>Transation is committed.</para>
411 /// <para></para>
412 /// </exception>
413 /// <exception cref="InvalidOperationException">
414 /// <para>Transation is reverted.</para>
415 /// <para></para>
416 /// </exception>
417 [MethodImpl(MethodImplOptions.AggressiveInlining)]
418 public static void EnsureTransactionAllowsWriteOperations(Transaction transaction)
419 {
420     if (transaction.IsReverted)
421     {
422         throw new InvalidOperationException("Transation is reverted.");
423     }
424     if (transaction.IsCommitted)
425     {
426         throw new InvalidOperationException("Transation is committed.");
427     }
428 }
429
430 /// <summary>
431 /// <para>
432 /// Disposes the manual.
433 /// </para>
434 /// <para></para>
435 /// </summary>
436 /// <param name="manual">
437 /// <para>The manual.</para>
438 /// <para></para>
439 /// </param>
440 /// <param name="wasDisposed">
441 /// <para>The was disposed.</para>
442 /// <para></para>
443 /// </param>
444 [MethodImpl(MethodImplOptions.AggressiveInlining)]
445 protected override void Dispose(bool manual, bool wasDisposed)
446 {
447     if (!wasDisposed && _layer != null && !_layer.Disposable.IsDisposed)

```

```

448         {
449             if (!IsCommitted && !IsReverted)
450             {
451                 Revert();
452             }
453             _layer.ResetCurrentTransation();
454         }
455     }
456 }
457
458 /// <summary>
459 /// <para>
460 /// The from seconds.
461 /// </para>
462 /// <para></para>
463 /// </summary>
464 public static readonly TimeSpan DefaultPushDelay = TimeSpan.FromSeconds(0.1);
465 private readonly string _logAddress;
466 private readonly FileStream _log;
467 private readonly Queue<Transition> _transitions;
468 private readonly UniqueTimestampFactory _uniqueTimestampFactory;
469 private Task _transitionsPusher;
470 private Transition _lastCommittedTransition;
471 private ulong _currentTransactionId;
472 private Queue<Transition> _currentTransactionTransitions;
473 private Transaction _currentTransaction;
474 private ulong _lastCommittedTransactionId;
475
476 /// <summary>
477 /// <para>
478 /// Initializes a new <see cref="UInt64LinksTransactionsLayer"/> instance.
479 /// </para>
480 /// <para></para>
481 /// </summary>
482 /// <param name="links">
483 /// <para>A links.</para>
484 /// <para></para>
485 /// </param>
486 /// <param name="logAddress">
487 /// <para>A log address.</para>
488 /// <para></para>
489 /// </param>
490 /// <exception cref="ArgumentNullException">
491 /// <para></para>
492 /// <para></para>
493 /// </exception>
494 /// <exception cref="NotSupportedException">
495 /// <para>Database is damaged, autorecovery is not supported yet.</para>
496 /// <para></para>
497 /// </exception>
498 [MethodImpl(MethodImplOptions.AggressiveInlining)]
499 public UInt64LinksTransactionsLayer(ILinks<ulong> links, string logAddress)
500     : base(links)
501 {
502     if (string.IsNullOrEmpty(logAddress))
503     {
504         throw new ArgumentNullException(nameof(logAddress));
505     }
506     // В первой строке файла хранится последняя законченную транзакцию.
507     // При запуске это используется для проверки удачного закрытия файла лога.
508     // In the first line of the file the last committed transaction is stored.
509     // On startup, this is used to check that the log file is successfully closed.
510     var lastCommittedTransition = FileHelpers.ReadFirstOrDefault<Transition>(logAddress);
511     var lastWrittenTransition = FileHelpers.ReadLastOrDefault<Transition>(logAddress);
512     if (!lastCommittedTransition.Equals(lastWrittenTransition))
513     {
514         Dispose();
515         throw new NotSupportedException("Database is damaged, autorecovery is not
516             ↳ supported yet.");
517     }
518     if (lastCommittedTransition == default)
519     {
520         FileHelpers.WriteFirst(logAddress, lastCommittedTransition);
521     }
522     _lastCommittedTransition = lastCommittedTransition;
523     // TODO: Think about a better way to calculate or store this value
524     var allTransitions = FileHelpers.ReadAll<Transition>(logAddress);
525     _lastCommittedTransactionId = allTransitions.Length > 0 ? allTransitions.Max(x =>
526         ↳ x.TransactionId) : 0;

```

```

525     _uniqueTimestampFactory = new UniqueTimestampFactory();
526     _logAddress = logAddress;
527     _log = FileHelpers.Append(logAddress);
528     _transitions = new Queue<Transition>();
529     _transitionsPusher = new Task(TransitionsPusher);
530     _transitionsPusher.Start();
531 }
532
533 /// <summary>
534 /// <para>
535 /// Gets the link value using the specified link.
536 /// </para>
537 /// <para></para>
538 /// </summary>
539 /// <param name="link">
540 /// <para>The link.</para>
541 /// <para></para>
542 /// </param>
543 /// <returns>
544 /// <para>A list of ulong</para>
545 /// <para></para>
546 /// </returns>
547 [MethodImpl(MethodImplOptions.AggressiveInlining)]
548 public IList<ulong> GetLinkValue(ulong link) => _links.GetLink(link);
549
550 /// <summary>
551 /// <para>
552 /// Creates the substitution.
553 /// </para>
554 /// <para></para>
555 /// </summary>
556 /// <param name="substitution">
557 /// <para>The substitution.</para>
558 /// <para></para>
559 /// </param>
560 /// <returns>
561 /// <para>The created link index.</para>
562 /// <para></para>
563 /// </returns>
564 [MethodImpl(MethodImplOptions.AggressiveInlining)]
565 public override ulong Create(IList<ulong> substitution, WriteHandler<ulong> handler)
566 {
567     return _links.Create(new Link<ulong>(), (before, after) =>
568     {
569         CommitTransition(new Transition(_uniqueTimestampFactory, _currentTransactionId,
570             ↪ new Link<ulong>(before), new Link<ulong>(after)));
571         return handler(before, after);
572     });
573 }
574
575 /// <summary>
576 /// <para>
577 /// Updates the substitution.
578 /// </para>
579 /// <para></para>
580 /// </summary>
581 /// <param name="restriction">
582 /// <para>The substitution.</para>
583 /// <para></para>
584 /// </param>
585 /// <param name="substitution">
586 /// <para>The substitution.</para>
587 /// <para></para>
588 /// </param>
589 /// <returns>
590 /// <para>The link index.</para>
591 /// <para></para>
592 /// </returns>
593 [MethodImpl(MethodImplOptions.AggressiveInlining)]
594 public override ulong Update(IList<ulong> restriction, IList<ulong> substitution,
595     ↪ WriteHandler<ulong> handler)
596 {
597     return _links.Update(restriction, substitution, (before, after) =>
598     {
599         CommitTransition(new Transition(_uniqueTimestampFactory,
600             ↪ _currentTransactionId, new Link<ulong>(before), new Link<ulong>(after)));
601         return handler(before, after);
602     });
603 }

```

```

600     );
601 }
602
603 /// <summary>
604 /// <para>
605 /// Deletes the substitution.
606 /// </para>
607 /// <para></para>
608 /// </summary>
609 /// <param name="restriction">
610 /// <para>The substitution.</para>
611 /// <para></para>
612 /// </param>
613 [MethodImpl(MethodImplOptions.AggressiveInlining)]
614 public override ulong Delete(ICollection<ulong> restriction, WriteHandler<ulong> handler)
615 {
616     var link = restriction[_constants.IndexPart];
617     return _links.Delete(restriction, (before, after) =>
618     {
619         CommitTransition(new Transition(_uniqueTimestampFactory, _currentTransactionId,
620             ↪ before, after));
621         return handler(before, after);
622     });
623 }
624 [MethodImpl(MethodImplOptions.AggressiveInlining)]
625 private Queue<Transition> GetCurrentTransitions() => _currentTransactionTransitions ??
626     ↪ _transitions;
627 [MethodImpl(MethodImplOptions.AggressiveInlining)]
628 private void CommitTransition(Transition transition)
629 {
630     if (_currentTransaction != null)
631     {
632         Transaction.EnsureTransactionAllowsWriteOperations(_currentTransaction);
633     }
634     var transitions = GetCurrentTransitions();
635     transitions.Enqueue(transition);
636 }
637 [MethodImpl(MethodImplOptions.AggressiveInlining)]
638 private void RevertTransition(Transition transition)
639 {
640     if (transition.After.IsNull()) // Revert Deletion with Creation
641     {
642         _links.Create();
643     }
644     else if (transition.Before.IsNull()) // Revert Creation with Deletion
645     {
646         _links.Delete(transition.After.Index);
647     }
648     else // Revert Update
649     {
650         _links.Update(new[] { transition.After.Index, transition.Before.Source,
651             ↪ transition.Before.Target });
652     }
653 }
654 }
655 [MethodImpl(MethodImplOptions.AggressiveInlining)]
656 private void ResetCurrentTransation()
657 {
658     _currentTransactionId = 0;
659     _currentTransactionTransitions = null;
660     _currentTransaction = null;
661 }
662 [MethodImpl(MethodImplOptions.AggressiveInlining)]
663 private void PushTransitions()
664 {
665     if (_log == null || _transitions == null)
666     {
667         return;
668     }
669     for (var i = 0; i < _transitions.Count; i++)
670     {
671         var transition = _transitions.Dequeue();
672
673         _log.Write(transition);
674         _lastCommittedTransition = transition;
675     }
676 }
677 [MethodImpl(MethodImplOptions.AggressiveInlining)]
678 private void TransitionsPusher()

```

```

675     {
676         while (!Disposable.IsDisposed && _transitionsPusher != null)
677         {
678             Thread.Sleep(DefaultPushDelay);
679             PushTransitions();
680         }
681     }
682
683     /// <summary>
684     /// <para>
685     /// Begins the transaction.
686     /// </para>
687     /// <para></para>
688     /// </summary>
689     /// <returns>
690     /// <para>The transaction</para>
691     /// <para></para>
692     /// </returns>
693     [MethodImpl(MethodImplOptions.AggressiveInlining)]
694     public Transaction BeginTransaction() => new Transaction(this);
695     [MethodImpl(MethodImplOptions.AggressiveInlining)]
696     private void DisposeTransitions()
697     {
698         try
699         {
700             var pusher = _transitionsPusher;
701             if (pusher != null)
702             {
703                 _transitionsPusher = null;
704                 pusher.Wait();
705             }
706             if (_transitions != null)
707             {
708                 PushTransitions();
709             }
710             _log.DisposeIfPossible();
711             FileHelpers.WriteFirst(_logAddress, _lastCommittedTransition);
712         }
713         catch (Exception ex)
714         {
715             ex.Ignore();
716         }
717     }
718
719     #region DisposalBase
720
721     /// <summary>
722     /// <para>
723     /// Disposes the manual.
724     /// </para>
725     /// <para></para>
726     /// </summary>
727     /// <param name="manual">
728     /// <para>The manual.</para>
729     /// <para></para>
730     /// </param>
731     /// <param name="wasDisposed">
732     /// <para>The was disposed.</para>
733     /// <para></para>
734     /// </param>
735     [MethodImpl(MethodImplOptions.AggressiveInlining)]
736     protected override void Dispose(bool manual, bool wasDisposed)
737     {
738         if (!wasDisposed)
739         {
740             DisposeTransitions();
741         }
742         base.Dispose(manual, wasDisposed);
743     }
744
745     #endregion
746 }
747 }

```

1.118 ./csharp/Platform.Data.Doublets.Tests/GenericLinksTests.cs

```

1 using System;
2 using System.IO;
3 using Platform.Data.Doublets.Decorators;
4 using Xunit;

```

```

5
6 using Platform.Memory;
7
8 using Platform.Data.Doublets.Memory.United.Generic;
9
10 namespace Platform.Data.Doublets.Tests
11 {
12     public static class GenericLinksTests
13     {
14         [Fact]
15         public static void CRUDTest()
16         {
17             Using<byte>(links => links.TestCRUDOperations());
18             Using<ushort>(links => links.TestCRUDOperations());
19             Using<uint>(links => links.TestCRUDOperations());
20             Using<ulong>(links => links.TestCRUDOperations());
21         }
22
23         [Fact]
24         public static void RawNumbersCRUDTest()
25         {
26             Using<byte>(links => links.TestRawNumbersCRUDOperations());
27             Using<ushort>(links => links.TestRawNumbersCRUDOperations());
28             Using<uint>(links => links.TestRawNumbersCRUDOperations());
29             Using<ulong>(links => links.TestRawNumbersCRUDOperations());
30         }
31
32         [Fact]
33         public static void MultipleRandomCreationsAndDeletionsTest()
34         {
35             Using<byte>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Test
36                 ↳ MultipleRandomCreationsAndDeletions(16)); // Cannot use more because current
37                 ↳ implementation of tree cuts out 5 bits from the address space.
38             Using<ushort>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Te
39                 ↳ stMultipleRandomCreationsAndDeletions(100));
40             Using<uint>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Test
41                 ↳ MultipleRandomCreationsAndDeletions(100));
42             Using<ulong>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Tes
43                 ↳ tMultipleRandomCreationsAndDeletions(100));
44         }
45         private static void Using<TLink>(Action<ILinks<TLink>> action)
46         {
47             var unitedMemoryLinks = new UnitedMemoryLinks<TLink>(new
48                 ↳ HeapResizableDirectMemory());
49             using (var logFile = File.Open("linksLogger.txt", FileMode.Create, FileAccess.Write))
50             {
51                 LoggingDecorator<TLink> links = new(unitedMemoryLinks, logFile);
52                 action(links);
53             }
54
55             File.Delete("db.links");
56             using var ffiLinks = new FFI.UnitedMemoryLinks<TLink>("db.links");
57             action(ffiLinks);
58         }
59     }
60 }

```

1.119 ./csharp/Platform.Data.Doublets.Tests/ILinksBasicTests.cs

```

1 using System.IO;
2 using Platform.Data.Doublets.Memory.United.Generic;
3 using Platform.Memory;
4 using Xunit;
5
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(3U, links.Count());
30     }
31
32     [Fact]
33     public static void FfiDeleteAllUsages()
34     {
35         File.Delete("db.links");
36         var links = new FFI.UnitedMemoryLinks<uint>("db.links");
37
38         var root = links.CreatePoint();
39
40         var a = links.CreatePoint();
41         var b = links.CreatePoint();
42
43         links.CreateAndUpdate(a, root);
44         links.CreateAndUpdate(b, root);
45
46         Assert.Equal(5U, links.Count());
47
48         links.DeleteAllUsages(root);
49
50         Assert.Equal(3U, links.Count());
51     }
52 }
53

```

1.120 ./csharp/Platform.Data.Doublets.Tests/LinksConstantsTests.cs

```

1  using Xunit;
2
3  namespace Platform.Data.Doublets.Tests
4  {
5      public static class LinksConstantsTests
6      {
7          [Fact]
8          public static void ExternalReferencesTest()
9          {
10             LinksConstants<ulong> constants = new LinksConstants<ulong>((1, long.MaxValue),
11                 ↪ (long.MaxValue + 1UL, ulong.MaxValue));
12
13             //var minimum = new Hybrid<ulong>(0, isExternal: true);
14             var minimum = new Hybrid<ulong>(1, isExternal: true);
15             var maximum = new Hybrid<ulong>(long.MaxValue, isExternal: true);
16
17             Assert.True(constants.IsExternalReference(minimum));
18             Assert.True(constants.IsExternalReference(maximum));
19         }
20     }
21

```

1.121 ./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      public static class ResizableDirectMemoryLinksTests
10     {
11         private static readonly LinksConstants<ulong> _constants =
12             ↪ Default<LinksConstants<ulong>>.Instance;
13
14         [Fact]
15         public static void BasicFileMappedMemoryTest()
16         {
17             var tempFilename = Path.GetTempFileName();
18             using (var memoryAdapter = new UInt64UnitedMemoryLinks(tempFilename))
19             {
20                 memoryAdapter.TestBasicMemoryOperations();
21             }
22             File.Delete(tempFilename);
23         }
24     }
25

```

```

22     }
23
24     [Fact]
25     public static void BasicHeapMemoryTest()
26     {
27         using (var memory = new
28             ↪ HeapResizableDirectMemory(UInt64UnitedMemoryLinks.DefaultLinksSizeStep))
29         using (var memoryAdapter = new UInt64UnitedMemoryLinks(memory,
30             ↪ UInt64UnitedMemoryLinks.DefaultLinksSizeStep))
31         {
32             memoryAdapter.TestBasicMemoryOperations();
33         }
34     }
35     private static void TestBasicMemoryOperations(this ILinks<ulong> memoryAdapter)
36     {
37         var link = memoryAdapter.Create();
38         memoryAdapter.Delete(link);
39     }
40
41     [Fact]
42     public static void NonexistentReferencesHeapMemoryTest()
43     {
44         using (var memory = new
45             ↪ HeapResizableDirectMemory(UInt64UnitedMemoryLinks.DefaultLinksSizeStep))
46         using (var memoryAdapter = new UInt64UnitedMemoryLinks(memory,
47             ↪ UInt64UnitedMemoryLinks.DefaultLinksSizeStep))
48         {
49             memoryAdapter.TestNonexistentReferences();
50         }
51     }
52     private static void TestNonexistentReferences(this ILinks<ulong> memoryAdapter)
53     {
54         var link = memoryAdapter.Create();
55         memoryAdapter.Update(link, ulong.MaxValue, ulong.MaxValue);
56         var resultLink = _constants.Null;
57         memoryAdapter.Each(foundLink =>
58         {
59             resultLink = foundLink[_constants.IndexPart];
60             return _constants.Break;
61         }, _constants.Any, ulong.MaxValue, ulong.MaxValue);
62         Assert.True(resultLink == link);
63         Assert.True(memoryAdapter.Count(ulong.MaxValue) == 0);
64         memoryAdapter.Delete(link);
65     }
66 }
67
68 }

```

1.122 ./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     public static class ScopeTests
12     {
13         [Fact]
14         public static void SingleDependencyTest()
15         {
16             using (var scope = new Scope())
17             {
18                 scope.IncludeAssemblyOf<IMemory>();
19                 var instance = scope.Use<IDirectMemory>();
20                 Assert.IsType<HeapResizableDirectMemory>(instance);
21             }
22         }
23
24         [Fact]
25         public static void CascadeDependencyTest()
26         {
27             using (var scope = new Scope())
28             {
29                 scope.Include<TemporaryFileMappedResizableDirectMemory>();
30                 scope.Include<UInt64UnitedMemoryLinks>();
31                 var instance = scope.Use<ILinks<ulong>>();

```



```

32         Assert.IsType<UInt64UnitedMemoryLinks>(instance);
33     }
34 }
35
36 [Fact(Skip = "Would be fixed later.")]
37 public static void FullAutoResolutionTest()
38 {
39     using (var scope = new Scope(autoInclude: true, autoExplore: true))
40     {
41         var instance = scope.Use<UInt64Links>();
42         Assert.IsType<UInt64Links>(instance);
43     }
44 }
45
46 [Fact]
47 public static void TypeParametersTest()
48 {
49     using (var scope = new Scope<Types<HeapResizableDirectMemory,
50         ↪ UnitedMemoryLinks<ulong>>>())
51     {
52         var links = scope.Use<ILinks<ulong>>();
53         Assert.IsType<UnitedMemoryLinks<ulong>>(links);
54     }
55 }
56 }

```

1.123 ./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      public unsafe static class SplitMemoryGenericLinksTests
10     {
11         [Fact]
12         public static void CRUDTest()
13         {
14             Using<byte>(links => links.TestCRUDOperations());
15             Using<ushort>(links => links.TestCRUDOperations());
16             Using<uint>(links => links.TestCRUDOperations());
17             Using<ulong>(links => links.TestCRUDOperations());
18         }
19
20         [Fact]
21         public static void RawNumbersCRUDTest()
22         {
23             UsingWithExternalReferences<byte>(links => links.TestRawNumbersCRUDOperations());
24             UsingWithExternalReferences<ushort>(links => links.TestRawNumbersCRUDOperations());
25             UsingWithExternalReferences<uint>(links => links.TestRawNumbersCRUDOperations());
26             UsingWithExternalReferences<ulong>(links => links.TestRawNumbersCRUDOperations());
27         }
28
29         [Fact]
30         public static void MultipleRandomCreationsAndDeletionsTest()
31         {
32             Using<byte>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Test
33                 ↪ MultipleRandomCreationsAndDeletions(16)); // Cannot use more because current
34                 ↪ implementation of tree cuts out 5 bits from the address space.
35             Using<ushort>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Test
36                 ↪ stMultipleRandomCreationsAndDeletions(100));
37             Using<uint>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Test
38                 ↪ MultipleRandomCreationsAndDeletions(100));
39             Using<ulong>(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().Test
40                 ↪ tMultipleRandomCreationsAndDeletions(100));
41         }
42
43         private static void Using<TLink>(Action<ILinks<TLink>> action)
44         {
45             using (var dataMemory = new HeapResizableDirectMemory())
46             using (var indexMemory = new HeapResizableDirectMemory())
47             using (var memory = new SplitMemoryLinks<TLink>(dataMemory, indexMemory))
48             {
49                 action(memory);
50             }
51         }
52     }
53 }

```

```

46     private static void UsingWithExternalReferences<TLink>(Action<ILinks<TLink>> action)
47     {
48         var constants = new LinksConstants<TLink>(enableExternalReferencesSupport: true);
49         using (var dataMemory = new HeapResizableDirectMemory())
50         using (var indexMemory = new HeapResizableDirectMemory())
51         using (var memory = new SplitMemoryLinks<TLink>(dataMemory, indexMemory,
52             ↪ SplitMemoryLinks<TLink>.DefaultLinksSizeStep, constants))
53         {
54             action(memory);
55         }
56     }
57 }

```

1.124 ./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      public unsafe static class SplitMemoryUInt32LinksTests
10     {
11         [Fact]
12         public static void CRUDTest()
13         {
14             Using(links => links.TestCRUDOperations());
15         }
16
17         [Fact]
18         public static void RawNumbersCRUDTest()
19         {
20             UsingWithExternalReferences(links => links.TestRawNumbersCRUDOperations());
21         }
22
23         [Fact]
24         public static void MultipleRandomCreationsAndDeletionsTest()
25         {
26             Using(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().TestMultipleRandomCreationsAndDeletions(500));
27         }
28         private static void Using(Action<ILinks<TLink>> action)
29         {
30             using (var dataMemory = new HeapResizableDirectMemory())
31             using (var indexMemory = new HeapResizableDirectMemory())
32             using (var memory = new UInt32SplitMemoryLinks(dataMemory, indexMemory))
33             {
34                 action(memory);
35             }
36         }
37         private static void UsingWithExternalReferences(Action<ILinks<TLink>> action)
38         {
39             var constants = new LinksConstants<TLink>(enableExternalReferencesSupport: true);
40             using (var dataMemory = new HeapResizableDirectMemory())
41             using (var indexMemory = new HeapResizableDirectMemory())
42             using (var memory = new UInt32SplitMemoryLinks(dataMemory, indexMemory,
43                 ↪ UInt32SplitMemoryLinks.DefaultLinksSizeStep, constants))
44             {
45                 action(memory);
46             }
47         }
48     }

```

1.125 ./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      public unsafe static class SplitMemoryUInt64LinksTests
10     {
11         [Fact]
12         public static void CRUDTest()

```

```

13     {
14         Using(links => links.TestCRUDOperations());
15     }
16
17     [Fact]
18     public static void RawNumbersCRUDTest()
19     {
20         UsingWithExternalReferences(links => links.TestRawNumbersCRUDOperations());
21     }
22
23     [Fact]
24     public static void MultipleRandomCreationsAndDeletionsTest()
25     {
26         Using(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().TestMultipleRandomCreationsAndDeletions(500));
27     }
28     private static void Using(Action<ILinks<TLink>> action)
29     {
30         using (var dataMemory = new HeapResizableDirectMemory())
31         using (var indexMemory = new HeapResizableDirectMemory())
32         using (var memory = new UInt64SplitMemoryLinks(dataMemory, indexMemory))
33         {
34             action(memory);
35         }
36     }
37     private static void UsingWithExternalReferences(Action<ILinks<TLink>> action)
38     {
39         var constants = new LinksConstants<TLink>(enableExternalReferencesSupport: true);
40         using (var dataMemory = new HeapResizableDirectMemory())
41         using (var indexMemory = new HeapResizableDirectMemory())
42         using (var memory = new UInt64SplitMemoryLinks(dataMemory, indexMemory,
43             ↪ UInt64SplitMemoryLinks.DefaultLinksSizeStep, constants))
44         {
45             action(memory);
46         }
47     }
48 }

```

1.126 ./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     public static class TestExtensions
12     {
13         public static void TestCRUDOperations<T>(this ILinks<T> links)
14         {
15             var constants = links.Constants;
16
17             var equalityComparer = EqualityComparer<T>.Default;
18
19             var zero = default(T);
20             var one = Arithmetic.Increment(zero);
21
22             // Create Link
23             Assert.True(equalityComparer.Equals(links.Count(), zero));
24
25             var setter = new Setter<T>(constants.Null);
26             links.Each(constants.Any, constants.Any, setter.SetAndReturnTrue);
27
28             Assert.True(equalityComparer.Equals(setter.Result, constants.Null));
29
30             var linkAddress = links.Create();
31
32             var link = new Link<T>(links.GetLink(linkAddress));
33
34             Assert.True(link.Count == 3);
35             Assert.True(equalityComparer.Equals(link.Index, linkAddress));
36             Assert.True(equalityComparer.Equals(link.Source, constants.Null));
37             Assert.True(equalityComparer.Equals(link.Target, constants.Null));
38
39             Assert.True(equalityComparer.Equals(links.Count(), one));
40

```

```

41 // Get first link
42 setter = new Setter<T>(constants.Null);
43 links.Each(constants.Any, constants.Any, setter.SetAndReturnFalse);
44
45 Assert.True(equalityComparer.Equals(setter.Result, linkAddress));
46
47 // Update link to reference itself
48 links.Update(linkAddress, linkAddress, linkAddress);
49
50 link = new Link<T>(links.GetLink(linkAddress));
51
52 Assert.True(equalityComparer.Equals(link.Source, linkAddress));
53 Assert.True(equalityComparer.Equals(link.Target, linkAddress));
54
55 // Update link to reference null (prepare for delete)
56 var updated = links.Update(linkAddress, constants.Null, constants.Null);
57
58 Assert.True(equalityComparer.Equals(updated, linkAddress));
59
60 link = new Link<T>(links.GetLink(linkAddress));
61
62 Assert.True(equalityComparer.Equals(link.Source, constants.Null));
63 Assert.True(equalityComparer.Equals(link.Target, constants.Null));
64
65 // Delete link
66 links.Delete(linkAddress);
67
68 Assert.True(equalityComparer.Equals(links.Count(), zero));
69
70 setter = new Setter<T>(constants.Null);
71 links.Each(constants.Any, constants.Any, setter.SetAndReturnTrue);
72
73 Assert.True(equalityComparer.Equals(setter.Result, constants.Null));
74 }
75
76 public static void TestRawNumbersCRUDOperations<T>(this ILinks<T> links)
77 {
78     // Constants
79     var constants = links.Constants;
80     var equalityComparer = EqualityComparer<T>.Default;
81
82     var zero = default(T);
83     var one = Arithmetic.Increment(zero);
84     var two = Arithmetic.Increment(one);
85
86     var h106E = new Hybrid<T>(106L, isExternal: true);
87     var h107E = new Hybrid<T>(-char.ConvertFromUtf32(107)[0]);
88     var h108E = new Hybrid<T>(-108L);
89
90     Assert.Equal(106L, h106E.AbsoluteValue);
91     Assert.Equal(107L, h107E.AbsoluteValue);
92     Assert.Equal(108L, h108E.AbsoluteValue);
93
94     // Create Link (External -> External)
95     var linkAddress1 = links.Create();
96
97     links.Update(linkAddress1, h106E, h108E);
98
99     var link1 = new Link<T>(links.GetLink(linkAddress1));
100
101     Assert.True(equalityComparer.Equals(link1.Source, h106E));
102     Assert.True(equalityComparer.Equals(link1.Target, h108E));
103
104     // Create Link (Internal -> External)
105     var linkAddress2 = links.Create();
106
107     links.Update(linkAddress2, linkAddress1, h108E);
108
109     var link2 = new Link<T>(links.GetLink(linkAddress2));
110
111     Assert.True(equalityComparer.Equals(link2.Source, linkAddress1));
112     Assert.True(equalityComparer.Equals(link2.Target, h108E));
113
114     // Create Link (Internal -> Internal)
115     var linkAddress3 = links.Create();
116
117     links.Update(linkAddress3, linkAddress1, linkAddress2);
118
119     var link3 = new Link<T>(links.GetLink(linkAddress3));
120

```

```

121 Assert.True(equalityComparer.Equals(link3.Source, linkAddress1));
122 Assert.True(equalityComparer.Equals(link3.Target, linkAddress2));
123
124 // Search for created link
125 var setter1 = new Setter<T>(constants.Null);
126 links.Each(h106E, h108E, setter1.SetAndReturnFalse);
127
128 Assert.True(equalityComparer.Equals(setter1.Result, linkAddress1));
129
130 // Search for nonexistent link
131 var setter2 = new Setter<T>(constants.Null);
132 links.Each(h106E, h107E, setter2.SetAndReturnFalse);
133
134 Assert.True(equalityComparer.Equals(setter2.Result, constants.Null));
135
136 // Update link to reference null (prepare for delete)
137 var updated = links.Update(linkAddress3, constants.Null, constants.Null);
138
139 Assert.True(equalityComparer.Equals(updated, linkAddress3));
140
141 link3 = new Link<T>(links.GetLink(linkAddress3));
142
143 Assert.True(equalityComparer.Equals(link3.Source, constants.Null));
144 Assert.True(equalityComparer.Equals(link3.Target, constants.Null));
145
146 // Delete link
147 links.Delete(linkAddress3);
148
149 Assert.True(equalityComparer.Equals(links.Count(), two));
150
151 var setter3 = new Setter<T>(constants.Null);
152 links.Each(constants.Any, constants.Any, setter3.SetAndReturnTrue);
153
154 Assert.True(equalityComparer.Equals(setter3.Result, linkAddress2));
155 }
156
157 public static void TestMultipleRandomCreationsAndDeletions<TLink>(this ILinks<TLink>
→ links, int maximumOperationsPerCycle)
158 {
159     var comparer = Comparer<TLink>.Default;
160     var addressToUInt64Converter = CheckedConverter<TLink, ulong>.Default;
161     var uint64ToAddressConverter = CheckedConverter<ulong, TLink>.Default;
162     for (var N = 1; N < maximumOperationsPerCycle; N++)
163     {
164         var random = new System.Random(N);
165         var created = 0UL;
166         var deleted = 0UL;
167         for (var i = 0; i < N; i++)
168         {
169             var linksCount = addressToUInt64Converter.Convert(links.Count());
170             var createPoint = random.NextBoolean();
171             if (linksCount >= 2 && createPoint)
172             {
173                 var linksAddressRange = new Range<ulong>(1, linksCount);
174                 TLink source = uint64ToAddressConverter.Convert(random.NextUInt64(linksA
→ ddressRange));
175                 TLink target = uint64ToAddressConverter.Convert(random.NextUInt64(linksA
→ ddressRange));
176                 → //-V3086
177                 var resultLink = links.GetOrCreate(source, target);
178                 if (comparer.Compare(resultLink,
→ uint64ToAddressConverter.Convert(linksCount)) > 0)
179                 {
180                     created++;
181                 }
182             }
183             else
184             {
185                 links.Create();
186                 created++;
187             }
188         }
189         Assert.True(created == addressToUInt64Converter.Convert(links.Count()));
190         for (var i = 0; i < N; i++)
191         {
192             TLink link = uint64ToAddressConverter.Convert((ulong)i + 1UL);
193             if (links.Exists(link))
194             {
195                 links.Delete(link);

```

```

195         deleted++;
196     }
197 }
198 Assert.True(addressToUInt64Converter.Convert(links.Count()) == 0L);
199 }
200 }
201 }
202 }

```

1.127 ./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.Numbers.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     public class UInt64LinksExtensionsTests
13     {
14         public static ILinks<TLink> CreateLinks() => CreateLinks<TLink>(new
15             ↪ Platform.IO.TemporaryFile());
16
17         public static ILinks<TLink> CreateLinks<TLink>(string dataDBFilename)
18         {
19             var linksConstants = new LinksConstants<TLink>(enableExternalReferencesSupport:
20                 ↪ true);
21             return new UnitedMemoryLinks<TLink>(new
22                 ↪ FileMappedResizableDirectMemory(dataDBFilename),
23                 ↪ UnitedMemoryLinks<TLink>.DefaultLinksSizeStep, linksConstants,
24                 ↪ IndexTreeType.Default);
25         }
26         [Fact]
27         public void FormatStructureWithExternalReferenceTest()
28         {
29             ILinks<TLink> links = CreateLinks();
30             TLink zero = default;
31             var one = Arithmetic.Increment(zero);
32             var markerIndex = one;
33             var meaningRoot = links.GetOrCreate(markerIndex, markerIndex);
34             var numberMarker = links.GetOrCreate(meaningRoot, Arithmetic.Increment(ref
35                 ↪ markerIndex));
36             AddressToRawNumberConverter<TLink> addressToNumberConverter = new();
37             var numberAddress = addressToNumberConverter.Convert(1);
38             var numberLink = links.GetOrCreate(numberMarker, numberAddress);
39             var linkNotation = links.FormatStructure(numberLink, link => link.IsFullPoint(),
40                 ↪ true);
41             Assert.Equal("(3:(2:1 2) 18446744073709551615)", linkNotation);
42         }
43     }
44 }

```

1.128 ./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     public unsafe static class UnitedMemoryUInt32LinksTests
12     {
13         [Fact]
14         public static void CRUDTest()
15         {
16             Using(links => links.TestCRUDOperations());
17         }
18
19         [Fact]
20         public static void RawNumbersCRUDTest()
21         {
22             Using(links => links.TestRawNumbersCRUDOperations());
23         }
24     }
25 }

```

```

24     [Fact]
25     public static void MultipleRandomCreationsAndDeletionsTest()
26     {
27         Using(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().TestMultip
28             ↳ leRandomCreationsAndDeletions(100));
29     }
30     private static void Using(Action<ILinks<TLink>> action)
31     {
32         using (var scope = new Scope<Types<HeapResizableDirectMemory,
33             ↳ UInt32UnitedMemoryLinks>>())
34         {
35             action(scope.Use<ILinks<TLink>>());
36         }
37     }
38 }

```

1.129 ./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     public unsafe static class UnitedMemoryUInt64LinksTests
12     {
13         [Fact]
14         public static void CRUDTest()
15         {
16             Using(links => links.TestCRUDOperations());
17         }
18
19         [Fact]
20         public static void RawNumbersCRUDTest()
21         {
22             Using(links => links.TestRawNumbersCRUDOperations());
23         }
24
25         [Fact]
26         public static void MultipleRandomCreationsAndDeletionsTest()
27         {
28             Using(links => links.DecorateWithAutomaticUniquenessAndUsagesResolution().TestMultip
29                 ↳ leRandomCreationsAndDeletions(100));
30         }
31         private static void Using(Action<ILinks<TLink>> action)
32         {
33             using (var scope = new Scope<Types<HeapResizableDirectMemory,
34                 ↳ UInt64UnitedMemoryLinks>>())
35             {
36                 action(scope.Use<ILinks<TLink>>());
37             }
38         }
39     }
40 }

```

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