

# LinksPlatform's Platform.Data Class Library

## 1.1 ./csharp/Platform.Data/Exceptions/ArgumentLinkDoesNotExistsException.cs

```
1  using System;
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.Exceptions
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the argument link does not exists exception.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="ArgumentException"/>
15     public class ArgumentLinkDoesNotExistsException<TLinkAddress> : ArgumentException
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="ArgumentLinkDoesNotExistsException{TLinkAddress}"/>
20         ///     instance.
21         /// </para>
22         /// <para>
23         /// Инициализирует новый экземпляр класса <see
24         ///     cref="ArgumentLinkDoesNotExistsException{TLinkAddress}"/>.
25         /// </para>
26         /// <para></para>
27         /// </summary>
28         /// <param name="link">
29         /// <para>A link.</para>
30         /// <para>Связь.</para>
31         /// </param>
32         /// <param name="argumentName">
33         /// <para>A argument name.</para>
34         /// <para>Имя аргумента.</para>
35         /// </param>
36         [MethodImpl(MethodImplOptions.AggressiveInlining)]
37         public ArgumentLinkDoesNotExistsException(TLinkAddress link, string argumentName) :
38             base(FormatMessage(link, argumentName), argumentName) { }
39
40         /// <summary>
41         /// <para>
42         /// Initializes a new <see cref="ArgumentLinkDoesNotExistsException{TLinkAddress}"/>
43         ///     instance.
44         /// </para>
45         /// <para>
46         /// Инициализирует новый экземпляр класса <see
47         ///     cref="ArgumentLinkDoesNotExistsException{TLinkAddress}"/>.
48         /// </para>
49         /// <para></para>
50         /// </summary>
51         /// <param name="link">
52         /// <para>A link.</para>
53         /// <para>Связь.</para>
54         /// </param>
55         [MethodImpl(MethodImplOptions.AggressiveInlining)]
56         public ArgumentLinkDoesNotExistsException(TLinkAddress link) : base(FormatMessage(link))
57         { }
58
59         /// <summary>
60         /// <para>
61         /// Initializes a new <see cref="ArgumentLinkDoesNotExistsException{TLinkAddress}"/>
62         ///     instance.
63         /// </para>
64         /// <para>
65         /// Инициализирует новый экземпляр класса <see
66         ///     cref="ArgumentLinkDoesNotExistsException{TLinkAddress}"/>.
67         /// </para>
68         /// </summary>
69         /// <param name="message">
70         /// <para>A message.</para>
71         /// <para>Сообщение.</para>
72         /// </param>
73         /// <param name="innerException">
74         /// <para>A inner exception.</para>
75         /// <para>Внутренняя ошибка.</para>
76         /// </param>
77     }
```

```

68     /// </param>
69     [MethodImpl(MethodImplOptions.AggressiveInlining)]
70     public ArgumentLinkDoesNotExistsException(string message, Exception innerException) :
71         ↪ base(message, innerException) { }
72
73     /// <summary>
74     /// <para>
75     /// Initializes a new <see cref="ArgumentLinkDoesNotExistsException{TLinkAddress}"/>
76     ↪ instance.
77     /// </para>
78     /// <para>
79     /// Инициализирует новый экземпляр класса <see
80     ↪ cref="ArgumentLinkDoesNotExistsException{TLinkAddress}"/>.
81     /// </para>
82     /// </summary>
83     /// <param name="message">
84     /// <para>A message.</para>
85     /// <para>Сообщение.</para>
86     /// </param>
87     [MethodImpl(MethodImplOptions.AggressiveInlining)]
88     public ArgumentLinkDoesNotExistsException(string message) : base(message) { }
89
90     /// <summary>
91     /// <para>
92     /// Initializes a new <see cref="ArgumentLinkDoesNotExistsException{TLinkAddress}"/>
93     ↪ instance.
94     /// </para>
95     /// <para>
96     /// Инициализирует новый экземпляр класса <see
97     ↪ cref="ArgumentLinkDoesNotExistsException{TLinkAddress}"/>.
98     /// </para>
99     /// </summary>
100    [MethodImpl(MethodImplOptions.AggressiveInlining)]
101    public ArgumentLinkDoesNotExistsException() { }
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    private static string FormatMessage(TLinkAddress link, string argumentName) => $"Связь
104    ↪ [{link}] переданная в аргумент [{argumentName}] не существует.";
105    [MethodImpl(MethodImplOptions.AggressiveInlining)]
106    private static string FormatMessage(TLinkAddress link) => $"Связь [{link}] переданная в
107    ↪ качестве аргумента не существует.";
108 }
109 }

```

## 1.2 ./csharp/Platform.Data/Exceptions/ArgumentLinkHasDependenciesException.cs

```

1  using System;
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.Exceptions
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the argument link has dependencies exception.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="ArgumentException"/>
15     public class ArgumentLinkHasDependenciesException<TLinkAddress> : ArgumentException
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="ArgumentLinkHasDependenciesException{TLinkAddress}"/>
20         ↪ instance.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         /// <param name="link">
25         /// <para>A link.</para>
26         /// <para>Связь.</para>
27         /// </param>
28         /// <param name="paramName">
29         /// <para>A param name.</para>
30         /// <para>Имя параметра.</para>
31         /// </param>
32         [MethodImpl(MethodImplOptions.AggressiveInlining)]
33         public ArgumentLinkHasDependenciesException(TLinkAddress link, string paramName) :
34             ↪ base(FormatMessage(link, paramName), paramName) { }

```

```

33
34     /// <summary>
35     /// <para>
36     /// Initializes a new <see cref="ArgumentLinkHasDependenciesException{TLinkAddress}"/>
37     → instance.
38     /// </para>
39     /// <para></para>
40     /// </summary>
41     /// <param name="link">
42     /// <para>A link.</para>
43     /// <para></para>
44     /// </param>
45     [MethodImpl(MethodImplOptions.AggressiveInlining)]
46     public ArgumentLinkHasDependenciesException(TLinkAddress link) :
47     → base(FormatMessage(link)) { }
48
49     /// <summary>
50     /// <para>
51     /// Initializes a new <see cref="ArgumentLinkHasDependenciesException{TLinkAddress}"/>
52     → instance.
53     /// </para>
54     /// <para></para>
55     /// </summary>
56     /// <param name="message">
57     /// <para>A message.</para>
58     /// <para></para>
59     /// </param>
60     /// <param name="innerException">
61     /// <para>A inner exception.</para>
62     /// <para></para>
63     /// </param>
64     [MethodImpl(MethodImplOptions.AggressiveInlining)]
65     public ArgumentLinkHasDependenciesException(string message, Exception innerException) :
66     → base(message, innerException) { }
67
68     /// <summary>
69     /// <para>
70     /// Initializes a new <see cref="ArgumentLinkHasDependenciesException{TLinkAddress}"/>
71     → instance.
72     /// </para>
73     /// <para></para>
74     /// </summary>
75     /// <param name="message">
76     /// <para>A message.</para>
77     /// <para></para>
78     /// </param>
79     [MethodImpl(MethodImplOptions.AggressiveInlining)]
80     public ArgumentLinkHasDependenciesException(string message) : base(message) { }
81
82     /// <summary>
83     /// <para>
84     /// Initializes a new <see cref="ArgumentLinkHasDependenciesException{TLinkAddress}"/>
85     → instance.
86     /// </para>
87     /// <para></para>
88     /// </summary>
89     [MethodImpl(MethodImplOptions.AggressiveInlining)]
90     public ArgumentLinkHasDependenciesException() { }
91     [MethodImpl(MethodImplOptions.AggressiveInlining)]
92     private static string FormatMessage(TLinkAddress link, string paramName) => $"У связи
93     → [{link}] переданной в аргумент [{paramName}] присутствуют зависимости, которые
94     → препятствуют изменению её внутренней структуры.";
95     [MethodImpl(MethodImplOptions.AggressiveInlining)]
96     private static string FormatMessage(TLinkAddress link) => $"У связи [{link}] переданной
97     → в качестве аргумента присутствуют зависимости, которые препятствуют изменению её
98     → внутренней структуры.";
99 }
100 }

```

### 1.3 ./csharp/Platform.Data/Exceptions/LinkWithSameValueAlreadyExistsException.cs

```

1 using System;
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.Exceptions
7 {
8     /// <summary>

```

```

9      /// <para>
10     /// Represents the link with same value already exists exception.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="Exception"/>
15     public class LinkWithSameValueAlreadyExistsException : Exception
16     {
17         /// <summary>
18         /// <para>
19         /// The default message.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         public static readonly string DefaultMessage = "Связь с таким же значением уже
24             ↳ существует.";
25
26         /// <summary>
27         /// <para>
28         /// Initializes a new <see cref="LinkWithSameValueAlreadyExistsException"/> instance.
29         /// </para>
30         /// <para></para>
31         /// </summary>
32         /// <param name="message">
33         /// <para>A message.</para>
34         /// <para></para>
35         /// </param>
36         /// <param name="innerException">
37         /// <para>A inner exception.</para>
38         /// <para></para>
39         /// </param>
40         [MethodImpl(MethodImplOptions.AggressiveInlining)]
41         public LinkWithSameValueAlreadyExistsException(string message, Exception innerException)
42             ↳ : base(message, innerException) { }
43
44         /// <summary>
45         /// <para>
46         /// Initializes a new <see cref="LinkWithSameValueAlreadyExistsException"/> instance.
47         /// </para>
48         /// <para></para>
49         /// </summary>
50         /// <param name="message">
51         /// <para>A message.</para>
52         /// <para></para>
53         /// </param>
54         [MethodImpl(MethodImplOptions.AggressiveInlining)]
55         public LinkWithSameValueAlreadyExistsException(string message) : base(message) { }
56
57         /// <summary>
58         /// <para>
59         /// Initializes a new <see cref="LinkWithSameValueAlreadyExistsException"/> instance.
60         /// </para>
61         /// <para></para>
62         /// </summary>
63         [MethodImpl(MethodImplOptions.AggressiveInlining)]
64         public LinkWithSameValueAlreadyExistsException() : base(DefaultMessage) { }
65     }
66 }

```

#### 1.4 ./csharp/Platform.Data/Exceptions/LinksLimitReachedException.cs

```

1  using System;
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.Exceptions
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the links limit reached exception.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="LinksLimitReachedExceptionBase"/>
15     public class LinksLimitReachedException<TLinkAddress> : LinksLimitReachedExceptionBase
16     {
17         /// <summary>
18         /// <para>
19         /// Initializes a new <see cref="LinksLimitReachedException{TLinkAddress}"/> instance.

```

```

20     /// </para>
21     /// <para></para>
22     /// </summary>
23     /// <param name="limit">
24     /// <para>A limit.</para>
25     /// <para></para>
26     /// </param>
27     [MethodImpl(MethodImplOptions.AggressiveInlining)]
28     public LinksLimitReachedException(TLinkAddress limit) : this(FormatMessage(limit)) { }
29
30     /// <summary>
31     /// <para>
32     /// Initializes a new <see cref="LinksLimitReachedException{TLinkAddress}" /> instance.
33     /// </para>
34     /// <para></para>
35     /// </summary>
36     /// <param name="message">
37     /// <para>A message.</para>
38     /// <para></para>
39     /// </param>
40     /// <param name="innerException">
41     /// <para>A inner exception.</para>
42     /// <para></para>
43     /// </param>
44     [MethodImpl(MethodImplOptions.AggressiveInlining)]
45     public LinksLimitReachedException(string message, Exception innerException) :
46         ↪ base(message, innerException) { }
47
48     /// <summary>
49     /// <para>
50     /// Initializes a new <see cref="LinksLimitReachedException{TLinkAddress}" /> instance.
51     /// </para>
52     /// <para></para>
53     /// </summary>
54     /// <param name="message">
55     /// <para>A message.</para>
56     /// <para></para>
57     /// </param>
58     [MethodImpl(MethodImplOptions.AggressiveInlining)]
59     public LinksLimitReachedException(string message) : base(message) { }
60
61     /// <summary>
62     /// <para>
63     /// Initializes a new <see cref="LinksLimitReachedException{TLinkAddress}" /> instance.
64     /// </para>
65     /// <para></para>
66     /// </summary>
67     [MethodImpl(MethodImplOptions.AggressiveInlining)]
68     public LinksLimitReachedException() : base(DefaultMessage) { }
69     [MethodImpl(MethodImplOptions.AggressiveInlining)]
70     private static string FormatMessage(TLinkAddress limit) => $"Достигнут лимит количества
71     ↪ связей в хранилище ({limit}).";
72 }

```

## 1.5 ./csharp/Platform.Data/Exceptions/LinksLimitReachedExceptionBase.cs

```

1  using System;
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.Exceptions
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the links limit reached exception base.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="Exception"/>
15     public abstract class LinksLimitReachedExceptionBase : Exception
16     {
17         /// <summary>
18         /// <para>
19         /// The default message.
20         /// </para>
21         /// <para></para>
22         /// </summary>

```

```

23     public static readonly string DefaultMessage = "Достигнут лимит количества связей в
    ↳ хранилище.";
24
25     /// <summary>
26     /// <para>
27     /// Initializes a new <see cref="LinksLimitReachedExceptionBase"/> instance.
28     /// </para>
29     /// <para></para>
30     /// </summary>
31     /// <param name="message">
32     /// <para>A message.</para>
33     /// <para></para>
34     /// </param>
35     /// <param name="innerException">
36     /// <para>A inner exception.</para>
37     /// <para></para>
38     /// </param>
39     [MethodImpl(MethodImplOptions.AggressiveInlining)]
40     protected LinksLimitReachedExceptionBase(string message, Exception innerException) :
    ↳ base(message, innerException) { }
41
42     /// <summary>
43     /// <para>
44     /// Initializes a new <see cref="LinksLimitReachedExceptionBase"/> instance.
45     /// </para>
46     /// <para></para>
47     /// </summary>
48     /// <param name="message">
49     /// <para>A message.</para>
50     /// <para></para>
51     /// </param>
52     [MethodImpl(MethodImplOptions.AggressiveInlining)]
53     protected LinksLimitReachedExceptionBase(string message) : base(message) { }
54 }
55 }

```

## 1.6 ./csharp/Platform.Data/Hybrid.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4  using Platform.Exceptions;
5  using Platform.Reflection;
6  using Platform.Converters;
7  using Platform.Numbers;
8
9  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
10
11 namespace Platform.Data
12 {
13     /// <summary>
14     /// <para>
15     /// The hybrid.
16     /// </para>
17     /// <para></para>
18     /// </summary>
19     public struct Hybrid<TLinkAddress> : IEquatable<Hybrid<TLinkAddress>>
20     {
21         private static readonly EqualityComparer<TLinkAddress> _equalityComparer =
    ↳ EqualityComparer<TLinkAddress>.Default;
22         private static readonly UncheckedSignExtendingConverter<TLinkAddress, long>
    ↳ _addressToInt64Converter = UncheckedSignExtendingConverter<TLinkAddress,
    ↳ long>.Default;
23         private static readonly UncheckedConverter<long, TLinkAddress> _int64ToAddressConverter
    ↳ = UncheckedConverter<long, TLinkAddress>.Default;
24         private static readonly UncheckedConverter<TLinkAddress, ulong>
    ↳ _addressToUInt64Converter = UncheckedConverter<TLinkAddress, ulong>.Default;
25         private static readonly UncheckedConverter<ulong, TLinkAddress>
    ↳ _uInt64ToAddressConverter = UncheckedConverter<ulong, TLinkAddress>.Default;
26         private static readonly UncheckedConverter<object, long> _objectToInt64Converter =
    ↳ UncheckedConverter<object, long>.Default;
27
28         /// <summary>
29         /// <para>
30         /// The max value.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         public static readonly ulong HalfOfNumberValuesRange =
    ↳ _addressToUInt64Converter.Convert(NumericType<TLinkAddress>.MaxValue) / 2;

```

```

35     /// <summary>
36     /// <para>
37     /// The half of number values range.
38     /// </para>
39     /// <para></para>
40     /// </summary>
41     public static readonly TLinkAddress ExternalZero =
42         ↪ _uInt64ToAddressConverter.Convert(HalfOfNumberValuesRange + 1UL);
43
44     /// <summary>
45     /// <para>
46     /// The value.
47     /// </para>
48     /// <para></para>
49     /// </summary>
50     public readonly TLinkAddress Value;
51
52     /// <summary>
53     /// <para>
54     /// Gets the is nothing value.
55     /// </para>
56     /// <para></para>
57     /// </summary>
58     public bool IsNothing
59     {
60         [MethodImpl(MethodImplOptions.AggressiveInlining)]
61         get => _equalityComparer.Equals(Value, ExternalZero) || SignedValue == 0;
62     }
63
64     /// <summary>
65     /// <para>
66     /// Gets the is internal value.
67     /// </para>
68     /// <para></para>
69     /// </summary>
70     public bool IsInternal
71     {
72         [MethodImpl(MethodImplOptions.AggressiveInlining)]
73         get => SignedValue > 0;
74     }
75
76     /// <summary>
77     /// <para>
78     /// Gets the is external value.
79     /// </para>
80     /// <para></para>
81     /// </summary>
82     public bool IsExternal
83     {
84         [MethodImpl(MethodImplOptions.AggressiveInlining)]
85         get => _equalityComparer.Equals(Value, ExternalZero) || SignedValue < 0;
86     }
87
88     /// <summary>
89     /// <para>
90     /// Gets the signed value value.
91     /// </para>
92     /// <para></para>
93     /// </summary>
94     public long SignedValue
95     {
96         [MethodImpl(MethodImplOptions.AggressiveInlining)]
97         get => _addressToInt64Converter.Convert(Value);
98     }
99
100     /// <summary>
101     /// <para>
102     /// Gets the absolute value value.
103     /// </para>
104     /// <para></para>
105     /// </summary>
106     public long AbsoluteValue
107     {
108         [MethodImpl(MethodImplOptions.AggressiveInlining)]
109         get => _equalityComparer.Equals(Value, ExternalZero) ? 0 :
110             ↪ Platform.Numbers.Math.Abs(SignedValue);
111     }
112
113     /// <summary>

```

```

112    /// <para>
113    /// Initializes a new <see cref="Hybrid{TLinkAddress}"/> instance.
114    /// </para>
115    /// <para></para>
116    /// </summary>
117    /// <param name="value">
118    /// <para>A value.</para>
119    /// <para></para>
120    /// </param>
121    [MethodImpl(MethodImplOptions.AggressiveInlining)]
122    public Hybrid(TLinkAddress value)
123    {
124        Ensure.OnDebug.IsUnsignedInteger<TLinkAddress>();
125        Value = value;
126    }
127
128    /// <summary>
129    /// <para>
130    /// Initializes a new <see cref="Hybrid{TLinkAddress}"/> instance.
131    /// </para>
132    /// <para></para>
133    /// </summary>
134    /// <param name="value">
135    /// <para>A value.</para>
136    /// <para></para>
137    /// </param>
138    /// <param name="isExternal">
139    /// <para>A is external.</para>
140    /// <para></para>
141    /// </param>
142    [MethodImpl(MethodImplOptions.AggressiveInlining)]
143    public Hybrid(TLinkAddress value, bool isExternal)
144    {
145        if (_equalityComparer.Equals(value, default) && isExternal)
146        {
147            Value = ExternalZero;
148        }
149        else
150        {
151            if (isExternal)
152            {
153                Value = Math<TLinkAddress>.Negate(value);
154            }
155            else
156            {
157                Value = value;
158            }
159        }
160    }
161
162    /// <summary>
163    /// <para>
164    /// Initializes a new <see cref="Hybrid{TLinkAddress}"/> instance.
165    /// </para>
166    /// <para></para>
167    /// </summary>
168    /// <param name="value">
169    /// <para>A value.</para>
170    /// <para></para>
171    /// </param>
172    [MethodImpl(MethodImplOptions.AggressiveInlining)]
173    public Hybrid(object value) => Value =
174        ↪ _int64ToAddressConverter.Convert(_objectToInt64Converter.Convert(value));
175
176    /// <summary>
177    /// <para>
178    /// Initializes a new <see cref="Hybrid{TLinkAddress}"/> instance.
179    /// </para>
180    /// <para></para>
181    /// </summary>
182    /// <param name="value">
183    /// <para>A value.</para>
184    /// <para></para>
185    /// </param>
186    /// <param name="isExternal">
187    /// <para>A is external.</para>
188    /// <para></para>
189    /// </param>

```



```

189 [MethodImpl(MethodImplOptions.AggressiveInlining)]
190 public Hybrid(object value, bool isExternal)
191 {
192     var signedValue = value == null ? 0 : _objectToInt64Converter.Convert(value);
193     if (signedValue == 0 && isExternal)
194     {
195         Value = ExternalZero;
196     }
197     else
198     {
199         var absoluteValue = System.Math.Abs(signedValue);
200         Value = isExternal ? _int64ToAddressConverter.Convert(-absoluteValue) :
            ↪ _int64ToAddressConverter.Convert(absoluteValue);
201     }
202 }
203
204 [MethodImpl(MethodImplOptions.AggressiveInlining)]
205 public static implicit operator Hybrid<TLinkAddress>(TLinkAddress integer) => new
    ↪ Hybrid<TLinkAddress>(integer);
206
207 [MethodImpl(MethodImplOptions.AggressiveInlining)]
208 public static explicit operator Hybrid<TLinkAddress>(ulong integer) => new
    ↪ Hybrid<TLinkAddress>(integer);
209
210 [MethodImpl(MethodImplOptions.AggressiveInlining)]
211 public static explicit operator Hybrid<TLinkAddress>(long integer) => new
    ↪ Hybrid<TLinkAddress>(integer);
212
213 [MethodImpl(MethodImplOptions.AggressiveInlining)]
214 public static explicit operator Hybrid<TLinkAddress>(uint integer) => new
    ↪ Hybrid<TLinkAddress>(integer);
215
216 [MethodImpl(MethodImplOptions.AggressiveInlining)]
217 public static explicit operator Hybrid<TLinkAddress>(int integer) => new
    ↪ Hybrid<TLinkAddress>(integer);
218
219 [MethodImpl(MethodImplOptions.AggressiveInlining)]
220 public static explicit operator Hybrid<TLinkAddress>(ushort integer) => new
    ↪ Hybrid<TLinkAddress>(integer);
221
222 [MethodImpl(MethodImplOptions.AggressiveInlining)]
223 public static explicit operator Hybrid<TLinkAddress>(short integer) => new
    ↪ Hybrid<TLinkAddress>(integer);
224
225 [MethodImpl(MethodImplOptions.AggressiveInlining)]
226 public static explicit operator Hybrid<TLinkAddress>(byte integer) => new
    ↪ Hybrid<TLinkAddress>(integer);
227
228 [MethodImpl(MethodImplOptions.AggressiveInlining)]
229 public static explicit operator Hybrid<TLinkAddress>(sbyte integer) => new
    ↪ Hybrid<TLinkAddress>(integer);
230
231 [MethodImpl(MethodImplOptions.AggressiveInlining)]
232 public static implicit operator TLinkAddress(Hybrid<TLinkAddress> hybrid) =>
    ↪ hybrid.Value;
233
234 [MethodImpl(MethodImplOptions.AggressiveInlining)]
235 public static explicit operator ulong(Hybrid<TLinkAddress> hybrid) =>
    ↪ CheckedConverter<TLinkAddress, ulong>.Default.Convert(hybrid.Value);
236
237 [MethodImpl(MethodImplOptions.AggressiveInlining)]
238 public static explicit operator long(Hybrid<TLinkAddress> hybrid) =>
    ↪ hybrid.AbsoluteValue;
239
240 [MethodImpl(MethodImplOptions.AggressiveInlining)]
241 public static explicit operator uint(Hybrid<TLinkAddress> hybrid) =>
    ↪ CheckedConverter<TLinkAddress, uint>.Default.Convert(hybrid.Value);
242
243 [MethodImpl(MethodImplOptions.AggressiveInlining)]
244 public static explicit operator int(Hybrid<TLinkAddress> hybrid) =>
    ↪ (int)hybrid.AbsoluteValue;
245
246 [MethodImpl(MethodImplOptions.AggressiveInlining)]
247 public static explicit operator ushort(Hybrid<TLinkAddress> hybrid) =>
    ↪ CheckedConverter<TLinkAddress, ushort>.Default.Convert(hybrid.Value);
248
249 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

250 public static explicit operator short(Hybrid<TLinkAddress> hybrid) =>
251     ↪ (short)hybrid.AbsoluteValue;
252
253 [MethodImpl(MethodImplOptions.AggressiveInlining)]
254 public static explicit operator byte(Hybrid<TLinkAddress> hybrid) =>
255     ↪ CheckedConverter<TLinkAddress, byte>.Default.Convert(hybrid.Value);
256
257 [MethodImpl(MethodImplOptions.AggressiveInlining)]
258 public static explicit operator sbyte(Hybrid<TLinkAddress> hybrid) =>
259     ↪ (sbyte)hybrid.AbsoluteValue;
260
261 /// <summary>
262 /// <para>
263 /// Returns the string.
264 /// </para>
265 /// <para></para>
266 /// </summary>
267 /// <returns>
268 /// <para>The string</para>
269 /// <para></para>
270 /// </returns>
271 [MethodImpl(MethodImplOptions.AggressiveInlining)]
272 public override string ToString() => IsExternal ? $"{<AbsoluteValue>}" :
273     ↪ Value.ToString();
274
275 /// <summary>
276 /// <para>
277 /// Determines whether this instance equals.
278 /// </para>
279 /// <para></para>
280 /// </summary>
281 /// <param name="other">
282 /// <para>The other.</para>
283 /// <para></para>
284 /// </param>
285 /// <returns>
286 /// <para>The bool</para>
287 /// <para></para>
288 /// </returns>
289 [MethodImpl(MethodImplOptions.AggressiveInlining)]
290 public bool Equals(Hybrid<TLinkAddress> other) => _equalityComparer.Equals(Value,
291     ↪ other.Value);
292
293 /// <summary>
294 /// <para>
295 /// Determines whether this instance equals.
296 /// </para>
297 /// <para></para>
298 /// </summary>
299 /// <param name="obj">
300 /// <para>The obj.</para>
301 /// <para></para>
302 /// </param>
303 /// <returns>
304 /// <para>The bool</para>
305 /// <para></para>
306 /// </returns>
307 [MethodImpl(MethodImplOptions.AggressiveInlining)]
308 public override bool Equals(object obj) => obj is Hybrid<TLinkAddress> hybrid ?
309     ↪ Equals(hybrid) : false;
310
311 /// <summary>
312 /// <para>
313 /// Gets the hash code.
314 /// </para>
315 /// <para></para>
316 /// </summary>
317 /// <returns>
318 /// <para>The int</para>
319 /// <para></para>
320 /// </returns>
321 [MethodImpl(MethodImplOptions.AggressiveInlining)]
322 public override int GetHashCode() => Value.GetHashCode();
323
324 [MethodImpl(MethodImplOptions.AggressiveInlining)]
325 public static bool operator ==(Hybrid<TLinkAddress> left, Hybrid<TLinkAddress> right) =>
326     ↪ left.Equals(right);

```

```

321     [MethodImpl(MethodImplOptions.AggressiveInlining)]
322     public static bool operator !=(Hybrid<TLinkAddress> left, Hybrid<TLinkAddress> right) =>
        ↪     !(left == right);
323 }
324 }

```

## 1.7 ./csharp/Platform.Data/ILinks.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
8  {
9      /// <summary>
10     /// <para>Represents an interface for manipulating data in the Links (links storage)
11     ↪     format.</para>
12     /// <para>Представляет интерфейс для манипуляции с данными в формате Links (хранилища
13     ↪     связей).</para>
14     /// </summary>
15     /// <remarks>
16     /// <para>This interface is independent of the size of the content of the link, meaning it
17     ↪     is suitable for both doublets, triplets, and link sequences of any size.</para>
18     /// <para>Этот интерфейс не зависит от размера содержимого связи, а значит подходит как для
19     ↪     дуплетов, триплетов и последовательностей связей любого размера.</para>
20     /// </remarks>
21     public interface ILinks<TLinkAddress, TConstants>
22     where TConstants : LinksConstants<TLinkAddress>
23     {
24         #region Constants
25
26         /// <summary>
27         /// <para>Returns the set of constants that is necessary for effective communication
28         ↪     with the methods of this interface.</para>
29         /// <para>Возвращает набор констант, который необходим для эффективной коммуникации с
30         ↪     методами этого интерфейса.</para>
31         /// </summary>
32         /// <remarks>
33         /// <para>These constants are not changed since the creation of the links storage access
34         ↪     point.</para>
35         /// <para>Эти константы не меняются с момента создания точки доступа к хранилищу
36         ↪     связей.</para>
37         /// </remarks>
38         TConstants Constants
39         {
40             [MethodImpl(MethodImplOptions.AggressiveInlining)]
41             get;
42         }
43
44         #endregion
45
46         #region Read
47
48         /// <summary>
49         /// <para>Counts and returns the total number of links in the storage that meet the
50         ↪     specified restriction.</para>
51         /// <para>Подсчитывает и возвращает общее число связей находящихся в хранилище,
52         ↪     соответствующих указанному ограничению.</para>
53         /// </summary>
54         /// <param name="restriction"><para>Restriction on the contents of
55         ↪     links.</para><para>Ограничение на содержимое связей.</para></param>
56         /// <returns><para>The total number of links in the storage that meet the specified
57         ↪     restriction.</para><para>Общее число связей находящихся в хранилище, соответствующих
58         ↪     указанному ограничению.</para></returns>
59         [MethodImpl(MethodImplOptions.AggressiveInlining)]
60         TLinkAddress Count(IList<TLinkAddress> restriction);
61
62         /// <summary>
63         /// <para>Passes through all the links matching the pattern, invoking a handler for each
64         ↪     matching link.</para>
65         /// <para>Выполняет проход по всем связям, соответствующим шаблону, вызывая обработчик
66         ↪     (handler) для каждой подходящей связи.</para>
67         /// </summary>
68         /// <param name="restriction">
69         /// <para>Restriction on the contents of links. Each constraint can have values:
70         ↪     Constants.Null - the 0th link denoting a reference to the void, Any - the absence of
71         ↪     a constraint, 1..∞ a specific link index.</para>

```

```

55  /// <para>Ограничение на содержимое связей. Каждое ограничение может иметь значения:
    → Constants.Null - 0-я связь, обозначающая ссылку на пустоту, Any - отсутствие
    → ограничения, 1.. $\infty$  конкретный индекс связи.</para>
56  /// </param>
57  /// <param name="handler"><para>A handler for each matching link.</para><para>Обработчик
    → для каждой подходящей связи.</para></param>
58  /// <returns><para>Constants.Continue, if the pass through the links was not
    → interrupted, and Constants.Break otherwise.</para><para>Constants.Continue, в случае
    → если проход по связям не был прерван и Constants.Break в обратном
    → случае.</para></returns>
59  [MethodImpl(MethodImplOptions.AggressiveInlining)]
60  TLinkAddress Each(IList<TLinkAddress> restriction, ReadHandler<TLinkAddress> handler);
61
62  #endregion
63
64  #region Write
65
66  /// <summary>
67  /// <para>Creates a link.</para>
68  /// <para>Создаёт связь.</para>
69  /// <param name="substitution">
70  /// <para>The content of a new link. This argument is optional, if the null passed as
    → value that means no content of a link is set.</para>
71  /// <para>Содержимое новой связи. Этот аргумент опционален, если null передан в качестве
    → значения это означает, что никакого содержимого для связи не установлено.</para>
72  /// </param>
73  /// <param name="handler">
74  /// <para>A function to handle each executed change. This function can use
    → Constants.Continue to continue process each change. Constants.Break can be used to
    → stop receiving of executed changes.</para>
75  /// <para>Функция для обработки каждого выполненного изменения. Эта функция может
    → использовать Constants.Continue чтобы продолжить обрабатывать каждое изменение.
    → Constants.Break может быть использована для остановки получения выполненных
    → изменений.</para>
76  /// </param>
77  /// </summary>
78  /// <returns>
79  /// <para>
80  /// Constants.Continue if all executed changes are handled.
81  /// Constants.Break if proccessing of handled changes is stoped.
82  /// </para>
83  /// <para>
84  /// Constants.Continue если все выполненные изменения обработаны.
85  /// Constants.Break если обработка выполненных изменений остановлена.
86  /// </para>
87  /// </returns>
88  [MethodImpl(MethodImplOptions.AggressiveInlining)]
89  TLinkAddress Create(IList<TLinkAddress> substitution, WriteHandler<TLinkAddress>
    → handler);
90
91  /// <summary>
92  /// Обновляет связь с указанными restriction[Constants.IndexPart] в адресом связи
93  /// на связь с указанным новым содержимым.
94  /// </summary>
95  /// <param name="restriction">
96  /// Ограничение на содержимое связей.
97  /// Предполагается, что будет указан индекс связи (в restriction[Constants.IndexPart]) и
    → далее за ним будет следовать содержимое связи.
98  /// Каждое ограничение может иметь значения: Constants.Null - 0-я связь, обозначающая
    → ссылку на пустоту,
99  /// Constants.Itself - требование установить ссылку на себя, 1.. $\infty$  конкретный индекс
    → другой связи.
100  /// </param>
101  /// <param name="substitution"></param>
102  /// <param name="handler">
103  /// <para>A function to handle each executed change. This function can use
    → Constants.Continue to continue process each change. Constants.Break can be used to
    → stop receiving of executed changes.</para>
104  /// <para>Функция для обработки каждого выполненного изменения. Эта функция может
    → использовать Constants.Continue чтобы продолжить обрабатывать каждое изменение.
    → Constants.Break может быть использована для остановки получения выполненных
    → изменений.</para>
105  /// </param>
106  /// <returns>
107  /// <para>
108  /// Constants.Continue if all executed changes are handled.
109  /// Constants.Break if proccessing of handled changes is stoped.
110  /// </para>

```

```

111     /// <para>
112     /// Constants.Continue если все выполненные изменения обработаны.
113     /// Constants.Break если обработка выполненных изменений остановлена.
114     /// </para>
115     /// </returns>
116     [MethodImpl(MethodImplOptions.AggressiveInlining)]
117     TLinkAddress Update(IList<TLinkAddress> restriction, IList<TLinkAddress> substitution,
118         → WriteHandler<TLinkAddress> handler);
119
120     /// <summary>
121     /// <para>Deletes links that match the specified restriction.</para>
122     /// <para>Удаляет связи соответствующие указанному ограничению.</para>
123     /// </summary>
124     /// <param name="restriction">
125     /// <para>Restriction on the content of a link. This argument is optional, if the null
126     → passed as value that means no restriction on the content of a link are set.</para>
127     /// <para>Ограничение на содержимое связи. Этот аргумент опционален, если null передан в
128     → качестве значения это означает, что никаких ограничений на содержимое связи не
129     → установлено.</para>
130     /// </param>
131     /// <param name="handler">
132     /// <para>A function to handle each executed change. This function can use
133     → Constants.Continue to continue process each change. Constants.Break can be used to
134     → stop receiving of executed changes.</para>
135     /// <para>Функция для обработки каждого выполненного изменения. Эта функция может
136     → использовать Constants.Continue чтобы продолжить обрабатывать каждое изменение.
137     → Constants.Break может быть использована для остановки получения выполненных
138     → изменений.</para>
139     /// </param>
140     /// </returns>
141     [MethodImpl(MethodImplOptions.AggressiveInlining)]
142     TLinkAddress Delete(IList<TLinkAddress> restriction, WriteHandler<TLinkAddress> handler);
143
144     #endregion
145 }
146 }

```

## 1.8 ./csharp/Platform.Data/ILinksExtensions.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4  using Platform.Setters;
5  using Platform.Data.Exceptions;
6
7  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
8
9  namespace Platform.Data
10 {
11     /// <summary>
12     /// <para>
13     /// Represents the links extensions.
14     /// </para>
15     /// <para></para>
16     /// </summary>
17     public static class ILinksExtensions
18     {
19         public static TLink Create<TLink>(this ILinks<TLink, LinksConstants<TLink>> links) =>
20             → links.Create(null);
21
22         public static TLink Create<TLink>(this ILinks<TLink, LinksConstants<TLink>> links,
23             → IList<TLink> substitution)
24         {
25             var constants = links.Constants;
26             var result = constants.Null;
27             links.Create(substitution, (_, after) =>
28             {
29                 result = after[constants.IndexPart];
30                 return constants.Continue;
31             });
32             return result;
33         }
34     }
35 }

```

```

31 }
32
33 public static TLink Update<TLink>(this ILinks<TLink, LinksConstants<TLink>> links,
    ↳ IList<TLink> restriction, IList<TLink> substitution)
34 {
35     var constants = links.Constants;
36     var result = constants.Null;
37     links.Update(restriction, substitution, (_, after) =>
38     {
39         result = after[constants.IndexPart];
40         return constants.Continue;
41     });
42     return result;
43 }
44
45 public static TLink Delete<TLink>(this ILinks<TLink, LinksConstants<TLink>> links, TLink
    ↳ linkToDelete) => Delete(links, (IList<TLink>)new LinkAddress<TLink>(linkToDelete));
46
47 public static TLink Delete<TLink>(this ILinks<TLink, LinksConstants<TLink>> links,
    ↳ IList<TLink> restriction)
48 {
49     var constants = links.Constants;
50     var result = constants.Null;
51     links.Delete(restriction, (before, _) =>
52     {
53         result = before[constants.IndexPart];
54         return constants.Continue;
55     });
56     return result;
57 }
58
59 /// <summary>
60 /// <para>
61 /// Counts the links.
62 /// </para>
63 /// <para></para>
64 /// </summary>
65 /// <typeparam name="TLinkAddress">
66 /// <para>The link address.</para>
67 /// <para></para>
68 /// </typeparam>
69 /// <typeparam name="TConstants">
70 /// <para>The constants.</para>
71 /// <para></para>
72 /// </typeparam>
73 /// <param name="links">
74 /// <para>The links.</para>
75 /// <para></para>
76 /// </param>
77 /// <param name="restrictions">
78 /// <para>The restrictions.</para>
79 /// <para></para>
80 /// </param>
81 /// <returns>
82 /// <para>The link address</para>
83 /// <para></para>
84 /// </returns>
85 [MethodImpl(MethodImplOptions.AggressiveInlining)]
86 public static TLinkAddress Count<TLinkAddress, TConstants>(this ILinks<TLinkAddress,
    ↳ TConstants> links, params TLinkAddress[] restrictions)
87     where TConstants : LinksConstants<TLinkAddress>
88     => links.Count(restrictions);
89
90 /// <summary>
91 /// Возвращает значение, определяющее существует ли связь с указанным индексом в
    ↳ хранилище связей.
92 /// </summary>
93 /// <param name="links">Хранилище связей.</param>
94 /// <param name="link">Индекс проверяемой на существование связи.</param>
95 /// <returns>Значение, определяющее существует ли связь.</returns>
96 [MethodImpl(MethodImplOptions.AggressiveInlining)]
97 public static bool Exists<TLinkAddress, TConstants>(this ILinks<TLinkAddress,
    ↳ TConstants> links, TLinkAddress link)
98     where TConstants : LinksConstants<TLinkAddress>
99 {
100     var constants = links.Constants;
101     return constants.IsExternalReference(link) || (constants.IsInternalReference(link)
        ↳ && Comparer<TLinkAddress>.Default.Compare(links.Count(new
            ↳ LinkAddress<TLinkAddress>(link)), default) > 0);

```

```

102 }
103
104 /// <param name="links">Хранилище связей.</param>
105 /// <param name="link">Индекс проверяемой на существование связи.</param>
106 /// <remarks>
107 /// TODO: May be move to EnsureExtensions or make it both there and here
108 /// </remarks>
109 [MethodImpl(MethodImplOptions.AggressiveInlining)]
110 public static void EnsureLinkExists<TLinkAddress, TConstants>(this ILinks<TLinkAddress,
    ↳ TConstants> links, TLinkAddress link)
111     where TConstants : LinksConstants<TLinkAddress>
112 {
113     if (!links.Exists(link))
114     {
115         throw new ArgumentLinkDoesNotExistsException<TLinkAddress>(link);
116     }
117 }
118
119 /// <param name="links">Хранилище связей.</param>
120 /// <param name="link">Индекс проверяемой на существование связи.</param>
121 /// <param name="argumentName">Имя аргумента, в который передаётся индекс связи.</param>
122 [MethodImpl(MethodImplOptions.AggressiveInlining)]
123 public static void EnsureLinkExists<TLinkAddress, TConstants>(this ILinks<TLinkAddress,
    ↳ TConstants> links, TLinkAddress link, string argumentName)
124     where TConstants : LinksConstants<TLinkAddress>
125 {
126     if (!links.Exists(link))
127     {
128         throw new ArgumentLinkDoesNotExistsException<TLinkAddress>(link, argumentName);
129     }
130 }
131
132 /// <summary>
133 /// Выполняет проход по всем связям, соответствующим шаблону, вызывая обработчик
134 ↳ (handler) для каждой подходящей связи.
135 /// </summary>
136 /// <param name="links">Хранилище связей.</param>
137 /// <param name="handler">Обработчик каждой подходящей связи.</param>
138 /// <param name="restrictions">Ограничения на содержимое связей. Каждое ограничение
139 ↳ может иметь значения: Constants.Null - 0-я связь, обозначающая ссылку на пустоту,
140 ↳ Any - отсутствие ограничения, 1..∞ конкретный индекс связи.</param>
141 /// <returns>True, в случае если проход по связям не был прерван и False в обратном
142 ↳ случае.</returns>
143 [MethodImpl(MethodImplOptions.AggressiveInlining)]
144 public static TLinkAddress Each<TLinkAddress, TConstants>(this ILinks<TLinkAddress,
    ↳ TConstants> links, ReadHandler<TLinkAddress> handler, params TLinkAddress[]
    ↳ restrictions)
145     where TConstants : LinksConstants<TLinkAddress>
146     => links.Each(handler, restrictions);
147
148 /// <summary>
149 /// Возвращает части-значения для связи с указанным индексом.
150 /// </summary>
151 /// <param name="links">Хранилище связей.</param>
152 /// <param name="link">Индекс связи.</param>
153 /// <returns>Уникальную связь.</returns>
154 [MethodImpl(MethodImplOptions.AggressiveInlining)]
155 public static IList<TLinkAddress> GetLink<TLinkAddress, TConstants>(this
    ↳ ILinks<TLinkAddress, TConstants> links, TLinkAddress link)
156     where TConstants : LinksConstants<TLinkAddress>
157 {
158     var constants = links.Constants;
159     if (constants.IsExternalReference(link))
160     {
161         return new Point<TLinkAddress>(link, constants.TargetPart + 1);
162     }
163     var linkPartsSetter = new Setter<IList<TLinkAddress>,
    ↳ TLinkAddress>(constants.Continue, constants.Break);
164     links.Each(linkPartsSetter.SetAndReturnTrue, link);
165     return linkPartsSetter.Result;
166 }
167
168 #region Points
169
170 /// <summary>Возвращает значение, определяющее является ли связь с указанным индексом
171 ↳ точкой полностью (связью замкнутой на себе дважды).</summary>
172 /// <param name="links">Хранилище связей.</param>
173 /// <param name="link">Индекс проверяемой связи.</param>

```

```

169    /// <returns>Значение, определяющее является ли связь точкой полностью.</returns>
170    /// <remarks>
171    /// Связь точка - это связь, у которой начало (Source) и конец (Target) есть сама эта
    → связь.
172    /// Но что, если точка уже есть, а нужно создать пару с таким же значением? Должны ли
    → точка и пара существовать одновременно?
173    /// Или в качестве решения для точек нужно использовать 0 в качестве начала и конца, а
    → сортировать по индексу в массиве связей?
174    /// Какое тогда будет значение Source и Target у точки? 0 или её индекс?
175    /// Или точка должна быть одновременно точкой и парой, а также последовательностями из
    → самой себя любого размера?
176    /// Как только есть ссылка на себя, появляется этот парадокс, причём достаточно даже
    → одной ссылки на себя (частичной точки).
177    /// А что если не выбирать что является точкой, пара нулей (цикл через пустоту) или
178    /// самостоятельный цикл через себя? Что если предоставить все варианты использования
    → связей?
179    /// Что если разрешить и нули, а так же частичные варианты?
180    ///
181    /// Что если точка, это только в том случае когда link.Source == link &&
    → link.Target == link , т.е. дважды ссылка на себя.
182    /// А пара это тогда, когда link.Source == link.Target && link.Source != link ,
    → т.е. ссылка не на себя а во вне.
183    ///
184    /// Тогда если у нас уже создана пара, но нам нужна точка, мы можем используя
    → промежуточную связь,
185    /// например "DoubletOf" обозначить что является точно парой, а что точно точкой.
186    /// И наоборот этот же метод поможет, если уже существует точка, но нам нужна пара.
187    /// </remarks>
188    [MethodImpl(MethodImplOptions.AggressiveInlining)]
189    public static bool IsFullPoint<TLinkAddress, TConstants>(this ILinks<TLinkAddress,
    → TConstants> links, TLinkAddress link)
    where TConstants : LinksConstants<TLinkAddress>
190    {
191        if (links.Constants.IsExternalReference(link))
192        {
193            return true;
194        }
195        links.EnsureLinkExists(link);
196        return Point<TLinkAddress>.IsFullPoint(links.GetLink(link));
197    }
198
199    /// <summary>Возвращает значение, определяющее является ли связь с указанным индексом
    → точкой частично (связью замкнутой на себе как минимум один раз).</summary>
200    /// <param name="links">Хранилище связей.</param>
201    /// <param name="link">Индекс проверяемой связи.</param>
202    /// <returns>Значение, определяющее является ли связь точкой частично.</returns>
203    /// <remarks>
204    /// Достаточно любой одной ссылки на себя.
205    /// Также в будущем можно будет проверять и всех родителей, чтобы проверить есть ли
    → ссылки на себя (на эту связь).
206    /// </remarks>
207    [MethodImpl(MethodImplOptions.AggressiveInlining)]
208    public static bool IsPartialPoint<TLinkAddress, TConstants>(this ILinks<TLinkAddress,
    → TConstants> links, TLinkAddress link)
    where TConstants : LinksConstants<TLinkAddress>
209    {
210        if (links.Constants.IsExternalReference(link))
211        {
212            return true;
213        }
214        links.EnsureLinkExists(link);
215        return Point<TLinkAddress>.IsPartialPoint(links.GetLink(link));
216    }
217
218    #endregion
219
220 }
221
222 }

```

## 1.9 ./csharp/Platform.Data/ISynchronizedLinks.cs

```

1  using Platform.Threading.Synchronization;
2
3  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5  namespace Platform.Data
6  {
7      /// <summary>
8      /// <para>
9      /// Defines the synchronized links.

```



```

10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="ISynchronized{TLinks}"/>
14     /// <seealso cref="ILinks{TLinkAddress, TConstants}"/>
15     public interface ISynchronizedLinks<TLinkAddress, TLinks, TConstants> :
16         ↳ ISynchronized<TLinks>, ILinks<TLinkAddress, TConstants>
17         where TLinks : ILinks<TLinkAddress, TConstants>
18         where TConstants : LinksConstants<TLinkAddress>
19     {
20     }

```

## 1.10 ./csharp/Platform.Data/LinkAddress.cs

```

1  using System;
2  using System.Collections;
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
9  {
10     /// <summary>
11     /// <para>
12     /// Represents the link address.
13     /// </para>
14     /// <para></para>
15     /// </summary>
16     /// <seealso cref="IEquatable{LinkAddress{TLinkAddress}}"/>
17     /// <seealso cref="IList{TLinkAddress}"/>
18     public class LinkAddress<TLinkAddress> : IEquatable<LinkAddress<TLinkAddress>>,
19         ↳ IList<TLinkAddress>
20     {
21         private static readonly EqualityComparer<TLinkAddress> _equalityComparer =
22             ↳ EqualityComparer<TLinkAddress>.Default;
23
24         /// <summary>
25         /// <para>
26         /// Gets the index value.
27         /// </para>
28         /// <para></para>
29         /// </summary>
30         public TLinkAddress Index
31         {
32             [MethodImpl(MethodImplOptions.AggressiveInlining)]
33             get;
34         }
35
36         /// <summary>
37         /// <para>
38         /// The not supported exception.
39         /// </para>
40         /// <para></para>
41         /// </summary>
42         public TLinkAddress this[int index]
43         {
44             [MethodImpl(MethodImplOptions.AggressiveInlining)]
45             get
46             {
47                 {
48                     if (index == 0)
49                     {
50                         return Index;
51                     }
52                     else
53                     {
54                         throw new IndexOutOfRangeException();
55                     }
56                 }
57             }
58             [MethodImpl(MethodImplOptions.AggressiveInlining)]
59             set => throw new NotSupportedException();
60         }
61
62         /// <summary>
63         /// <para>
64         /// Gets the count value.
65         /// </para>
66         /// <para></para>
67         /// </summary>

```

```

64 public int Count
65 {
66     [MethodImpl(MethodImplOptions.AggressiveInlining)]
67     get => 1;
68 }
69
70 /// <summary>
71 /// <para>
72 /// Gets the is read only value.
73 /// </para>
74 /// <para></para>
75 /// </summary>
76 public bool IsReadOnly
77 {
78     [MethodImpl(MethodImplOptions.AggressiveInlining)]
79     get => true;
80 }
81
82 /// <summary>
83 /// <para>
84 /// Initializes a new <see cref="LinkAddress{TLinkAddress}"/> instance.
85 /// </para>
86 /// <para></para>
87 /// </summary>
88 /// <param name="index">
89 /// <para>A index.</para>
90 /// <para></para>
91 /// </param>
92 [MethodImpl(MethodImplOptions.AggressiveInlining)]
93 public LinkAddress(TLinkAddress index) => Index = index;
94
95 /// <summary>
96 /// <para>
97 /// Adds the item.
98 /// </para>
99 /// <para></para>
100 /// </summary>
101 /// <param name="item">
102 /// <para>The item.</para>
103 /// <para></para>
104 /// </param>
105 [MethodImpl(MethodImplOptions.AggressiveInlining)]
106 public void Add(TLinkAddress item) => throw new NotSupportedException();
107
108 /// <summary>
109 /// <para>
110 /// Clears this instance.
111 /// </para>
112 /// <para></para>
113 /// </summary>
114 [MethodImpl(MethodImplOptions.AggressiveInlining)]
115 public void Clear() => throw new NotSupportedException();
116
117 /// <summary>
118 /// <para>
119 /// Determines whether this instance contains.
120 /// </para>
121 /// <para></para>
122 /// </summary>
123 /// <param name="item">
124 /// <para>The item.</para>
125 /// <para></para>
126 /// </param>
127 /// <returns>
128 /// <para>The bool</para>
129 /// <para></para>
130 /// </returns>
131 [MethodImpl(MethodImplOptions.AggressiveInlining)]
132 public virtual bool Contains(TLinkAddress item) => _equalityComparer.Equals(item, Index);
133
134 /// <summary>
135 /// <para>
136 /// Copies the to using the specified array.
137 /// </para>
138 /// <para></para>
139 /// </summary>
140 /// <param name="array">
141 /// <para>The array.</para>

```

```

142     /// <para></para>
143     /// </param>
144     /// <param name="arrayIndex">
145     /// <para>The array index.</para>
146     /// <para></para>
147     /// </param>
148     [MethodImpl(MethodImplOptions.AggressiveInlining)]
149     public void CopyTo(TLinkAddress[] array, int arrayIndex) => array[arrayIndex] = Index;
150
151     /// <summary>
152     /// <para>
153     /// Gets the enumerator.
154     /// </para>
155     /// <para></para>
156     /// </summary>
157     /// <returns>
158     /// <para>An enumerator of t link address</para>
159     /// <para></para>
160     /// </returns>
161     [MethodImpl(MethodImplOptions.AggressiveInlining)]
162     public IEnumerator<TLinkAddress> GetEnumerator()
163     {
164         yield return Index;
165     }
166
167     /// <summary>
168     /// <para>
169     /// Indexes the of using the specified item.
170     /// </para>
171     /// <para></para>
172     /// </summary>
173     /// <param name="item">
174     /// <para>The item.</para>
175     /// <para></para>
176     /// </param>
177     /// <returns>
178     /// <para>The int</para>
179     /// <para></para>
180     /// </returns>
181     [MethodImpl(MethodImplOptions.AggressiveInlining)]
182     public virtual int IndexOf(TLinkAddress item) => _equalityComparer.Equals(item, Index) ?
        ↪ 0 : -1;
183
184     /// <summary>
185     /// <para>
186     /// Inserts the index.
187     /// </para>
188     /// <para></para>
189     /// </summary>
190     /// <param name="index">
191     /// <para>The index.</para>
192     /// <para></para>
193     /// </param>
194     /// <param name="item">
195     /// <para>The item.</para>
196     /// <para></para>
197     /// </param>
198     [MethodImpl(MethodImplOptions.AggressiveInlining)]
199     public void Insert(int index, TLinkAddress item) => throw new NotSupportedException();
200
201     /// <summary>
202     /// <para>
203     /// Determines whether this instance remove.
204     /// </para>
205     /// <para></para>
206     /// </summary>
207     /// <param name="item">
208     /// <para>The item.</para>
209     /// <para></para>
210     /// </param>
211     /// <returns>
212     /// <para>The bool</para>
213     /// <para></para>
214     /// </returns>
215     [MethodImpl(MethodImplOptions.AggressiveInlining)]
216     public bool Remove(TLinkAddress item) => throw new NotSupportedException();
217
218     /// <summary>

```

```

219    /// <para>
220    /// Removes the at using the specified index.
221    /// </para>
222    /// <para></para>
223    /// </summary>
224    /// <param name="index">
225    /// <para>The index.</para>
226    /// <para></para>
227    /// </param>
228    [MethodImpl(MethodImplOptions.AggressiveInlining)]
229    public void RemoveAt(int index) => throw new NotSupportedException();
230
231    /// <summary>
232    /// <para>
233    /// Gets the enumerator.
234    /// </para>
235    /// <para></para>
236    /// </summary>
237    /// <returns>
238    /// <para>The enumerator</para>
239    /// <para></para>
240    /// </returns>
241    [MethodImpl(MethodImplOptions.AggressiveInlining)]
242    IEnumerator IEnumerable.GetEnumerator()
243    {
244        yield return Index;
245    }
246
247    /// <summary>
248    /// <para>
249    /// Determines whether this instance equals.
250    /// </para>
251    /// <para></para>
252    /// </summary>
253    /// <param name="other">
254    /// <para>The other.</para>
255    /// <para></para>
256    /// </param>
257    /// <returns>
258    /// <para>The bool</para>
259    /// <para></para>
260    /// </returns>
261    [MethodImpl(MethodImplOptions.AggressiveInlining)]
262    public virtual bool Equals(LinkAddress<TLinkAddress> other) => other != null &&
        ↪ _equalityComparer.Equals(Index, other.Index);
263
264    [MethodImpl(MethodImplOptions.AggressiveInlining)]
265    public static implicit operator TLinkAddress(LinkAddress<TLinkAddress> linkAddress) =>
        ↪ linkAddress.Index;
266
267    [MethodImpl(MethodImplOptions.AggressiveInlining)]
268    public static implicit operator LinkAddress<TLinkAddress>(TLinkAddress linkAddress) =>
        ↪ new LinkAddress<TLinkAddress>(linkAddress);
269
270    /// <summary>
271    /// <para>
272    /// Determines whether this instance equals.
273    /// </para>
274    /// <para></para>
275    /// </summary>
276    /// <param name="obj">
277    /// <para>The obj.</para>
278    /// <para></para>
279    /// </param>
280    /// <returns>
281    /// <para>The bool</para>
282    /// <para></para>
283    /// </returns>
284    [MethodImpl(MethodImplOptions.AggressiveInlining)]
285    public override bool Equals(object obj) => obj is LinkAddress<TLinkAddress> linkAddress
        ↪ ? Equals(linkAddress) : false;
286
287    /// <summary>
288    /// <para>
289    /// Gets the hash code.
290    /// </para>
291    /// <para></para>
292    /// </summary>

```

```

293     /// <returns>
294     /// <para>The int</para>
295     /// <para></para>
296     /// </returns>
297     [MethodImpl(MethodImplOptions.AggressiveInlining)]
298     public override int GetHashCode() => Index.GetHashCode();
299
300     /// <summary>
301     /// <para>
302     /// Returns the string.
303     /// </para>
304     /// <para></para>
305     /// </summary>
306     /// <returns>
307     /// <para>The string</para>
308     /// <para></para>
309     /// </returns>
310     [MethodImpl(MethodImplOptions.AggressiveInlining)]
311     public override string ToString() => Index.ToString();
312
313     [MethodImpl(MethodImplOptions.AggressiveInlining)]
314     public static bool operator ==(LinkAddress<TLinkAddress> left, LinkAddress<TLinkAddress>
        ↪ right)
315     {
316         if (left == null && right == null)
317         {
318             return true;
319         }
320         if (left == null)
321         {
322             return false;
323         }
324         return left.Equals(right);
325     }
326
327     [MethodImpl(MethodImplOptions.AggressiveInlining)]
328     public static bool operator !=(LinkAddress<TLinkAddress> left, LinkAddress<TLinkAddress>
        ↪ right) => !(left == right);
329 }
330 }

```

### 1.11 ./csharp/Platform.Data/LinksConstants.cs

```

1  using System.Runtime.CompilerServices;
2  using Platform.Ranges;
3  using Platform.Reflection;
4  using Platform.Converters;
5  using Platform.Numbers;
6
7  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
8
9  namespace Platform.Data
10 {
11     /// <summary>
12     /// <para>
13     /// Represents the links constants.
14     /// </para>
15     /// <para></para>
16     /// </summary>
17     /// <seealso cref="LinksConstantsBase"/>
18     public class LinksConstants<TLinkAddress> : LinksConstantsBase
19     {
20         private static readonly TLinkAddress _one = Arithmetic<TLinkAddress>.Increment(default);
21         private static readonly UncheckedConverter<ulong, TLinkAddress>
            ↪ _uInt64ToAddressConverter = UncheckedConverter<ulong, TLinkAddress>.Default;
22
23         #region Link parts
24
25         /// <summary>Возвращает индекс части, которая отвечает за индекс (адрес, идентификатор)
            ↪ самой связи.</summary>
26         public int IndexPart
27         {
28             [MethodImpl(MethodImplOptions.AggressiveInlining)]
29             get;
30         }
31
32         /// <summary>Возвращает индекс части, которая отвечает за ссылку на связь-начало (первая
            ↪ часть-значение).</summary>
33         public int SourcePart
34         {

```

```

35     [MethodImpl(MethodImplOptions.AggressiveInlining)]
36     get;
37 }
38
39 /// <summary>Возвращает индекс части, которая отвечает за ссылку на связь-конец
40 ↪ (последняя часть-значение).</summary>
41 public int TargetPart
42 {
43     [MethodImpl(MethodImplOptions.AggressiveInlining)]
44     get;
45 }
46 #endregion
47
48 #region Flow control
49
50 /// <summary>Возвращает значение, обозначающее продолжение прохода по связям.</summary>
51 /// <remarks>Используется в функции обработчике, который передаётся в функцию
52 ↪ Each.</remarks>
53 public TLinkAddress Continue
54 {
55     [MethodImpl(MethodImplOptions.AggressiveInlining)]
56     get;
57 }
58
59 /// <summary>Возвращает значение, обозначающее пропуск в проходе по связям.</summary>
60 public TLinkAddress Skip
61 {
62     [MethodImpl(MethodImplOptions.AggressiveInlining)]
63     get;
64 }
65
66 /// <summary>Возвращает значение, обозначающее остановку прохода по связям.</summary>
67 /// <remarks>Используется в функции обработчике, который передаётся в функцию
68 ↪ Each.</remarks>
69 public TLinkAddress Break
70 {
71     [MethodImpl(MethodImplOptions.AggressiveInlining)]
72     get;
73 }
74 #endregion
75
76 #region Special symbols
77
78 /// <summary>Возвращает значение, обозначающее отсутствие связи.</summary>
79 public TLinkAddress Null
80 {
81     [MethodImpl(MethodImplOptions.AggressiveInlining)]
82     get;
83 }
84
85 /// <summary>Возвращает значение, обозначающее любую связь.</summary>
86 /// <remarks>Возможно нужно зарезервировать отдельное значение, тогда можно будет
87 ↪ создавать все варианты последовательностей в функции Create.</remarks>
88 public TLinkAddress Any
89 {
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     get;
92 }
93
94 /// <summary>Возвращает значение, обозначающее связь-ссылку на саму связь.</summary>
95 public TLinkAddress Itself
96 {
97     [MethodImpl(MethodImplOptions.AggressiveInlining)]
98     get;
99 }
100 #endregion
101
102 #region References
103
104 /// <summary>Возвращает диапазон возможных индексов для внутренних связей (внутренних
105 ↪ ссылок).</summary>
106 public Range<TLinkAddress> InternalReferencesRange
107 {
108     [MethodImpl(MethodImplOptions.AggressiveInlining)]
109     get;
110 }

```

```

110 /// <summary>Возвращает диапазон возможных индексов для внешних связей (внешних
111   ↳ ссылок).</summary>
112 public Range<TLinkAddress>? ExternalReferencesRange
113 {
114     [MethodImpl(MethodImplOptions.AggressiveInlining)]
115     get;
116 }
117 #endregion
118
119 /// <summary>
120 /// <para>
121 /// Initializes a new <see cref="LinksConstants{TLinkAddress}"/> instance.
122 /// </para>
123 /// <para></para>
124 /// </summary>
125 /// <param name="targetPart">
126 /// <para>A target part.</para>
127 /// <para></para>
128 /// </param>
129 /// <param name="possibleInternalReferencesRange">
130 /// <para>A possible internal references range.</para>
131 /// <para></para>
132 /// </param>
133 /// <param name="possibleExternalReferencesRange">
134 /// <para>A possible external references range.</para>
135 /// <para></para>
136 /// </param>
137 [MethodImpl(MethodImplOptions.AggressiveInlining)]
138 public LinksConstants(int targetPart, Range<TLinkAddress>
139   ↳ possibleInternalReferencesRange, Range<TLinkAddress>?
140   ↳ possibleExternalReferencesRange)
141 {
142     IndexPart = 0;
143     SourcePart = 1;
144     TargetPart = targetPart;
145     Null = default;
146     Break = default;
147     var currentInternalReferenceIndex = possibleInternalReferencesRange.Maximum;
148     Continue = currentInternalReferenceIndex;
149     Skip = Arithmetic.Decrement(ref currentInternalReferenceIndex);
150     Any = Arithmetic.Decrement(ref currentInternalReferenceIndex);
151     Itself = Arithmetic.Decrement(ref currentInternalReferenceIndex);
152     Arithmetic.Decrement(ref currentInternalReferenceIndex);
153     InternalReferencesRange = (possibleInternalReferencesRange.Minimum,
154   ↳ currentInternalReferenceIndex);
155     ExternalReferencesRange = possibleExternalReferencesRange;
156 }
157
158 /// <summary>
159 /// <para>
160 /// Initializes a new <see cref="LinksConstants{TLinkAddress}"/> instance.
161 /// </para>
162 /// <para></para>
163 /// </summary>
164 /// <param name="targetPart">
165 /// <para>A target part.</para>
166 /// <para></para>
167 /// </param>
168 /// <param name="enableExternalReferencesSupport">
169 /// <para>A enable external references support.</para>
170 /// <para></para>
171 /// </param>
172 [MethodImpl(MethodImplOptions.AggressiveInlining)]
173 public LinksConstants(int targetPart, bool enableExternalReferencesSupport) :
174   ↳ this(targetPart, GetDefaultInternalReferencesRange(enableExternalReferencesSupport),
175   ↳ GetDefaultExternalReferencesRange(enableExternalReferencesSupport)) { }
176
177 /// <summary>
178 /// <para>
179 /// Initializes a new <see cref="LinksConstants{TLinkAddress}"/> instance.
180 /// </para>
181 /// <para></para>
182 /// </summary>
183 /// <param name="possibleInternalReferencesRange">
184 /// <para>A possible internal references range.</para>
185 /// <para></para>
186 /// </param>

```

```

182 /// <param name="possibleExternalReferencesRange">
183 /// <para>A possible external references range.</para>
184 /// </para></param>
185 /// </param>
186 [MethodImpl(MethodImplOptions.AggressiveInlining)]
187 public LinksConstants(Range<TLinkAddress> possibleInternalReferencesRange,
    ↳ Range<TLinkAddress>? possibleExternalReferencesRange) : this(DefaultTargetPart,
    ↳ possibleInternalReferencesRange, possibleExternalReferencesRange) { }

188
189 /// <summary>
190 /// <para>
191 /// Initializes a new <see cref="LinksConstants{TLinkAddress}"/> instance.
192 /// </para>
193 /// </para></summary>
194 /// </summary>
195 /// <param name="enableExternalReferencesSupport">
196 /// <para>A enable external references support.</para>
197 /// </para></param>
198 /// </param>
199 [MethodImpl(MethodImplOptions.AggressiveInlining)]
200 public LinksConstants(bool enableExternalReferencesSupport) :
    ↳ this(GetDefaultInternalReferencesRange(enableExternalReferencesSupport),
    ↳ GetDefaultExternalReferencesRange(enableExternalReferencesSupport)) { }

201
202 /// <summary>
203 /// <para>
204 /// Initializes a new <see cref="LinksConstants{TLinkAddress}"/> instance.
205 /// </para>
206 /// </para></summary>
207 /// </summary>
208 /// <param name="targetPart">
209 /// <para>A target part.</para>
210 /// </para></param>
211 /// </param>
212 /// <param name="possibleInternalReferencesRange">
213 /// <para>A possible internal references range.</para>
214 /// </para></param>
215 /// </param>
216 [MethodImpl(MethodImplOptions.AggressiveInlining)]
217 public LinksConstants(int targetPart, Range<TLinkAddress>
    ↳ possibleInternalReferencesRange) : this(targetPart, possibleInternalReferencesRange,
    ↳ null) { }

218
219 /// <summary>
220 /// <para>
221 /// Initializes a new <see cref="LinksConstants{TLinkAddress}"/> instance.
222 /// </para>
223 /// </para></summary>
224 /// </summary>
225 /// <param name="possibleInternalReferencesRange">
226 /// <para>A possible internal references range.</para>
227 /// </para></param>
228 /// </param>
229 [MethodImpl(MethodImplOptions.AggressiveInlining)]
230 public LinksConstants(Range<TLinkAddress> possibleInternalReferencesRange) :
    ↳ this(DefaultTargetPart, possibleInternalReferencesRange, null) { }

231
232 /// <summary>
233 /// <para>
234 /// Initializes a new <see cref="LinksConstants{TLinkAddress}"/> instance.
235 /// </para>
236 /// </para></summary>
237 /// </summary>
238 [MethodImpl(MethodImplOptions.AggressiveInlining)]
239 public LinksConstants() : this(DefaultTargetPart, enableExternalReferencesSupport:
    ↳ false) { }

240
241 /// <summary>
242 /// <para>
243 /// Gets the default internal references range using the specified enable external
    ↳ references support.
244 /// </para>
245 /// </para></summary>
246 /// </summary>
247 /// <param name="enableExternalReferencesSupport">
248 /// <para>The enable external references support.</para>
249 /// </para></param>

```



```

250     /// </param>
251     /// <returns>
252     /// <para>A range of t link address</para>
253     /// <para></para>
254     /// </returns>
255     [MethodImpl(MethodImplOptions.AggressiveInlining)]
256     public static Range<TLinkAddress> GetDefaultInternalReferencesRange(bool
    ↪ enableExternalReferencesSupport)
257     {
258         if (enableExternalReferencesSupport)
259         {
260             return (_one, _uInt64ToAddressConverter.Convert(Hybrid<TLinkAddress>.HalfOfNumbe
    ↪ rValuesRange));
261         }
262         else
263         {
264             return (_one, NumericType<TLinkAddress>.MaxValue);
265         }
266     }
267
268     /// <summary>
269     /// <para>
270     /// Gets the default external references range using the specified enable external
    ↪ references support.
271     /// </para>
272     /// <para></para>
273     /// </summary>
274     /// <param name="enableExternalReferencesSupport">
275     /// <para>The enable external references support.</para>
276     /// <para></para>
277     /// </param>
278     /// <returns>
279     /// <para>A range of t link address</para>
280     /// <para></para>
281     /// </returns>
282     [MethodImpl(MethodImplOptions.AggressiveInlining)]
283     public static Range<TLinkAddress>? GetDefaultExternalReferencesRange(bool
    ↪ enableExternalReferencesSupport)
284     {
285         if (enableExternalReferencesSupport)
286         {
287             return (Hybrid<TLinkAddress>.ExternalZero, NumericType<TLinkAddress>.MaxValue);
288         }
289         else
290         {
291             return null;
292         }
293     }
294 }
295 }

```

## 1.12 ./csharp/Platform.Data/LinksConstantsBase.cs

```

1  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
2
3  namespace Platform.Data
4  {
5      /// <summary>
6      /// <para>
7      /// Represents the links constants base.
8      /// </para>
9      /// <para></para>
10     /// </summary>
11     public abstract class LinksConstantsBase
12     {
13         /// <summary>
14         /// <para>
15         /// The default target part.
16         /// </para>
17         /// <para></para>
18         /// </summary>
19         public static readonly int DefaultTargetPart = 2;
20     }
21 }

```

## 1.13 ./csharp/Platform.Data/LinksConstantsExtensions.cs

```

1  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
2
3  using System.Runtime.CompilerServices;

```

```

4
5 namespace Platform.Data
6 {
7     /// <summary>
8     /// <para>
9     /// Represents the links constants extensions.
10    /// </para>
11    /// <para></para>
12    /// </summary>
13    public static class LinksConstantsExtensions
14    {
15        /// <summary>
16        /// <para>
17        /// Determines whether is reference.
18        /// </para>
19        /// <para></para>
20        /// </summary>
21        /// <typeparam name="TLinkAddress">
22        /// <para>The link address.</para>
23        /// <para></para>
24        /// </typeparam>
25        /// <param name="linksConstants">
26        /// <para>The links constants.</para>
27        /// <para></para>
28        /// </param>
29        /// <param name="address">
30        /// <para>The address.</para>
31        /// <para></para>
32        /// </param>
33        /// <returns>
34        /// <para>The bool</para>
35        /// <para></para>
36        /// </returns>
37        [MethodImpl(MethodImplOptions.AggressiveInlining)]
38        public static bool IsReference<TLinkAddress>(this LinksConstants<TLinkAddress>
39            ↪ linksConstants, TLinkAddress address) => linksConstants.IsInternalReference(address)
40            ↪ || linksConstants.IsExternalReference(address);
41
42        /// <summary>
43        /// <para>
44        /// Determines whether is internal reference.
45        /// </para>
46        /// <para></para>
47        /// </summary>
48        /// <typeparam name="TLinkAddress">
49        /// <para>The link address.</para>
50        /// <para></para>
51        /// </typeparam>
52        /// <param name="linksConstants">
53        /// <para>The links constants.</para>
54        /// <para></para>
55        /// </param>
56        /// <param name="address">
57        /// <para>The address.</para>
58        /// <para></para>
59        /// </param>
60        /// <returns>
61        /// <para>The bool</para>
62        /// <para></para>
63        /// </returns>
64        [MethodImpl(MethodImplOptions.AggressiveInlining)]
65        public static bool IsInternalReference<TLinkAddress>(this LinksConstants<TLinkAddress>
66            ↪ linksConstants, TLinkAddress address) =>
67            ↪ linksConstants.InternalReferencesRange.Contains(address);
68
69        /// <summary>
70        /// <para>
71        /// Determines whether is external reference.
72        /// </para>
73        /// <para></para>
74        /// </summary>
75        /// <typeparam name="TLinkAddress">
76        /// <para>The link address.</para>
77        /// <para></para>
78        /// </typeparam>
79        /// <param name="linksConstants">
80        /// <para>The links constants.</para>
81        /// <para></para>
82        /// </param>
83        /// <param name="address">
84        /// <para>The address.</para>
85        /// <para></para>
86        /// </param>
87        /// <returns>
88        /// <para>The bool</para>
89        /// <para></para>
90        /// </returns>
91        [MethodImpl(MethodImplOptions.AggressiveInlining)]
92        public static bool IsExternalReference<TLinkAddress>(this LinksConstants<TLinkAddress>
93            ↪ linksConstants, TLinkAddress address) =>
94            ↪ !linksConstants.IsInternalReference(address);
95    }
96 }

```

```

78     /// </param>
79     /// <param name="address">
80     /// <para>The address.</para>
81     /// <para></para>
82     /// </param>
83     /// <returns>
84     /// <para>The bool</para>
85     /// <para></para>
86     /// </returns>
87     [MethodImpl(MethodImplOptions.AggressiveInlining)]
88     public static bool IsExternalReference<TLinkAddress>(this LinksConstants<TLinkAddress>
        ↪ linksConstants, TLinkAddress address) =>
        ↪ linksConstants.ExternalReferencesRange?.Contains(address) ?? false;
89 }
90 }

```

#### 1.14 ./csharp/Platform.Data/Numbers/Raw/AddressToRawNumberConverter.cs

```

1  using System.Runtime.CompilerServices;
2  using Platform.Converters;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Numbers.Raw
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the address to raw number converter.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="IConverter{TLink}" />
15     public class AddressToRawNumberConverter<TLink> : IConverter<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// Converts the source.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="source">
24         /// <para>The source.</para>
25         /// <para></para>
26         /// </param>
27         /// <returns>
28         /// <para>The link</para>
29         /// <para></para>
30         /// </returns>
31         [MethodImpl(MethodImplOptions.AggressiveInlining)]
32         public TLink Convert(TLink source) => new Hybrid<TLink>(source, isExternal: true);
33     }
34 }

```

#### 1.15 ./csharp/Platform.Data/Numbers/Raw/RawNumberToAddressConverter.cs

```

1  using System.Runtime.CompilerServices;
2  using Platform.Converters;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Data.Numbers.Raw
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the raw number to address converter.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="IConverter{TLink}" />
15     public class RawNumberToAddressConverter<TLink> : IConverter<TLink>
16     {
17         /// <summary>
18         /// <para>
19         /// The default.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         static private readonly UncheckedConverter<long, TLink> _converter =
            ↪ UncheckedConverter<long, TLink>.Default;
24

```

```

25     /// <summary>
26     /// <para>
27     /// Converts the source.
28     /// </para>
29     /// <para></para>
30     /// </summary>
31     /// <param name="source">
32     /// <para>The source.</para>
33     /// <para></para>
34     /// </param>
35     /// <returns>
36     /// <para>The link</para>
37     /// <para></para>
38     /// </returns>
39     [MethodImpl(MethodImplOptions.AggressiveInlining)]
40     public TLink Convert(TLink source) => _converter.Convert(new
41         ↪ Hybrid<TLink>(source).AbsoluteValue);
42 }

```

## 1.16 ./csharp/Platform.Data/Point.cs

```

1  using System;
2  using System.Collections;
3  using System.Collections.Generic;
4  using System.Runtime.CompilerServices;
5  using Platform.Exceptions;
6  using Platform.Ranges;
7  using Platform.Collections;
8
9  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
10
11 namespace Platform.Data
12 {
13     /// <summary>
14     /// <para>
15     /// Represents the point.
16     /// </para>
17     /// <para></para>
18     /// </summary>
19     /// <seealso cref="IEquatable{LinkAddress{TLinkAddress}}"/>
20     /// <seealso cref="IList{TLinkAddress}"/>
21     public class Point<TLinkAddress> : IEquatable<LinkAddress<TLinkAddress>>, IList<TLinkAddress>
22     {
23         private static readonly EqualityComparer<TLinkAddress> _equalityComparer =
24             ↪ EqualityComparer<TLinkAddress>.Default;
25
26         /// <summary>
27         /// <para>
28         /// Gets the index value.
29         /// </para>
30         /// <para></para>
31         /// </summary>
32         public TLinkAddress Index
33         {
34             [MethodImpl(MethodImplOptions.AggressiveInlining)]
35             get;
36         }
37
38         /// <summary>
39         /// <para>
40         /// Gets the size value.
41         /// </para>
42         /// <para></para>
43         /// </summary>
44         public int Size
45         {
46             [MethodImpl(MethodImplOptions.AggressiveInlining)]
47             get;
48         }
49
50         /// <summary>
51         /// <para>
52         /// The not supported exception.
53         /// </para>
54         /// <para></para>
55         /// </summary>
56         public TLinkAddress this[int index]
57         {
58             [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

58     get
59     {
60         if (index < Size)
61         {
62             return Index;
63         }
64         else
65         {
66             throw new IndexOutOfRangeException();
67         }
68     }
69     [MethodImpl(MethodImplOptions.AggressiveInlining)]
70     set => throw new NotSupportedException();
71 }
72
73 /// <summary>
74 /// <para>
75 /// Gets the count value.
76 /// </para>
77 /// <para></para>
78 /// </summary>
79 public int Count
80 {
81     [MethodImpl(MethodImplOptions.AggressiveInlining)]
82     get => Size;
83 }
84
85 /// <summary>
86 /// <para>
87 /// Gets the is read only value.
88 /// </para>
89 /// <para></para>
90 /// </summary>
91 public bool IsReadOnly
92 {
93     [MethodImpl(MethodImplOptions.AggressiveInlining)]
94     get => true;
95 }
96
97 /// <summary>
98 /// <para>
99 /// Initializes a new <see cref="Point{TLinkAddress}"/> instance.
100 /// </para>
101 /// <para></para>
102 /// </summary>
103 /// <param name="index">
104 /// <para>A index.</para>
105 /// <para></para>
106 /// </param>
107 /// <param name="size">
108 /// <para>A size.</para>
109 /// <para></para>
110 /// </param>
111 [MethodImpl(MethodImplOptions.AggressiveInlining)]
112 public Point(TLinkAddress index, int size)
113 {
114     Index = index;
115     Size = size;
116 }
117
118 /// <summary>
119 /// <para>
120 /// Adds the item.
121 /// </para>
122 /// <para></para>
123 /// </summary>
124 /// <param name="item">
125 /// <para>The item.</para>
126 /// <para></para>
127 /// </param>
128 [MethodImpl(MethodImplOptions.AggressiveInlining)]
129 public void Add(TLinkAddress item) => throw new NotSupportedException();
130
131 /// <summary>
132 /// <para>
133 /// Clears this instance.
134 /// </para>
135 /// <para></para>
136 /// </summary>

```

```

137 [MethodImpl(MethodImplOptions.AggressiveInlining)]
138 public void Clear() => throw new NotSupportedException();
139
140 /// <summary>
141 /// <para>
142 /// Determines whether this instance contains.
143 /// </para>
144 /// <para></para>
145 /// </summary>
146 /// <param name="item">
147 /// <para>The item.</para>
148 /// <para></para>
149 /// </param>
150 /// <returns>
151 /// <para>The bool</para>
152 /// <para></para>
153 /// </returns>
154 [MethodImpl(MethodImplOptions.AggressiveInlining)]
155 public virtual bool Contains(TLinkAddress item) => _equalityComparer.Equals(item, Index);
156
157 /// <summary>
158 /// <para>
159 /// Copies the to using the specified array.
160 /// </para>
161 /// <para></para>
162 /// </summary>
163 /// <param name="array">
164 /// <para>The array.</para>
165 /// <para></para>
166 /// </param>
167 /// <param name="arrayIndex">
168 /// <para>The array index.</para>
169 /// <para></para>
170 /// </param>
171 [MethodImpl(MethodImplOptions.AggressiveInlining)]
172 public void CopyTo(TLinkAddress[] array, int arrayIndex) => array[arrayIndex] = Index;
173
174 /// <summary>
175 /// <para>
176 /// Gets the enumerator.
177 /// </para>
178 /// <para></para>
179 /// </summary>
180 /// <returns>
181 /// <para>An enumerator of t link address</para>
182 /// <para></para>
183 /// </returns>
184 [MethodImpl(MethodImplOptions.AggressiveInlining)]
185 public IEnumerator<TLinkAddress> GetEnumerator()
186 {
187     for (int i = 0; i < Size; i++)
188     {
189         yield return Index;
190     }
191 }
192
193 /// <summary>
194 /// <para>
195 /// Indexes the of using the specified item.
196 /// </para>
197 /// <para></para>
198 /// </summary>
199 /// <param name="item">
200 /// <para>The item.</para>
201 /// <para></para>
202 /// </param>
203 /// <returns>
204 /// <para>The int</para>
205 /// <para></para>
206 /// </returns>
207 [MethodImpl(MethodImplOptions.AggressiveInlining)]
208 public virtual int IndexOf(TLinkAddress item) => _equalityComparer.Equals(item, Index) ?
    ↪ 0 : -1;
209
210 /// <summary>
211 /// <para>
212 /// Inserts the index.
213 /// </para>

```

```

214     /// <para></para>
215     /// </summary>
216     /// <param name="index">
217     /// <para>The index.</para>
218     /// <para></para>
219     /// </param>
220     /// <param name="item">
221     /// <para>The item.</para>
222     /// <para></para>
223     /// </param>
224     [MethodImpl(MethodImplOptions.AggressiveInlining)]
225     public void Insert(int index, TLinkAddress item) => throw new NotSupportedException();
226
227     /// <summary>
228     /// <para>
229     /// Determines whether this instance remove.
230     /// </para>
231     /// <para></para>
232     /// </summary>
233     /// <param name="item">
234     /// <para>The item.</para>
235     /// <para></para>
236     /// </param>
237     /// <returns>
238     /// <para>The bool</para>
239     /// <para></para>
240     /// </returns>
241     [MethodImpl(MethodImplOptions.AggressiveInlining)]
242     public bool Remove(TLinkAddress item) => throw new NotSupportedException();
243
244     /// <summary>
245     /// <para>
246     /// Removes the at using the specified index.
247     /// </para>
248     /// <para></para>
249     /// </summary>
250     /// <param name="index">
251     /// <para>The index.</para>
252     /// <para></para>
253     /// </param>
254     [MethodImpl(MethodImplOptions.AggressiveInlining)]
255     public void RemoveAt(int index) => throw new NotSupportedException();
256
257     /// <summary>
258     /// <para>
259     /// Gets the enumerator.
260     /// </para>
261     /// <para></para>
262     /// </summary>
263     /// <returns>
264     /// <para>The enumerator</para>
265     /// <para></para>
266     /// </returns>
267     [MethodImpl(MethodImplOptions.AggressiveInlining)]
268     IEnumerator IEnumerable.GetEnumerator()
269     {
270         for (int i = 0; i < Size; i++)
271         {
272             yield return Index;
273         }
274     }
275
276     /// <summary>
277     /// <para>
278     /// Determines whether this instance equals.
279     /// </para>
280     /// <para></para>
281     /// </summary>
282     /// <param name="other">
283     /// <para>The other.</para>
284     /// <para></para>
285     /// </param>
286     /// <returns>
287     /// <para>The bool</para>
288     /// <para></para>
289     /// </returns>
290     [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

291 public virtual bool Equals(LinkAddress<TLinkAddress> other) => other == null ? false :
    ↪ _equalityComparer.Equals(Index, other.Index);
292
293 [MethodImpl(MethodImplOptions.AggressiveInlining)]
294 public static implicit operator TLinkAddress(Point<TLinkAddress> linkAddress) =>
    ↪ linkAddress.Index;
295
296 /// <summary>
297 /// <para>
298 /// Determines whether this instance equals.
299 /// </para>
300 /// <para></para>
301 /// </summary>
302 /// <param name="obj">
303 /// <para>The obj.</para>
304 /// <para></para>
305 /// </param>
306 /// <returns>
307 /// <para>The bool</para>
308 /// <para></para>
309 /// </returns>
310 [MethodImpl(MethodImplOptions.AggressiveInlining)]
311 public override bool Equals(object obj) => obj is Point<TLinkAddress> linkAddress ?
    ↪ Equals(linkAddress) : false;
312
313 /// <summary>
314 /// <para>
315 /// Gets the hash code.
316 /// </para>
317 /// <para></para>
318 /// </summary>
319 /// <returns>
320 /// <para>The int</para>
321 /// <para></para>
322 /// </returns>
323 [MethodImpl(MethodImplOptions.AggressiveInlining)]
324 public override int GetHashCode() => Index.GetHashCode();
325
326 /// <summary>
327 /// <para>
328 /// Returns the string.
329 /// </para>
330 /// <para></para>
331 /// </summary>
332 /// <returns>
333 /// <para>The string</para>
334 /// <para></para>
335 /// </returns>
336 [MethodImpl(MethodImplOptions.AggressiveInlining)]
337 public override string ToString() => Index.ToString();
338
339 [MethodImpl(MethodImplOptions.AggressiveInlining)]
340 public static bool operator ==(Point<TLinkAddress> left, Point<TLinkAddress> right)
341 {
342     if (left == null && right == null)
343     {
344         return true;
345     }
346     if (left == null)
347     {
348         return false;
349     }
350     return left.Equals(right);
351 }
352
353 [MethodImpl(MethodImplOptions.AggressiveInlining)]
354 public static bool operator !=(Point<TLinkAddress> left, Point<TLinkAddress> right) =>
    ↪ !(left == right);
355
356 /// <summary>
357 /// <para>
358 /// Determines whether is full point.
359 /// </para>
360 /// <para></para>
361 /// </summary>
362 /// <param name="link">
363 /// <para>The link.</para>
364 /// <para></para>

```



```

365 /// </param>
366 /// <returns>
367 /// <para>The bool</para>
368 /// <para></para>
369 /// </returns>
370 [MethodImpl(MethodImplOptions.AggressiveInlining)]
371 public static bool IsFullPoint(params TLinkAddress[] link) =>
    ↳ IsFullPoint((IList<TLinkAddress>)link);
372
373 /// <summary>
374 /// <para>
375 /// Determines whether is full point.
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 bool</para>
385 /// <para></para>
386 /// </returns>
387 [MethodImpl(MethodImplOptions.AggressiveInlining)]
388 public static bool IsFullPoint(IList<TLinkAddress> link)
389 {
390     Ensure.Always.ArgumentNotEmpty(link, nameof(link));
391     Ensure.Always.ArgumentInRange(link.Count, (2, int.MaxValue), nameof(link), "Cannot
    ↳ determine link's pointness using only its identifier.");
392     return IsFullPointUnchecked(link);
393 }
394
395 /// <summary>
396 /// <para>
397 /// Determines whether is full point unchecked.
398 /// </para>
399 /// <para></para>
400 /// </summary>
401 /// <param name="link">
402 /// <para>The link.</para>
403 /// <para></para>
404 /// </param>
405 /// <returns>
406 /// <para>The result.</para>
407 /// <para></para>
408 /// </returns>
409 [MethodImpl(MethodImplOptions.AggressiveInlining)]
410 public static bool IsFullPointUnchecked(IList<TLinkAddress> link)
411 {
412     var result = true;
413     for (var i = 1; result && i < link.Count; i++)
414     {
415         result = _equalityComparer.Equals(link[0], link[i]);
416     }
417     return result;
418 }
419
420 /// <summary>
421 /// <para>
422 /// Determines whether is partial point.
423 /// </para>
424 /// <para></para>
425 /// </summary>
426 /// <param name="link">
427 /// <para>The link.</para>
428 /// <para></para>
429 /// </param>
430 /// <returns>
431 /// <para>The bool</para>
432 /// <para></para>
433 /// </returns>
434 [MethodImpl(MethodImplOptions.AggressiveInlining)]
435 public static bool IsPartialPoint(params TLinkAddress[] link) =>
    ↳ IsPartialPoint((IList<TLinkAddress>)link);
436
437 /// <summary>
438 /// <para>
439 /// Determines whether is partial point.

```

```

440     /// </para>
441     /// <para></para>
442     /// </summary>
443     /// <param name="link">
444     /// <para>The link.</para>
445     /// <para></para>
446     /// </param>
447     /// <returns>
448     /// <para>The bool</para>
449     /// <para></para>
450     /// </returns>
451     [MethodImpl(MethodImplOptions.AggressiveInlining)]
452     public static bool IsPartialPoint(IList<TLinkAddress> link)
453     {
454         Ensure.Always.ArgumentNotEmpty(link, nameof(link));
455         Ensure.Always.ArgumentInRange(link.Count, (2, int.MaxValue), nameof(link), "Cannot
         ↳ determine link's pointness using only its identifier.");
456         return IsPartialPointUnchecked(link);
457     }
458
459     /// <summary>
460     /// <para>
461     /// Determines whether is partial point unchecked.
462     /// </para>
463     /// <para></para>
464     /// </summary>
465     /// <param name="link">
466     /// <para>The link.</para>
467     /// <para></para>
468     /// </param>
469     /// <returns>
470     /// <para>The result.</para>
471     /// <para></para>
472     /// </returns>
473     [MethodImpl(MethodImplOptions.AggressiveInlining)]
474     public static bool IsPartialPointUnchecked(IList<TLinkAddress> link)
475     {
476         var result = false;
477         for (var i = 1; !result && i < link.Count; i++)
478         {
479             result = _equalityComparer.Equals(link[0], link[i]);
480         }
481         return result;
482     }
483 }
484 }

```

### 1.17 ./csharp/Platform.Data/ReadHandler.cs

```

1 using System.Collections.Generic;
2
3 namespace Platform.Data
4 {
5     public delegate TLink ReadHandler<TLink>(IList<TLink> link);
6 }

```

### 1.18 ./csharp/Platform.Data/Universal/IUniLinks.cs

```

1 using System;
2 using System.Collections.Generic;
3
4 // ReSharper disable TypeParameterCanBeVariant
5 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7 namespace Platform.Data.Universal
8 {
9     /// <remarks>Minimal sufficient universal Links API (for bulk operations).</remarks>
10    public partial interface IUniLinks<TLinkAddress>
11    {
12        /// <summary>
13        /// <para>
14        /// Triggers the condition.
15        /// </para>
16        /// <para></para>
17        /// </summary>
18        /// <param name="condition">
19        /// <para>The condition.</para>
20        /// <para></para>
21        /// </param>
22        /// <param name="substitution">

```

```

23     /// <para>The substitution.</para>
24     /// <para></para>
25     /// </param>
26     /// <returns>
27     /// <para>A list of i list i list t link address</para>
28     /// <para></para>
29     /// </returns>
30     IList<IList<IList<TLinkAddress>>> Trigger(IList<TLinkAddress> condition,
31         ↳ IList<TLinkAddress> substitution);
32 }
33 /// <remarks>Minimal sufficient universal Links API (for step by step operations).</remarks>
34 public partial interface IUniLinks<TLinkAddress>
35 {
36     /// <returns>
37     /// TLinkAddress that represents True (was finished fully) or TLinkAddress that
38     ↳ represents False (was stopped).
39     /// This is done to assure ability to push up stop signal through recursion stack.
40     /// </returns>
41     /// <remarks>
42     /// { 0, 0, 0 } => { itself, itself, itself } // create
43     /// { 1, any, any } => { itself, any, 3 } // update
44     /// { 3, any, any } => { 0, 0, 0 } // delete
45     /// </remarks>
46     TLinkAddress Trigger(IList<TLinkAddress> patternOrCondition, ReadHandler<TLinkAddress>
47         ↳ matchHandler,
48         ↳ IList<TLinkAddress> substitution, WriteHandler<TLinkAddress>
49         ↳ substitutionHandler);
50
51     /// <summary>
52     /// <para>
53     /// Triggers the restriction.
54     /// </para>
55     /// <para></para>
56     /// </summary>
57     /// <param name="restriction">
58     /// <para>The restriction.</para>
59     /// <para></para>
60     /// </param>
61     /// <param name="matchedHandler">
62     /// <para>The matched handler.</para>
63     /// <para></para>
64     /// </param>
65     /// <param name="substitution">
66     /// <para>The substitution.</para>
67     /// <para></para>
68     /// </param>
69     /// <param name="substitutedHandler">
70     /// <para>The substituted handler.</para>
71     /// <para></para>
72     /// </param>
73     /// <returns>
74     /// <para>The link address</para>
75     /// <para></para>
76     /// </returns>
77     TLinkAddress Trigger(IList<TLinkAddress> restriction, WriteHandler<TLinkAddress>
78         ↳ matchedHandler,
79         ↳ IList<TLinkAddress> substitution, WriteHandler<TLinkAddress> substitutedHandler);
80 }
81
82 /// <remarks>Extended with small optimization.</remarks>
83 public partial interface IUniLinks<TLinkAddress>
84 {
85     /// <remarks>
86     /// Something simple should be simple and optimized.
87     /// </remarks>
88     TLinkAddress Count(IList<TLinkAddress> restrictions);
89 }
90 }

```

## 1.19 ./csharp/Platform.Data/Universal/IUniLinksCRUD.cs

```

1  using System;
2  using System.Collections.Generic;
3
4  // ReSharper disable TypeParameterCanBeVariant
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Universal

```

```

8 {
9     /// <remarks>
10    /// CRUD aliases for IUniLinks.
11    /// </remarks>
12    public interface IUniLinksCRUD<TLinkAddress>
13    {
14        /// <summary>
15        /// <para>
16        /// Reads the part type.
17        /// </para>
18        /// <para></para>
19        /// </summary>
20        /// <param name="partType">
21        /// <para>The part type.</para>
22        /// <para></para>
23        /// </param>
24        /// <param name="link">
25        /// <para>The link.</para>
26        /// <para></para>
27        /// </param>
28        /// <returns>
29        /// <para>The link address</para>
30        /// <para></para>
31        /// </returns>
32        TLinkAddress Read(int partType, TLinkAddress link);
33        /// <summary>
34        /// <para>
35        /// Reads the handler.
36        /// </para>
37        /// <para></para>
38        /// </summary>
39        /// <param name="handler">
40        /// <para>The handler.</para>
41        /// <para></para>
42        /// </param>
43        /// <param name="pattern">
44        /// <para>The pattern.</para>
45        /// <para></para>
46        /// </param>
47        /// <returns>
48        /// <para>The link address</para>
49        /// <para></para>
50        /// </returns>
51        TLinkAddress Read(Func<TLinkAddress, bool> handler, IList<TLinkAddress> pattern);
52        /// <summary>
53        /// <para>
54        /// Creates the parts.
55        /// </para>
56        /// <para></para>
57        /// </summary>
58        /// <param name="parts">
59        /// <para>The parts.</para>
60        /// <para></para>
61        /// </param>
62        /// <returns>
63        /// <para>The link address</para>
64        /// <para></para>
65        /// </returns>
66        TLinkAddress Create(IList<TLinkAddress> parts);
67        /// <summary>
68        /// <para>
69        /// Updates the before.
70        /// </para>
71        /// <para></para>
72        /// </summary>
73        /// <param name="before">
74        /// <para>The before.</para>
75        /// <para></para>
76        /// </param>
77        /// <param name="after">
78        /// <para>The after.</para>
79        /// <para></para>
80        /// </param>
81        /// <returns>
82        /// <para>The link address</para>
83        /// <para></para>
84        /// </returns>
85        TLinkAddress Update(IList<TLinkAddress> before, IList<TLinkAddress> after);

```

```

86     /// <summary>
87     /// <para>
88     /// Deletes the parts.
89     /// </para>
90     /// <para></para>
91     /// </summary>
92     /// <param name="parts">
93     /// <para>The parts.</para>
94     /// <para></para>
95     /// </param>
96     TLinkAddress Delete(IList<TLinkAddress> parts);
97 }
98 }

```

## 1.20 ./csharp/Platform.Data/Universal/IUniLinksGS.cs

```

1  using System;
2  using System.Collections.Generic;
3
4  // ReSharper disable TypeParameterCanBeVariant
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Universal
8  {
9      /// <remarks>
10     /// Get/Set aliases for IUniLinks.
11     /// </remarks>
12     public interface IUniLinksGS<TLinkAddress>
13     {
14         /// <summary>
15         /// <para>
16         /// Gets the part type.
17         /// </para>
18         /// <para></para>
19         /// </summary>
20         /// <param name="partType">
21         /// <para>The part type.</para>
22         /// <para></para>
23         /// </param>
24         /// <param name="link">
25         /// <para>The link.</para>
26         /// <para></para>
27         /// </param>
28         /// <returns>
29         /// <para>The link address</para>
30         /// <para></para>
31         /// </returns>
32         TLinkAddress Get(int partType, TLinkAddress link);
33         /// <summary>
34         /// <para>
35         /// Gets the handler.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         /// <param name="handler">
40         /// <para>The handler.</para>
41         /// <para></para>
42         /// </param>
43         /// <param name="pattern">
44         /// <para>The pattern.</para>
45         /// <para></para>
46         /// </param>
47         /// <returns>
48         /// <para>The link address</para>
49         /// <para></para>
50         /// </returns>
51         TLinkAddress Get(Func<TLinkAddress, bool> handler, IList<TLinkAddress> pattern);
52         /// <summary>
53         /// <para>
54         /// Sets the before.
55         /// </para>
56         /// <para></para>
57         /// </summary>
58         /// <param name="before">
59         /// <para>The before.</para>
60         /// <para></para>
61         /// </param>
62         /// <param name="after">
63         /// <para>The after.</para>

```

```

64     /// <para></para>
65     /// </param>
66     /// <returns>
67     /// <para>The link address</para>
68     /// <para></para>
69     /// </returns>
70     TLinkAddress Set(IList<TLinkAddress> before, IList<TLinkAddress> after);
71 }
72 }

```

## 1.21 ./csharp/Platform.Data/Universal/IUniLinksIO.cs

```

1  using System;
2  using System.Collections.Generic;
3
4  // ReSharper disable TypeParameterCanBeVariant
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Data.Universal
8  {
9      /// <remarks>
10     /// In/Out aliases for IUniLinks.
11     /// TLinkAddress can be any number type of any size.
12     /// </remarks>
13     public interface IUniLinksIO<TLinkAddress>
14     {
15         /// <remarks>
16         /// default(TLinkAddress) means any link.
17         /// Single element pattern means just element (link).
18         /// Handler gets array of link contents.
19         /// * link[0] is index or identifier.
20         /// * link[1] is source or first.
21         /// * link[2] is target or second.
22         /// * link[3] is linker or third.
23         /// * link[n] is nth part/parent/element/value
24         /// of link (if variable length links used).
25         ///
26         /// Stops and returns false if handler return false.
27         ///
28         /// Acts as Each, Foreach, Select, Search, Match & ...
29         ///
30         /// Handles all links in store if pattern/restrictions is not defined.
31         /// </remarks>
32         bool Out(Func<IList<TLinkAddress>, bool> handler, IList<TLinkAddress> pattern);
33
34         /// <remarks>
35         /// default(TLinkAddress) means itself.
36         /// Equivalent to:
37         /// * creation if before == null
38         /// * deletion if after == null
39         /// * update if before != null & & after != null
40         /// * default(TLinkAddress) if before == null & & after == null
41         ///
42         /// Possible interpretation
43         /// * In(null, new[] { }) creates point (link that points to itself using minimum number
44         ///   ↳ of parts).
45         /// * In(new[] { 4 }, null) deletes 4th link.
46         /// * In(new[] { 4 }, new [] { 5 }) delete 5th link if it exists and moves 4th link to
47         ///   ↳ 5th index.
48         /// * In(new[] { 4 }, new [] { 0, 2, 3 }) replaces 4th link with new doublet link (with
49         ///   ↳ 2 as source and 3 as target), 0 means it can be placed in any address.
50         /// ...
51         /// </remarks>
52         TLinkAddress In(IList<TLinkAddress> before, IList<TLinkAddress> after);
53     }
54 }

```

## 1.22 ./csharp/Platform.Data/Universal/IUniLinksIOWithExtensions.cs

```

1  // ReSharper disable TypeParameterCanBeVariant
2  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
3
4  using System.Collections.Generic;
5
6  namespace Platform.Data.Universal
7  {
8      /// <remarks>Contains some optimizations of Out.</remarks>
9      public interface IUniLinksIOWithExtensions<TLinkAddress> : IUniLinksIO<TLinkAddress>
10     {
11         /// <remarks>

```

```

12     /// default(TLinkAddress) means nothing or null.
13     /// Single element pattern means just element (link).
14     /// OutPart(n, null) returns default(TLinkAddress).
15     /// OutPart(0, pattern) ~ Exists(link) or Search(pattern)
16     /// OutPart(1, pattern) ~ GetSource(link) or GetSource(Search(pattern))
17     /// OutPart(2, pattern) ~ GetTarget(link) or GetTarget(Search(pattern))
18     /// OutPart(3, pattern) ~ GetLinkAddresser(link) or GetLinkAddresser(Search(pattern))
19     /// OutPart(n, pattern) => For any variable length links, returns link or
    ↪ default(TLinkAddress).
20     ///
21     /// Outs(returns) inner contents of link, its part/parent/element/value.
22     /// </remarks>
23     TLinkAddress OutOne(int partType, IList<TLinkAddress> pattern);
24
25     /// <remarks>OutCount() returns total links in store as array.</remarks>
26     IList<IList<TLinkAddress>> OutAll(IList<TLinkAddress> pattern);
27
28     /// <remarks>OutCount() returns total amount of links in store.</remarks>
29     ulong OutCount(IList<TLinkAddress> pattern);
30 }
31 }

```

### 1.23 ./csharp/Platform.Data/Universal/IUniLinksRW.cs

```

1 using System;
2 using System.Collections.Generic;
3
4 // ReSharper disable TypeParameterCanBeVariant
5 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7 namespace Platform.Data.Universal
8 {
9     /// <remarks>
10    /// Read/Write aliases for IUniLinks.
11    /// </remarks>
12    public interface IUniLinksRW<TLinkAddress>
13    {
14        /// <summary>
15        /// <para>
16        /// Reads the part type.
17        /// </para>
18        /// <para></para>
19        /// </summary>
20        /// <param name="partType">
21        /// <para>The part type.</para>
22        /// <para></para>
23        /// </param>
24        /// <param name="link">
25        /// <para>The link.</para>
26        /// <para></para>
27        /// </param>
28        /// <returns>
29        /// <para>The link address</para>
30        /// <para></para>
31        /// </returns>
32        TLinkAddress Read(int partType, TLinkAddress link);
33        /// <summary>
34        /// <para>
35        /// Determines whether this instance read.
36        /// </para>
37        /// <para></para>
38        /// </summary>
39        /// <param name="handler">
40        /// <para>The handler.</para>
41        /// <para></para>
42        /// </param>
43        /// <param name="pattern">
44        /// <para>The pattern.</para>
45        /// <para></para>
46        /// </param>
47        /// <returns>
48        /// <para>The bool</para>
49        /// <para></para>
50        /// </returns>
51        bool Read(Func<TLinkAddress, bool> handler, IList<TLinkAddress> pattern);
52        /// <summary>
53        /// <para>
54        /// Writes the before.
55        /// </para>

```

```

56     /// <para></para>
57     /// </summary>
58     /// <param name="before">
59     /// <para>The before.</para>
60     /// <para></para>
61     /// </param>
62     /// <param name="after">
63     /// <para>The after.</para>
64     /// <para></para>
65     /// </param>
66     /// <returns>
67     /// <para>The link address</para>
68     /// <para></para>
69     /// </returns>
70     TLinkAddress Write(IList<TLinkAddress> before, IList<TLinkAddress> after);
71 }
72 }

```

#### 1.24 ./csharp/Platform.Data/WriteHandler.cs

```

1  using System.Collections.Generic;
2
3  namespace Platform.Data
4  {
5      public delegate TLink WriteHandler<TLink>(IList<TLink> before, IList<TLink> after);
6  }

```

#### 1.25 ./csharp/Platform.Data.Tests/HybridTests.cs

```

1  using Xunit;
2
3  namespace Platform.Data.Tests
4  {
5      /// <summary>
6      /// <para>
7      /// Represents the hybrid tests.
8      /// </para>
9      /// <para></para>
10     /// </summary>
11     public static class HybridTests
12     {
13         /// <summary>
14         /// <para>
15         /// Tests that object constructor test.
16         /// </para>
17         /// <para></para>
18         /// </summary>
19         [Fact]
20         public static void ObjectConstructorTest()
21         {
22             Assert.Equal(0, new Hybrid<byte>(unchecked((byte)128)).AbsoluteValue);
23             Assert.Equal(0, new Hybrid<byte>((object)128).AbsoluteValue);
24             Assert.Equal(1, new Hybrid<byte>(unchecked((byte)-1)).AbsoluteValue);
25             Assert.Equal(1, new Hybrid<byte>((object)-1).AbsoluteValue);
26             Assert.Equal(0, new Hybrid<byte>(unchecked((byte)0)).AbsoluteValue);
27             Assert.Equal(0, new Hybrid<byte>((object)0).AbsoluteValue);
28             Assert.Equal(1, new Hybrid<byte>(unchecked((byte)1)).AbsoluteValue);
29             Assert.Equal(1, new Hybrid<byte>((object)1).AbsoluteValue);
30         }
31     }
32 }

```

#### 1.26 ./csharp/Platform.Data.Tests/LinksConstantsTests.cs

```

1  using Xunit;
2  using Platform.Reflection;
3  using Platform.Converters;
4  using Platform.Numbers;
5
6  namespace Platform.Data.Tests
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the links constants tests.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     public static class LinksConstantsTests
15     {
16         /// <summary>
17         /// <para>

```



```

18     /// Tests that constructor test.
19     /// </para>
20     /// <para></para>
21     /// </summary>
22     [Fact]
23     public static void ConstructorTest()
24     {
25         var constants = new LinksConstants<ulong>(enableExternalReferencesSupport: true);
26         Assert.Equal(Hybrid<ulong>.ExternalZero,
27             ↪ constants.ExternalReferencesRange.Value.Minimum);
28         Assert.Equal(ulong.MaxValue, constants.ExternalReferencesRange.Value.Maximum);
29     }
30     /// <summary>
31     /// <para>
32     /// Tests that external references test.
33     /// </para>
34     /// <para></para>
35     /// </summary>
36     [Fact]
37     public static void ExternalReferencesTest()
38     {
39         TestExternalReferences<ulong, long>();
40         TestExternalReferences<uint, int>();
41         TestExternalReferences<ushort, short>();
42         TestExternalReferences<byte, sbyte>();
43     }
44     private static void TestExternalReferences<TUnsigned, TSigned>()
45     {
46         var unsingedOne = Arithmetic.Increment(default(TUnsigned));
47         var converter = UncheckedConverter<TSigned, TUnsigned>.Default;
48         var half = converter.Convert(NumericType<TSigned>.MaxValue);
49         LinksConstants<TUnsigned> constants = new LinksConstants<TUnsigned>((unsingedOne,
50             ↪ half), (Arithmetic.Add(half, unsingedOne), NumericType<TUnsigned>.MaxValue));
51
52         var minimum = new Hybrid<TUnsigned>(default, isExternal: true);
53         var maximum = new Hybrid<TUnsigned>(half, isExternal: true);
54
55         Assert.True(constants.IsExternalReference(minimum));
56         Assert.True(minimum.IsExternal);
57         Assert.False(minimum.IsInternal);
58         Assert.True(constants.IsExternalReference(maximum));
59         Assert.True(maximum.IsExternal);
60         Assert.False(maximum.IsInternal);
61     }
62 }

```

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