## 1.1 ./csharp/Platform.Data.Doublets.Json/DefaultJsonStorage.cs

```
using Platform.Numbers;
using Platform.Data.Doublets.Unicode;
using Platform.Data.Doublets.Sequences.Converters;
using Platform.Data.Doublets.CriterionMatchers;
using Platform.Data.Numbers.Raw;
using Platform.Converters;
using Platform.Data.Doublets.Sequences.Walkers;
using Platform.Collections.Stacks;
using System;
using System.Collections.Generic;
using Platform.Data.Doublets.Numbers.Rational;
using Platform.Data.Doublets.Numbers.Raw;
using Platform.Data.Doublets.Sequences.HeightProviders;
using Platform.Data.Doublets.Sequences;

#pragma warning disable CS1591 // Missing XML comment for publicly visible type or member

namespace Platform.Data.Doublets.Json
{
    /// <summary>
    /// <para>
    /// Represents the default json storage.
    /// </para>
    /// <para></para>
    /// </summary>
    /// <seealso cref="IJsonStorage{TLink}"/>
    public class DefaultJsonStorage<TLink> : IJsonStorage<TLink>
        where TLink : struct
    {
        /// <summary>
        /// <para>
        /// The any.
        /// </para>
        /// <para></para>
        /// </summary>
        public readonly TLink Any;
        /// <summary>
        /// <para>
        /// The zero.
        /// </para>
        /// <para></para>
        /// </summary>
        public static readonly TLink Zero = default;
        /// <summary>
        /// <para>
        /// The zero.
        /// </para>
        /// <para></para>
        /// </summary>
        public static readonly TLink One = Arithmetic.Increment(Zero);
        /// <summary>
        /// <para>
        /// The balanced variant converter.
        /// </para>
        /// <para></para>
        /// </summary>
        public readonly BalancedVariantConverter<TLink> BalancedVariantConverter;
        /// <summary>
        /// <para>
        /// The list to sequence converter.
        /// </para>
        /// <para></para>
        /// </summary>
        public readonly IConverter<IList<TLink>, TLink> ListToSequenceConverter;
        /// <summary>
        /// <para>
        /// The meaning root.
        /// </para>
        /// <para></para>
        /// </summary>
        public readonly TLink MeaningRoot;
        /// <summary>
        /// <para>
        /// The default.
        /// </para>
        /// <para></para>
        /// </summary>
```

```
78          public readonly EqualityComparer<TLink> EqualityComparer =
            ↪ EqualityComparer<TLink>.Default;
79          // Converters that are able to convert link's address (UInt64 value) to a raw number
            ↪ represented with another UInt64 value and back
80          /// <summary>
81          /// <para>
82          /// The number to address converter.
83          /// </para>
84          /// <para></para>
85          /// </summary>
86          public readonly RawNumberToAddressConverter<TLink> NumberToAddressConverter = new();
87          /// <summary>
88          /// <para>
89          /// The address to number converter.
90          /// </para>
91          /// <para></para>
92          /// </summary>
93          public readonly AddressToRawNumberConverter<TLink> AddressToNumberConverter = new();
94          // Converters between BigInteger and raw number sequence
95          /// <summary>
96          /// <para>
97          /// The big integer to raw number sequence converter.
98          /// </para>
99          /// <para></para>
100         /// </summary>
101         public readonly BigIntegerToRawNumberSequenceConverter<TLink>
            ↪ BigIntegerToRawNumberSequenceConverter;
102         /// <summary>
103         /// <para>
104         /// The raw number sequence to big integer converter.
105         /// </para>
106         /// <para></para>
107         /// </summary>
108         public readonly RawNumberSequenceToBigIntegerConverter<TLink>
            ↪ RawNumberSequenceToBigIntegerConverter;
109         // Converters between decimal and rational number sequence
110         /// <summary>
111         /// <para>
112         /// The decimal to rational converter.
113         /// </para>
114         /// <para></para>
115         /// </summary>
116         public readonly DecimalToRationalConverter<TLink> DecimalToRationalConverter;
117         /// <summary>
118         /// <para>
119         /// The rational to decimal converter.
120         /// </para>
121         /// <para></para>
122         /// </summary>
123         public readonly RationalToDecimalConverter<TLink> RationalToDecimalConverter;
124         // Converters between string and unicode sequence
125         /// <summary>
126         /// <para>
127         /// The string to unicode sequence converter.
128         /// </para>
129         /// <para></para>
130         /// </summary>
131         public readonly IConverter<string, TLink> StringToUnicodeSequenceConverter;
132         /// <summary>
133         /// <para>
134         /// The unicode sequence to string converter.
135         /// </para>
136         /// <para></para>
137         /// </summary>
138         public readonly IConverter<TLink, string> UnicodeSequenceToStringConverter;
139         // For sequences
140         /// <summary>
141         /// <para>
142         /// The json array element criterion matcher.
143         /// </para>
144         /// <para></para>
145         /// </summary>
146         public readonly JsonArrayElementCriterionMatcher<TLink> JsonArrayElementCriterionMatcher;
147         /// <summary>
148         /// <para>
149         /// The default sequence right height provider.
150         /// </para>
151         /// <para></para>
```

```
152         /// </summary>
153         public readonly DefaultSequenceRightHeightProvider<TLink>
            ↪  DefaultSequenceRightHeightProvider;
154         /// <summary>
155         /// <para>
156         /// The default sequence appender.
157         /// </para>
158         /// <para></para>
159         /// </summary>
160         public readonly DefaultSequenceAppender<TLink> DefaultSequenceAppender;
161         /// <summary>
162         /// <para>
163         /// Gets the links value.
164         /// </para>
165         /// <para></para>
166         /// </summary>
167         public ILinks<TLink> Links { get; }
168         /// <summary>
169         /// <para>
170         /// Gets the document marker value.
171         /// </para>
172         /// <para></para>
173         /// </summary>
174         public TLink DocumentMarker { get; }
175         /// <summary>
176         /// <para>
177         /// Gets the object marker value.
178         /// </para>
179         /// <para></para>
180         /// </summary>
181         public TLink ObjectMarker { get; }
182         /// <summary>
183         /// <para>
184         /// Gets the member marker value.
185         /// </para>
186         /// <para></para>
187         /// </summary>
188         public TLink MemberMarker { get; }
189         /// <summary>
190         /// <para>
191         /// Gets the value marker value.
192         /// </para>
193         /// <para></para>
194         /// </summary>
195         public TLink ValueMarker { get; }
196         /// <summary>
197         /// <para>
198         /// Gets the string marker value.
199         /// </para>
200         /// <para></para>
201         /// </summary>
202         public TLink StringMarker { get; }
203         /// <summary>
204         /// <para>
205         /// Gets the empty string marker value.
206         /// </para>
207         /// <para></para>
208         /// </summary>
209         public TLink EmptyStringMarker { get; }
210         /// <summary>
211         /// <para>
212         /// Gets the number marker value.
213         /// </para>
214         /// <para></para>
215         /// </summary>
216         public TLink NumberMarker { get; }
217         /// <summary>
218         /// <para>
219         /// Gets the negative number marker value.
220         /// </para>
221         /// <para></para>
222         /// </summary>
223         public TLink NegativeNumberMarker { get; }
224         /// <summary>
225         /// <para>
226         /// Gets the array marker value.
227         /// </para>
228         /// <para></para>
```

```
229         /// </summary>
230         public TLink ArrayMarker { get; }
231         /// <summary>
232         /// <para>
233         /// Gets the empty array marker value.
234         /// </para>
235         /// <para></para>
236         /// </summary>
237         public TLink EmptyArrayMarker { get; }
238         /// <summary>
239         /// <para>
240         /// Gets the true marker value.
241         /// </para>
242         /// <para></para>
243         /// </summary>
244         public TLink TrueMarker { get; }
245         /// <summary>
246         /// <para>
247         /// Gets the false marker value.
248         /// </para>
249         /// <para></para>
250         /// </summary>
251         public TLink FalseMarker { get; }
252         /// <summary>
253         /// <para>
254         /// Gets the null marker value.
255         /// </para>
256         /// <para></para>
257         /// </summary>
258         public TLink NullMarker { get; }
259
260         /// <summary>
261         /// <para>
262         /// Initializes a new <see cref="DefaultJsonStorage"/> instance.
263         /// </para>
264         /// <para></para>
265         /// </summary>
266         /// <param name="links">
267         /// <para>A links.</para>
268         /// <para></para>
269         /// </param>
270         /// <param name="listToSequenceConverter">
271         /// <para>A list to sequence converter.</para>
272         /// <para></para>
273         /// </param>
274         public DefaultJsonStorage(ILinks<TLink> links, IConverter<IList<TLink>, TLink>
            ↪ listToSequenceConverter)
275         {
276             Links = links;
277             ListToSequenceConverter = listToSequenceConverter;
278             // Initializes constants
279             Any = Links.Constants.Any;
280             var markerIndex = One;
281             MeaningRoot = links.GetOrCreate(markerIndex, markerIndex);
282             var unicodeSymbolMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref
                ↪ markerIndex));
283             var unicodeSequenceMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref
                ↪ markerIndex));
284             DocumentMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref
                ↪ markerIndex));
285             ObjectMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref markerIndex));
286             MemberMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref markerIndex));
287             ValueMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref markerIndex));
288             StringMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref markerIndex));
289             EmptyStringMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref
                ↪ markerIndex));
290             NumberMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref markerIndex));
291             NegativeNumberMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref
                ↪ markerIndex));
292             ArrayMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref markerIndex));
293             EmptyArrayMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref
                ↪ markerIndex));
294             TrueMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref markerIndex));
295             FalseMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref markerIndex));
296             NullMarker = links.GetOrCreate(MeaningRoot, Arithmetic.Increment(ref markerIndex));
297             BalancedVariantConverter = new(links);
298             TargetMatcher<TLink> unicodeSymbolCriterionMatcher = new(Links, unicodeSymbolMarker);
```

```
            TargetMatcher<TLink> unicodeSequenceCriterionMatcher = new(Links,
            ↪  unicodeSequenceMarker);
            CharToUnicodeSymbolConverter<TLink> charToUnicodeSymbolConverter =
                new(Links, AddressToNumberConverter, unicodeSymbolMarker);
            UnicodeSymbolToCharConverter<TLink> unicodeSymbolToCharConverter =
                new(Links, NumberToAddressConverter, unicodeSymbolCriterionMatcher);
            StringToUnicodeSequenceConverter = new CachingConverterDecorator<string, TLink>(
                new StringToUnicodeSequenceConverter<TLink>(Links, charToUnicodeSymbolConverter,
                    BalancedVariantConverter, unicodeSequenceMarker));
            RightSequenceWalker<TLink> sequenceWalker =
                new(Links, new DefaultStack<TLink>(), unicodeSymbolCriterionMatcher.IsMatched);
            UnicodeSequenceToStringConverter = new CachingConverterDecorator<TLink, string>(
                new UnicodeSequenceToStringConverter<TLink>(Links,
                ↪  unicodeSequenceCriterionMatcher, sequenceWalker,
                    unicodeSymbolToCharConverter));
            BigIntegerToRawNumberSequenceConverter =
                new(links, AddressToNumberConverter, ListToSequenceConverter,
                ↪  NegativeNumberMarker);
            RawNumberSequenceToBigIntegerConverter = new(links, NumberToAddressConverter,
            ↪  NegativeNumberMarker);
            DecimalToRationalConverter = new(links, BigIntegerToRawNumberSequenceConverter);
            RationalToDecimalConverter = new(links, RawNumberSequenceToBigIntegerConverter);
            JsonArrayElementCriterionMatcher = new(this);
            DefaultSequenceRightHeightProvider = new(Links, JsonArrayElementCriterionMatcher);
            DefaultSequenceAppender = new(Links, new DefaultStack<TLink>(),
            ↪  DefaultSequenceRightHeightProvider);
        }

        /// <summary>
        /// <para>
        /// Creates the string using the specified content.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="content">
        /// <para>The content.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink CreateString(string content)
        {
            var @string = GetStringSequence(content);
            return Links.GetOrCreate(StringMarker, @string);
        }

        /// <summary>
        /// <para>
        /// Creates the string value using the specified content.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="content">
        /// <para>The content.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink CreateStringValue(string content)
        {
            var @string = CreateString(content);
            return CreateValue(@string);
        }

        /// <summary>
        /// <para>
        /// Creates the number using the specified number.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="number">
        /// <para>The number.</para>
        /// <para></para>
        /// </param>
```

```
372         /// <returns>
373         /// <para>The link</para>
374         /// <para></para>
375         /// </returns>
376         public TLink CreateNumber(decimal number)
377         {
378             var numberSequence = DecimalToRationalConverter.Convert(number);
379             return Links.GetOrCreate(NumberMarker, numberSequence);
380         }
381 
382         /// <summary>
383         /// <para>
384         /// Creates the number value using the specified number.
385         /// </para>
386         /// <para></para>
387         /// </summary>
388         /// <param name="number">
389         /// <para>The number.</para>
390         /// <para></para>
391         /// </param>
392         /// <returns>
393         /// <para>The link</para>
394         /// <para></para>
395         /// </returns>
396         public TLink CreateNumberValue(decimal number)
397         {
398             var numberLink = CreateNumber(number);
399             return CreateValue(numberLink);
400         }
401 
402         /// <summary>
403         /// <para>
404         /// Creates the boolean value using the specified value.
405         /// </para>
406         /// <para></para>
407         /// </summary>
408         /// <param name="value">
409         /// <para>The value.</para>
410         /// <para></para>
411         /// </param>
412         /// <returns>
413         /// <para>The link</para>
414         /// <para></para>
415         /// </returns>
416         public TLink CreateBooleanValue(bool value) => CreateValue(value ? TrueMarker :
            ↪ FalseMarker);
417 
418         /// <summary>
419         /// <para>
420         /// Creates the null value.
421         /// </para>
422         /// <para></para>
423         /// </summary>
424         /// <returns>
425         /// <para>The link</para>
426         /// <para></para>
427         /// </returns>
428         public TLink CreateNullValue() => CreateValue(NullMarker);
429 
430         /// <summary>
431         /// <para>
432         /// Creates the document using the specified name.
433         /// </para>
434         /// <para></para>
435         /// </summary>
436         /// <param name="name">
437         /// <para>The name.</para>
438         /// <para></para>
439         /// </param>
440         /// <returns>
441         /// <para>The link</para>
442         /// <para></para>
443         /// </returns>
444         public TLink CreateDocument(string name)
445         {
446             var documentName = CreateString(name);
447             return Links.GetOrCreate(DocumentMarker, documentName);
448         }
```

```
449
450         /// <summary>
451         /// <para>
452         /// Creates the object.
453         /// </para>
454         /// <para></para>
455         /// </summary>
456         /// <returns>
457         /// <para>The link</para>
458         /// <para></para>
459         /// </returns>
460         public TLink CreateObject()
461         {
462             var @object = Links.Create();
463             return Links.Update(@object, newSource: ObjectMarker, newTarget: @object);
464         }
465
466         /// <summary>
467         /// <para>
468         /// Creates the object value.
469         /// </para>
470         /// <para></para>
471         /// </summary>
472         /// <returns>
473         /// <para>The link</para>
474         /// <para></para>
475         /// </returns>
476         public TLink CreateObjectValue()
477         {
478             var @object = CreateObject();
479             return CreateValue(@object);
480         }
481
482         /// <summary>
483         /// <para>
484         /// Creates the array using the specified array.
485         /// </para>
486         /// <para></para>
487         /// </summary>
488         /// <param name="array">
489         /// <para>The array.</para>
490         /// <para></para>
491         /// </param>
492         /// <returns>
493         /// <para>The link</para>
494         /// <para></para>
495         /// </returns>
496         public TLink CreateArray(IList<TLink> array)
497         {
498             var arraySequence = array.Count == 0 ? EmptyArrayMarker :
                ↪  BalancedVariantConverter.Convert(array);
499             return CreateArray(arraySequence);
500         }
501
502         /// <summary>
503         /// <para>
504         /// Creates the array using the specified sequence.
505         /// </para>
506         /// <para></para>
507         /// </summary>
508         /// <param name="sequence">
509         /// <para>The sequence.</para>
510         /// <para></para>
511         /// </param>
512         /// <returns>
513         /// <para>The link</para>
514         /// <para></para>
515         /// </returns>
516         public TLink CreateArray(TLink sequence) => Links.GetOrCreate(ArrayMarker, sequence);
517
518         /// <summary>
519         /// <para>
520         /// Creates the array value using the specified array.
521         /// </para>
522         /// <para></para>
523         /// </summary>
524         /// <param name="array">
525         /// <para>The array.</para>
```

```
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink CreateArrayValue(IList<TLink> array)
        {
            var arrayLink = CreateArray(array);
            return CreateValue(arrayLink);
        }

        /// <summary>
        /// <para>
        /// Creates the array value using the specified sequence.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="sequence">
        /// <para>The sequence.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink CreateArrayValue(TLink sequence)
        {
            var array = CreateArray(sequence);
            return CreateValue(array);
        }

        /// <summary>
        /// <para>
        /// Creates the member using the specified name.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="name">
        /// <para>The name.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink CreateMember(string name)
        {
            var nameLink = CreateString(name);
            return Links.GetOrCreate(MemberMarker, nameLink);
        }

        /// <summary>
        /// <para>
        /// Creates the value using the specified value.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="value">
        /// <para>The value.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink CreateValue(TLink value) => Links.GetOrCreate(ValueMarker, value);

        /// <summary>
        /// <para>
        /// Attaches the object using the specified parent.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="parent">
        /// <para>The parent.</para>
        /// <para></para>
        /// </param>
```

```
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink AttachObject(TLink parent) => Attach(parent, CreateObjectValue());

        /// <summary>
        /// <para>
        /// Attaches the string using the specified parent.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="parent">
        /// <para>The parent.</para>
        /// <para></para>
        /// </param>
        /// <param name="content">
        /// <para>The content.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink AttachString(TLink parent, string content)
        {
            var @string = CreateString(content);
            var stringValue = CreateValue(@string);
            return Attach(parent, stringValue);
        }

        /// <summary>
        /// <para>
        /// Attaches the number using the specified parent.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="parent">
        /// <para>The parent.</para>
        /// <para></para>
        /// </param>
        /// <param name="number">
        /// <para>The number.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink AttachNumber(TLink parent, decimal number)
        {
            var numberLink = CreateNumber(number);
            var numberValue = CreateValue(numberLink);
            return Attach(parent, numberValue);
        }

        /// <summary>
        /// <para>
        /// Attaches the boolean using the specified parent.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="parent">
        /// <para>The parent.</para>
        /// <para></para>
        /// </param>
        /// <param name="value">
        /// <para>The value.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink AttachBoolean(TLink parent, bool value)
        {
            var booleanValue = CreateBooleanValue(value);
            return Attach(parent, booleanValue);
```

```
682         }
683
684         /// <summary>
685         /// <para>
686         /// Attaches the null using the specified parent.
687         /// </para>
688         /// <para></para>
689         /// </summary>
690         /// <param name="parent">
691         /// <para>The parent.</para>
692         /// <para></para>
693         /// </param>
694         /// <returns>
695         /// <para>The link</para>
696         /// <para></para>
697         /// </returns>
698         public TLink AttachNull(TLink parent)
699         {
700             var nullValue = CreateNullValue();
701             return Attach(parent, nullValue);
702         }
703
704         /// <summary>
705         /// <para>
706         /// Attaches the array using the specified parent.
707         /// </para>
708         /// <para></para>
709         /// </summary>
710         /// <param name="parent">
711         /// <para>The parent.</para>
712         /// <para></para>
713         /// </param>
714         /// <param name="array">
715         /// <para>The array.</para>
716         /// <para></para>
717         /// </param>
718         /// <returns>
719         /// <para>The link</para>
720         /// <para></para>
721         /// </returns>
722         public TLink AttachArray(TLink parent, IList<TLink> array)
723         {
724             var arrayValue = CreateArrayValue(array);
725             return Attach(parent, arrayValue);
726         }
727
728         /// <summary>
729         /// <para>
730         /// Attaches the member to object using the specified object.
731         /// </para>
732         /// <para></para>
733         /// </summary>
734         /// <param name="@object">
735         /// <para>The object.</para>
736         /// <para></para>
737         /// </param>
738         /// <param name="keyName">
739         /// <para>The key name.</para>
740         /// <para></para>
741         /// </param>
742         /// <returns>
743         /// <para>The link</para>
744         /// <para></para>
745         /// </returns>
746         public TLink AttachMemberToObject(TLink @object, string keyName)
747         {
748             var member = CreateMember(keyName);
749             return Attach(@object, member);
750         }
751
752         /// <summary>
753         /// <para>
754         /// Attaches the parent.
755         /// </para>
756         /// <para></para>
757         /// </summary>
758         /// <param name="parent">
759         /// <para>The parent.</para>
```

```
        /// <para></para>
        /// </param>
        /// <param name="child">
        /// <para>The child.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink Attach(TLink parent, TLink child) => Links.GetOrCreate(parent, child);

        /// <summary>
        /// <para>
        /// Appends the array value using the specified array value.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="arrayValue">
        /// <para>The array value.</para>
        /// <para></para>
        /// </param>
        /// <param name="appendant">
        /// <para>The appendant.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The new array value.</para>
        /// <para></para>
        /// </returns>
        public TLink AppendArrayValue(TLink arrayValue, TLink appendant)
        {
            var array = GetArray(arrayValue);
            var arraySequence = Links.GetTarget(array);
            TLink newArrayValue;
            if (EqualityComparer.Equals(arraySequence, EmptyArrayMarker))
            {
                newArrayValue = CreateArrayValue(appendant);
            }
            else
            {
                arraySequence = DefaultSequenceAppender.Append(arraySequence, appendant);
                newArrayValue = CreateArrayValue(arraySequence);
            }
            return newArrayValue;
        }

        /// <summary>
        /// <para>
        /// Gets the document or default using the specified name.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="name">
        /// <para>The name.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink GetDocumentOrDefault(string name)
        {
            var stringSequence = GetStringSequence(name);
            var @string = Links.SearchOrDefault(StringMarker, stringSequence);
            if (EqualityComparer.Equals(@string, default))
            {
                return default;
            }
            return Links.SearchOrDefault(DocumentMarker, @string);
        }
        private TLink GetStringSequence(string content) => content == "" ? EmptyStringMarker :
        ↪  StringToUnicodeSequenceConverter.Convert(content);

        /// <summary>
        /// <para>
        /// Gets the string using the specified string value.
        /// </para>
```

```
        /// <para></para>
        /// </summary>
        /// <param name="stringValue">
        /// <para>The string value.</para>
        /// <para></para>
        /// </param>
        /// <exception cref="Exception">
        /// <para>The passed link does not contain a string.</para>
        /// <para></para>
        /// </exception>
        /// <returns>
        /// <para>The string</para>
        /// <para></para>
        /// </returns>
        public string GetString(TLink stringValue)
        {
            var current = stringValue;
            TLink source;
            for (int i = 0; i < 3; i++)
            {
                source = Links.GetSource(current);
                if (EqualityComparer.Equals(source, StringMarker))
                {
                    var sequence = Links.GetTarget(current);
                    var isEmpty = EqualityComparer.Equals(sequence, EmptyStringMarker);
                    return isEmpty ? "" : UnicodeSequenceToStringConverter.Convert(sequence);
                }
                current = Links.GetTarget(current);
            }
            throw new Exception("The passed link does not contain a string.");
        }

        /// <summary>
        /// <para>
        /// Gets the number using the specified value link.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="valueLink">
        /// <para>The value link.</para>
        /// <para></para>
        /// </param>
        /// <exception cref="Exception">
        /// <para>The passed link does not contain a number.</para>
        /// <para></para>
        /// </exception>
        /// <returns>
        /// <para>The decimal</para>
        /// <para></para>
        /// </returns>
        public decimal GetNumber(TLink valueLink)
        {
            var current = valueLink;
            TLink source;
            TLink target;
            for (int i = 0; i < 3; i++)
            {
                source = Links.GetSource(current);
                target = Links.GetTarget(current);
                if (EqualityComparer.Equals(source, NumberMarker))
                {
                    return RationalToDecimalConverter.Convert(target);
                }
                current = target;
            }
            throw new Exception("The passed link does not contain a number.");
        }


        /// <summary>
        /// <para>
        /// Gets the object using the specified object value link.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="objectValueLink">
        /// <para>The object value link.</para>
        /// <para></para>
```

```
        /// </param>
        /// <exception cref="Exception">
        /// <para>The passed link does not contain an object.</para>
        /// <para></para>
        /// </exception>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink GetObject(TLink objectValueLink)
        {
            var current = objectValueLink;
            TLink source;
            for (int i = 0; i < 3; i++)
            {
                source = Links.GetSource(current);
                if (EqualityComparer.Equals(source, ObjectMarker))
                {
                    return current;
                }
                current = Links.GetTarget(current);
            }
            throw new Exception("The passed link does not contain an object.");
        }

        /// <summary>
        /// <para>
        /// Gets the array using the specified array value link.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="arrayValueLink">
        /// <para>The array value link.</para>
        /// <para></para>
        /// </param>
        /// <exception cref="Exception">
        /// <para>The passed link does not contain an array.</para>
        /// <para></para>
        /// </exception>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink GetArray(TLink arrayValueLink)
        {
            var current = arrayValueLink;
            TLink source;
            for (int i = 0; i < 3; i++)
            {
                source = Links.GetSource(current);
                if (EqualityComparer.Equals(source, ArrayMarker))
                {
                    return current;
                }
                current = Links.GetTarget(current);
            }
            throw new Exception("The passed link does not contain an array.");
        }

        /// <summary>
        /// <para>
        /// Gets the array sequence using the specified array.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="array">
        /// <para>The array.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink GetArraySequence(TLink array) => Links.GetTarget(array);

        /// <summary>
        /// <para>
        /// Gets the value link using the specified parent.
```

```
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="parent">
        /// <para>The parent.</para>
        /// <para></para>
        /// </param>
        /// <exception cref="InvalidOperationException">
        /// <para>More than 1 value found.</para>
        /// <para></para>
        /// </exception>
        /// <exception cref="InvalidOperationException">
        /// <para>The list elements length is negative.</para>
        /// <para></para>
        /// </exception>
        /// <exception cref="InvalidOperationException">
        /// <para>The passed link is not a value.</para>
        /// <para></para>
        /// </exception>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink GetValueLink(TLink parent)
        {
            var query = new Link<TLink>(index: Any, source: parent, target: Any);
            var resultLinks = Links.All(query);
            switch (resultLinks.Count)
            {
                case 0:
                    return default;
                case 1:
                    var resultLinkTarget = Links.GetTarget(resultLinks[0]);
                    if (EqualityComparer.Equals(Links.GetSource(resultLinkTarget), ValueMarker))
                    {
                        return resultLinkTarget;
                    }
                    else
                    {
                        throw new InvalidOperationException("The passed link is not a value.");
                    }
                case > 1:
                    throw new InvalidOperationException("More than 1 value found.");
                default:
                    throw new InvalidOperationException("The list elements length is negative.");
            }
        }

        /// <summary>
        /// <para>
        /// Gets the value marker using the specified value.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="value">
        /// <para>The value.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The target source.</para>
        /// <para></para>
        /// </returns>
        public TLink GetValueMarker(TLink value)
        {
            var target = Links.GetTarget(value);
            var targetSource = Links.GetSource(target);
            if (EqualityComparer.Equals(MeaningRoot, targetSource))
            {
                return target;
            }
            return targetSource;
        }

        /// <summary>
        /// <para>
        /// Gets the members links using the specified object.
        /// </para>
        /// <para></para>
```

```
        /// </summary>
        /// <param name="@object">
        /// <para>The object.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The members.</para>
        /// <para></para>
        /// </returns>
        public List<TLink> GetMembersLinks(TLink @object)
        {
            Link<TLink> query = new(index: Any, source: @object, target: Any);
            List<TLink> members = new();
            Links.Each(objectMemberLink =>
            {
                var memberLink = Links.GetTarget(objectMemberLink);
                var memberMarker = Links.GetSource(memberLink);
                if (EqualityComparer.Equals(memberMarker, MemberMarker))
                {
                    members.Add(Links.GetIndex(objectMemberLink));
                }
                return Links.Constants.Continue;
            }, query);
            return members;
        }
    }
}
```

## 1.2 ./csharp/Platform.Data.Doublets.Json/IJsonStorage.cs

```
using System.Collections.Generic;

#pragma warning disable CS1591 // Missing XML comment for publicly visible type or member

namespace Platform.Data.Doublets.Json
{
    /// <summary>
    /// <para>
    /// Defines the json storage.
    /// </para>
    /// <para></para>
    /// </summary>
    public interface IJsonStorage<TLink>
    {
        /// <summary>
        /// <para>
        /// Gets the links value.
        /// </para>
        /// <para></para>
        /// </summary>
        public ILinks<TLink> Links { get; }
        /// <summary>
        /// <para>
        /// Gets the document marker value.
        /// </para>
        /// <para></para>
        /// </summary>
        public TLink DocumentMarker { get; }
        /// <summary>
        /// <para>
        /// Gets the object marker value.
        /// </para>
        /// <para></para>
        /// </summary>
        public TLink ObjectMarker { get; }
        /// <summary>
        /// <para>
        /// Gets the string marker value.
        /// </para>
        /// <para></para>
        /// </summary>
        public TLink StringMarker { get; }
        /// <summary>
        /// <para>
        /// Gets the empty string marker value.
        /// </para>
        /// <para></para>
        /// </summary>
        public TLink EmptyStringMarker { get; }
```

```
        /// <summary>
        /// <para>
        /// Gets the member marker value.
        /// </para>
        /// <para></para>
        /// </summary>
        public TLink MemberMarker { get; }
        /// <summary>
        /// <para>
        /// Gets the value marker value.
        /// </para>
        /// <para></para>
        /// </summary>
        public TLink ValueMarker { get; }
        /// <summary>
        /// <para>
        /// Gets the number marker value.
        /// </para>
        /// <para></para>
        /// </summary>
        public TLink NumberMarker { get; }
        /// <summary>
        /// <para>
        /// Gets the array marker value.
        /// </para>
        /// <para></para>
        /// </summary>
        public TLink ArrayMarker { get; }
        /// <summary>
        /// <para>
        /// Gets the empty array marker value.
        /// </para>
        /// <para></para>
        /// </summary>
        public TLink EmptyArrayMarker { get; }
        /// <summary>
        /// <para>
        /// Gets the true marker value.
        /// </para>
        /// <para></para>
        /// </summary>
        public TLink TrueMarker { get; }
        /// <summary>
        /// <para>
        /// Gets the false marker value.
        /// </para>
        /// <para></para>
        /// </summary>
        public TLink FalseMarker { get; }
        /// <summary>
        /// <para>
        /// Gets the null marker value.
        /// </para>
        /// <para></para>
        /// </summary>
        public TLink NullMarker { get; }
        /// <summary>
        /// <para>
        /// Creates the string using the specified content.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="content">
        /// <para>The content.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink CreateString(string content);
        /// <summary>
        /// <para>
        /// Creates the string value using the specified content.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="content">
```

```
        /// <para>The content.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink CreateStringValue(string content);
        /// <summary>
        /// <para>
        /// Creates the number using the specified number.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="number">
        /// <para>The number.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink CreateNumber(decimal number);
        /// <summary>
        /// <para>
        /// Creates the number value using the specified number.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="number">
        /// <para>The number.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink CreateNumberValue(decimal number);
        /// <summary>
        /// <para>
        /// Creates the boolean value using the specified value.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="value">
        /// <para>The value.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink CreateBooleanValue(bool value);
        /// <summary>
        /// <para>
        /// Creates the null value.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink CreateNullValue();
        /// <summary>
        /// <para>
        /// Creates the document using the specified name.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="name">
        /// <para>The name.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
```

```
        TLink CreateDocument(string name);
        /// <summary>
        /// <para>
        /// Gets the document or default using the specified name.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="name">
        /// <para>The name.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink GetDocumentOrDefault(string name);
        /// <summary>
        /// <para>
        /// Creates the object.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink CreateObject();
        /// <summary>
        /// <para>
        /// Creates the object value.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink CreateObjectValue();
        /// <summary>
        /// <para>
        /// Creates the array using the specified array.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="array">
        /// <para>The array.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink CreateArray(IList<TLink> array);
        /// <summary>
        /// <para>
        /// Creates the array value using the specified array.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="array">
        /// <para>The array.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink CreateArrayValue(IList<TLink> array) => CreateValue(CreateArray(array));
        /// <summary>
        /// <para>
        /// Creates the array value using the specified array.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="array">
        /// <para>The array.</para>
        /// <para></para>
        /// </param>
```

```
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink CreateArrayValue(TLink array) => CreateValue(array);
        /// <summary>
        /// <para>
        /// Creates the member using the specified name.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="name">
        /// <para>The name.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink CreateMember(string name);
        /// <summary>
        /// <para>
        /// Creates the value using the specified value.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="value">
        /// <para>The value.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink CreateValue(TLink value);
        /// <summary>
        /// <para>
        /// Attaches the source.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="source">
        /// <para>The source.</para>
        /// <para></para>
        /// </param>
        /// <param name="target">
        /// <para>The target.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink Attach(TLink source, TLink target);
        /// <summary>
        /// <para>
        /// Attaches the object using the specified parent.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="parent">
        /// <para>The parent.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink AttachObject(TLink parent);
        /// <summary>
        /// <para>
        /// Attaches the string using the specified parent.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="parent">
        /// <para>The parent.</para>
        /// <para></para>
```

```
        /// </param>
        /// <param name="content">
        /// <para>The content.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink AttachString(TLink parent, string content);
        /// <summary>
        /// <para>
        /// Attaches the number using the specified parent.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="parent">
        /// <para>The parent.</para>
        /// <para></para>
        /// </param>
        /// <param name="number">
        /// <para>The number.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink AttachNumber(TLink parent, decimal number);
        /// <summary>
        /// <para>
        /// Attaches the boolean using the specified parent.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="parent">
        /// <para>The parent.</para>
        /// <para></para>
        /// </param>
        /// <param name="value">
        /// <para>The value.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink AttachBoolean(TLink parent, bool value);
        /// <summary>
        /// <para>
        /// Attaches the null using the specified parent.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="parent">
        /// <para>The parent.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink AttachNull(TLink parent);
        /// <summary>
        /// <para>
        /// Attaches the array using the specified parent.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="parent">
        /// <para>The parent.</para>
        /// <para></para>
        /// </param>
        /// <param name="array">
        /// <para>The array.</para>
        /// <para></para>
        /// </param>
        /// <returns>
```

```
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink AttachArray(TLink parent, IList<TLink> array);
        /// <summary>
        /// <para>
        /// Attaches the member to object using the specified object.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="@object">
        /// <para>The object.</para>
        /// <para></para>
        /// </param>
        /// <param name="keyName">
        /// <para>The key name.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink AttachMemberToObject(TLink @object, string keyName);
        /// <summary>
        /// <para>
        /// Appends the array value using the specified array value.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="arrayValue">
        /// <para>The array value.</para>
        /// <para></para>
        /// </param>
        /// <param name="appendant">
        /// <para>The appendant.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink AppendArrayValue(TLink arrayValue, TLink appendant);
        /// <summary>
        /// <para>
        /// Gets the string using the specified string value.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="stringValue">
        /// <para>The string value.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The string</para>
        /// <para></para>
        /// </returns>
        string GetString(TLink stringValue);
        /// <summary>
        /// <para>
        /// Gets the number using the specified value.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="value">
        /// <para>The value.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The decimal</para>
        /// <para></para>
        /// </returns>
        decimal GetNumber(TLink value);
        /// <summary>
        /// <para>
        /// Gets the object using the specified object value.
        /// </para>
        /// <para></para>
        /// </summary>
```

```
        /// <param name="objectValue">
        /// <para>The object value.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink GetObject(TLink objectValue);
        /// <summary>
        /// <para>
        /// Gets the array using the specified array value link.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="arrayValueLink">
        /// <para>The array value link.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink GetArray(TLink arrayValueLink);
        /// <summary>
        /// <para>
        /// Gets the array sequence using the specified array.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="array">
        /// <para>The array.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink GetArraySequence(TLink array);
        /// <summary>
        /// <para>
        /// Gets the value link using the specified parent.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="parent">
        /// <para>The parent.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink GetValueLink(TLink parent);
        /// <summary>
        /// <para>
        /// Gets the value marker using the specified link.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="link">
        /// <para>The link.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        TLink GetValueMarker(TLink link);
        /// <summary>
        /// <para>
        /// Gets the members links using the specified object.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="@object">
        /// <para>The object.</para>
        /// <para></para>
```

```
596             /// </param>
597             /// <returns>
598             /// <para>A list of t link</para>
599             /// <para></para>
600             /// </returns>
601             List<TLink> GetMembersLinks(TLink @object);
602         }
603     }
```

## 1.3 ./csharp/Platform.Data.Doublets.Json/JsonArrayElementCriterionMatcher.cs

```
1   using System;
2   using System.Collections.Generic;
3   using System.Linq;
4   using System.Text;
5   using System.Threading.Tasks;
6   using System.Text.Json;
7   using System.Threading;
8   using System.IO;
9   using Platform.Converters;
10  using System.Collections;
11  using Platform.Data.Doublets.Sequences;
12  using Platform.Data.Doublets.Sequences.HeightProviders;
13  using Platform.Data.Doublets.Sequences.CriterionMatchers;
14  using Platform.Interfaces;
15
16  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
17
18  namespace Platform.Data.Doublets.Json
19  {
20      /// <summary>
21      /// <para>
22      /// Represents the json array element criterion matcher.
23      /// </para>
24      /// <para></para>
25      /// </summary>
26      /// <seealso cref="ICriterionMatcher{TLink}"/>
27      public class JsonArrayElementCriterionMatcher<TLink> : ICriterionMatcher<TLink>
28      {
29          /// <summary>
30          /// <para>
31          /// The storage.
32          /// </para>
33          /// <para></para>
34          /// </summary>
35          public readonly IJsonStorage<TLink> Storage;
36          /// <summary>
37          /// <para>
38          /// Initializes a new <see cref="JsonArrayElementCriterionMatcher"/> instance.
39          /// </para>
40          /// <para></para>
41          /// </summary>
42          /// <param name="storage">
43          /// <para>A storage.</para>
44          /// <para></para>
45          /// </param>
46          public JsonArrayElementCriterionMatcher(IJsonStorage<TLink> storage) => Storage =
            ↪  storage;
47          /// <summary>
48          /// <para>
49          /// Determines whether this instance is matched.
50          /// </para>
51          /// <para></para>
52          /// </summary>
53          /// <param name="link">
54          /// <para>The link.</para>
55          /// <para></para>
56          /// </param>
57          /// <returns>
58          /// <para>The bool</para>
59          /// <para></para>
60          /// </returns>
61          public bool IsMatched(TLink link) =>
            ↪  EqualityComparer<TLink>.Default.Equals(Storage.Links.GetSource(link),
            ↪  Storage.ValueMarker);
62      }
63  }
```

## 1.4 ./csharp/Platform.Data.Doublets.Json/JsonExporter.cs

```
1   using System;
2   using System.Collections.Generic;
```

```
using System.Text.Json;
using System.Threading;
using Platform.Data.Doublets.Sequences.Walkers;
using Platform.Collections.Stacks;

#pragma warning disable CS1591 // Missing XML comment for publicly visible type or member

namespace Platform.Data.Doublets.Json
{
    /// <summary>
    /// <para>
    /// Represents the json exporter.
    /// </para>
    /// <para></para>
    /// </summary>
    public class JsonExporter<TLink>
    {
        /// <summary>
        /// <para>
        /// The storage.
        /// </para>
        /// <para></para>
        /// </summary>
        public readonly IJsonStorage<TLink> Storage;
        /// <summary>
        /// <para>
        /// The default.
        /// </para>
        /// <para></para>
        /// </summary>
        public readonly EqualityComparer<TLink> EqualityComparer =
        ↪  EqualityComparer<TLink>.Default;

        /// <summary>
        /// <para>
        /// Initializes a new <see cref="JsonExporter"/> instance.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="storage">
        /// <para>A storage.</para>
        /// <para></para>
        /// </param>
        public JsonExporter(IJsonStorage<TLink> storage) => Storage = storage;
            private bool IsElement(TLink link)
        {
            var marker = Storage.Links.GetSource(link);
            return EqualityComparer.Equals(marker, Storage.ValueMarker);
        }
        private void WriteStringValue(in Utf8JsonWriter utf8JsonWriter, TLink valueLink) =>
        ↪  utf8JsonWriter.WriteStringValue(Storage.GetString(valueLink));
        private void WriteString(in Utf8JsonWriter utf8JsonWriter, string parent, TLink
        ↪  valueLink) => utf8JsonWriter.WriteString(parent, Storage.GetString(valueLink));
        private void WriteNumberValue(in Utf8JsonWriter utf8JsonWriter, TLink valueLink) =>
        ↪  utf8JsonWriter.WriteNumberValue(Storage.GetNumber(valueLink));
        private void WriteNumber(in Utf8JsonWriter utf8JsonWriter, string parent, TLink
        ↪  valueLink) => utf8JsonWriter.WriteNumber(parent, Storage.GetNumber(valueLink));
        private void Write(ref Utf8JsonWriter utf8JsonWriter, string parent, TLink valueLink,
        ↪  CancellationToken cancellationToken)
        {
            if (cancellationToken.IsCancellationRequested)
            {
                return;
            }
            var valueMarker = Storage.GetValueMarker(valueLink);
            if (EqualityComparer.Equals(valueMarker, Storage.ObjectMarker))
            {
                utf8JsonWriter.WriteStartObject(parent);
                var membersLinks = Storage.GetMembersLinks(Storage.GetObject(valueLink));
                foreach (var memberLink in membersLinks)
                {
                    if (cancellationToken.IsCancellationRequested)
                    {
                        return;
                    }
                    Write(ref utf8JsonWriter, Storage.GetString(memberLink),
                    ↪  Storage.GetValueLink(memberLink), cancellationToken);
                }
```

```
74                  utf8JsonWriter.WriteEndObject();
75              }
76              else if (EqualityComparer.Equals(valueMarker, Storage.ArrayMarker))
77              {
78                  var array = Storage.GetArray(valueLink);
79                  var sequence = Storage.GetArraySequence(array);
80                  utf8JsonWriter.WriteStartArray(parent);
81                  if (!EqualityComparer.Equals(sequence, Storage.EmptyArrayMarker))
82                  {
83                      RightSequenceWalker<TLink> rightSequenceWalker = new(Storage.Links, new
                        ↪  DefaultStack<TLink>(), IsElement);
84                      var elements = rightSequenceWalker.Walk(sequence);
85                      foreach (var element in elements)
86                      {
87                          if (cancellationToken.IsCancellationRequested)
88                          {
89                              return;
90                          }
91                          Write(ref utf8JsonWriter, element, in cancellationToken);
92                      }
93                  }
94                  utf8JsonWriter.WriteEndArray();
95              }
96              else if (EqualityComparer.Equals(valueMarker, Storage.StringMarker))
97              {
98                  WriteString(in utf8JsonWriter, parent, valueLink);
99              }
100             else if (EqualityComparer.Equals(valueMarker, Storage.NumberMarker))
101             {
102                 WriteNumber(in utf8JsonWriter, parent, valueLink);
103             }
104             else if (EqualityComparer.Equals(valueMarker, Storage.TrueMarker))
105             {
106                 utf8JsonWriter.WriteBoolean(parent, true);
107             }
108             else if (EqualityComparer.Equals(valueMarker, Storage.FalseMarker))
109             {
110                 utf8JsonWriter.WriteBoolean(parent, false);
111             }
112             else if (EqualityComparer.Equals(valueMarker, Storage.NullMarker))
113             {
114                 utf8JsonWriter.WriteNull(parent);
115             }
116         }
117         private void Write(ref Utf8JsonWriter utf8JsonWriter, TLink valueLink, in
            ↪  CancellationToken cancellationToken)
118         {
119             if (cancellationToken.IsCancellationRequested)
120             {
121                 return;
122             }
123             var valueMarker = Storage.GetValueMarker(valueLink);
124             if (EqualityComparer.Equals(valueMarker, Storage.ObjectMarker))
125             {
126                 utf8JsonWriter.WriteStartObject();
127                 var membersLinks = Storage.GetMembersLinks(Storage.GetObject(valueLink));
128                 foreach (var memberLink in membersLinks)
129                 {
130                     if (cancellationToken.IsCancellationRequested)
131                     {
132                         return;
133                     }
134                     Write(ref utf8JsonWriter, Storage.GetString(memberLink),
                        ↪  Storage.GetValueLink(memberLink), cancellationToken);
135                 }
136                 utf8JsonWriter.WriteEndObject();
137             }
138             else if (EqualityComparer.Equals(valueMarker, Storage.ArrayMarker))
139             {
140                 var array = Storage.GetArray(valueLink);
141                 var sequence = Storage.GetArraySequence(array);
142                 utf8JsonWriter.WriteStartArray();
143                 if (!EqualityComparer.Equals(sequence, Storage.EmptyArrayMarker))
144                 {
145                     RightSequenceWalker<TLink> rightSequenceWalker = new(Storage.Links, new
                        ↪  DefaultStack<TLink>(), IsElement);
146                     var elements = rightSequenceWalker.Walk(sequence);
```

```
                    foreach (var element in elements)
                    {
                        if (cancellationToken.IsCancellationRequested)
                        {
                            return;
                        }
                        Write(ref utf8JsonWriter, element, in cancellationToken);
                    }
                }
                utf8JsonWriter.WriteEndArray();
            }
            else if (EqualityComparer.Equals(valueMarker, Storage.StringMarker))
            {
                WriteStringValue(in utf8JsonWriter, valueLink);
            }
            else if (EqualityComparer.Equals(valueMarker, Storage.NumberMarker))
            {
                WriteNumberValue(in utf8JsonWriter, valueLink);
            }
            else if (EqualityComparer.Equals(valueMarker, Storage.TrueMarker))
            {
                utf8JsonWriter.WriteBooleanValue(true);
            }
            else if (EqualityComparer.Equals(valueMarker, Storage.FalseMarker))
            {
                utf8JsonWriter.WriteBooleanValue(false);
            }
            else if (EqualityComparer.Equals(valueMarker, Storage.NullMarker))
            {
                utf8JsonWriter.WriteNullValue();
            }
        }

        /// <summary>
        /// <para>
        /// Exports the document.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="document">
        /// <para>The document.</para>
        /// <para></para>
        /// </param>
        /// <param name="utf8JsonWriter">
        /// <para>The utf json writer.</para>
        /// <para></para>
        /// </param>
        /// <param name="cancellationToken">
        /// <para>The cancellation token.</para>
        /// <para></para>
        /// </param>
        /// <exception cref="Exception">
        /// <para>No document with this name exists</para>
        /// <para></para>
        /// </exception>
        public void Export(TLink document, ref Utf8JsonWriter utf8JsonWriter, in
        ↪  CancellationToken cancellationToken)
        {
            if (EqualityComparer.Equals(document, default))
            {
                throw new Exception("No document with this name exists");
            }
            var valueLink = Storage.GetValueLink(document);
            Write(ref utf8JsonWriter, valueLink, in cancellationToken);
            utf8JsonWriter.Flush();
        }

        /// <summary>
        /// <para>
        /// Exports the document name.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="documentName">
        /// <para>The document name.</para>
        /// <para></para>
        /// </param>
        /// <param name="utf8JsonWriter">
```

```
224         /// <para>The utf json writer.</para>
225         /// <para></para>
226         /// </param>
227         /// <param name="cancellationToken">
228         /// <para>The cancellation token.</para>
229         /// <para></para>
230         /// </param>
231         public void Export(string documentName, Utf8JsonWriter utf8JsonWriter, CancellationToken
            ↪ cancellationToken) => Export(Storage.GetDocumentOrDefault(documentName), ref
            ↪ utf8JsonWriter, in cancellationToken);
232     }
233 }
```

## 1.5 ./csharp/Platform.Data.Doublets.Json/JsonExporterCli.cs

```
1  using System;
2  using System.IO;
3  using System.Text.Encodings.Web;
4  using Platform.Data.Doublets.Memory.United.Generic;
5  using Platform.IO;
6  using System.Text.Json;
7  using Platform.Data.Doublets.Memory;
8  using Platform.Data.Doublets.Sequences.Converters;
9  using Platform.Memory;
10
11 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
12
13 namespace Platform.Data.Doublets.Json
14 {
15     /// <summary>
16     /// <para>
17     /// Represents the json exporter cli.
18     /// </para>
19     /// <para></para>
20     /// </summary>
21     public class JsonExporterCli<TLink>
22         where TLink : struct
23     {
24         /// <summary>
25         /// <para>
26         /// Runs the args.
27         /// </para>
28         /// <para></para>
29         /// </summary>
30         /// <param name="args">
31         /// <para>The args.</para>
32         /// <para></para>
33         /// </param>
34         public void Run(params string[] args)
35         {
36             var argumentIndex = 0;
37             var linksFilePath = ConsoleHelpers.GetOrReadArgument(argumentIndex++, "Links file
                ↪ path", args);
38             var jsonFilePath = ConsoleHelpers.GetOrReadArgument(argumentIndex++, "JSON file
                ↪ path", args);
39             var defaultDocumentName = Path.GetFileNameWithoutExtension(jsonFilePath);
40             var documentName = ConsoleHelpers.GetOrReadArgument(argumentIndex, $"Document name
                ↪ (default: {defaultDocumentName})", args);
41             if (string.IsNullOrWhiteSpace(documentName))
42             {
43                 documentName = defaultDocumentName;
44             }
45             if (!File.Exists(linksFilePath))
46             {
47                 Console.WriteLine($"${linksFilePath} file does not exist.");
48             }
49             using FileStream jsonFileStream = new(jsonFilePath, FileMode.Append);
50             JsonWriterOptions utf8JsonWriterOptions = new()
51             {
52                 Encoder = JavaScriptEncoder.UnsafeRelaxedJsonEscaping,
53                 Indented = true
54             };
55             Utf8JsonWriter utf8JsonWriter = new(jsonFileStream, utf8JsonWriterOptions);
56             var linksConstants = new LinksConstants<TLink>(enableExternalReferencesSupport:
                ↪ true);
57             using UnitedMemoryLinks<TLink> memoryAdapter = new (new
                ↪ FileMappedResizableDirectMemory(linksFilePath),
                ↪ UnitedMemoryLinks<TLink>.DefaultLinksSizeStep, linksConstants,
                ↪ IndexTreeType.Default);
58             var links = memoryAdapter.DecorateWithAutomaticUniquenessAndUsagesResolution();
```

```
            BalancedVariantConverter<TLink> balancedVariantConverter = new(links);
            var storage = new DefaultJsonStorage<TLink>(links, balancedVariantConverter);
            var exporter = new JsonExporter<TLink>(storage);
            var document = storage.GetDocumentOrDefault(documentName);
            if (storage.EqualityComparer.Equals(document, default))
            {
                Console.WriteLine("No document with this name.");
            }
            using ConsoleCancellation cancellation = new ();
            var cancellationToken = cancellation.Token;
            Console.WriteLine("Press CTRL+C to stop.");
            try
            {
                exporter.Export(document, ref utf8JsonWriter, in cancellationToken);
            }
            catch (Exception exception)
            {
                Console.WriteLine(exception);
                return;
            }
            finally
            {
                utf8JsonWriter.Dispose();
            }
            Console.WriteLine("Export completed successfully.");
        }
    }
}
```

## 1.6 ./csharp/Platform.Data.Doublets.Json/JsonImporter.cs

```
using System;
using System.Collections.Generic;
using System.Text.Json;
using System.Threading;

#pragma warning disable CS1591 // Missing XML comment for publicly visible type or member

namespace Platform.Data.Doublets.Json
{
    /// <summary>
    /// <para>
    /// Represents the json importer.
    /// </para>
    /// <para></para>
    /// </summary>
    public class JsonImporter<TLink>
    {
        /// <summary>
        /// <para>
        /// The storage.
        /// </para>
        /// <para></para>
        /// </summary>
        public readonly IJsonStorage<TLink> Storage;
        /// <summary>
        /// <para>
        /// The default.
        /// </para>
        /// <para></para>
        /// </summary>
        public readonly EqualityComparer<TLink> EqualityComparer =
        ↪  EqualityComparer<TLink>.Default;
        /// <summary>
        /// <para>
        /// The parents.
        /// </para>
        /// <para></para>
        /// </summary>
        public readonly Stack<TLink> Parents = new ();
        /// <summary>
        /// <para>
        /// Initializes a new <see cref="JsonImporter"/> instance.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="storage">
        /// <para>A storage.</para>
        /// <para></para>
        /// </param>
```

```
49          public JsonImporter(IJsonStorage<TLink> storage) => Storage = storage;
50              private void PopIfParentIsMember()
51          {
52              var parent = Parents.Peek();
53              var parentMarker = Storage.GetValueMarker(parent);
54              if (EqualityComparer.Equals(parentMarker, Storage.MemberMarker))
55              {
56                  Parents.Pop();
57              }
58          }
59
60          /// <summary>
61          /// <para>
62          /// Imports the document name.
63          /// </para>
64          /// <para></para>
65          /// </summary>
66          /// <param name="documentName">
67          /// <para>The document name.</para>
68          /// <para></para>
69          /// </param>
70          /// <param name="utf8JsonReader">
71          /// <para>The utf json reader.</para>
72          /// <para></para>
73          /// </param>
74          /// <param name="cancellationToken">
75          /// <para>The cancellation token.</para>
76          /// <para></para>
77          /// </param>
78          /// <exception cref="Exception">
79          /// <para>The document with the specified name already exists.</para>
80          /// <para></para>
81          /// </exception>
82          /// <returns>
83          /// <para>The document.</para>
84          /// <para></para>
85          /// </returns>
86          public TLink Import(string documentName, ref Utf8JsonReader utf8JsonReader, in
            ↪ CancellationToken cancellationToken)
87          {
88              Parents.Clear();
89              if (!EqualityComparer.Equals(Storage.GetDocumentOrDefault(documentName), default))
90              {
91                  throw new Exception("The document with the specified name already exists.");
92              }
93              var document = Storage.CreateDocument(documentName);
94              Parents.Push(document);
95              TLink parent;
96              TLink parentMarker;
97              JsonTokenType tokenType;
98              TLink value;
99              TLink newParentArray;
100             while (utf8JsonReader.Read())
101             {
102                 cancellationToken.ThrowIfCancellationRequested();
103                 parent = Parents.Peek();
104                 parentMarker = Storage.GetValueMarker(parent);
105                 tokenType = utf8JsonReader.TokenType;
106                 if (utf8JsonReader.TokenType == JsonTokenType.PropertyName)
107                 {
108                     var @object = Storage.GetObject(parent);
109                     var property = utf8JsonReader.GetString();
110                     Parents.Push(Storage.AttachMemberToObject(@object, property));
111                 }
112                 switch (tokenType)
113                 {
114                     case JsonTokenType.StartObject:
115                     {
116                         value = Storage.CreateObjectValue();
117                         if (EqualityComparer.Equals(parentMarker, Storage.ArrayMarker))
118                         {
119                             Parents.Pop();
120                             newParentArray = Storage.AppendArrayValue(parent, value);
121                             Parents.Push(newParentArray);
122                             Parents.Push(value);
123                         }
124                         else
125                         {
```

```
                    var @object = Storage.Attach(parent, value);
                    Parents.Push(@object);
                }
                break;
            }
            case JsonTokenType.EndObject:
                Parents.Pop();
                break;
            case JsonTokenType.StartArray:
                value = Storage.CreateArrayValue(Array.Empty<TLink>());
                Parents.Push(value);
                break;
            case JsonTokenType.EndArray:
            {
                var arrayValue = Parents.Pop();
                parent = Parents.Peek();
                parentMarker = Storage.GetValueMarker(parent);
                if (EqualityComparer.Equals(parentMarker, Storage.ArrayMarker))
                {
                    Parents.Pop();
                    newParentArray = Storage.AppendArrayValue(parent, arrayValue);
                    Parents.Push(newParentArray);
                }
                Storage.Attach(parent, arrayValue);
                break;
            }
            case JsonTokenType.String:
            {
                var @string = utf8JsonReader.GetString();
                value = Storage.CreateStringValue(@string);
                if (EqualityComparer.Equals(parentMarker, Storage.ArrayMarker))
                {
                    Parents.Pop();
                    newParentArray = Storage.AppendArrayValue(parent, value);
                    Parents.Push(newParentArray);
                }
                else
                {
                    Storage.Attach(parent, value);
                }
                break;
            }
            case JsonTokenType.Number:
            {
                value = Storage.CreateNumberValue(utf8JsonReader.GetDecimal());
                if (EqualityComparer.Equals(parentMarker, Storage.ArrayMarker))
                {
                    Parents.Pop();
                    newParentArray = Storage.AppendArrayValue(parent, value);
                    Parents.Push(newParentArray);
                }
                else
                {
                    Storage.Attach(parent, value);
                }
                break;
            }
            case JsonTokenType.True:
            {
                value = Storage.CreateBooleanValue(true);
                if (EqualityComparer.Equals(parentMarker, Storage.ArrayMarker))
                {
                    Parents.Pop();
                    newParentArray = Storage.AppendArrayValue(parent, value);
                    Parents.Push(newParentArray);
                }
                else
                {
                    Storage.Attach(parent, value);
                }
                break;
            }
            case JsonTokenType.False:
            {
                value = Storage.CreateBooleanValue(false);
                if (EqualityComparer.Equals(parentMarker, Storage.ArrayMarker))
                {
                    Parents.Pop();
                    newParentArray = Storage.AppendArrayValue(parent, value);
```

```
                            Parents.Push(newParentArray);
                        }
                        else
                        {
                            Storage.Attach(parent, value);
                        }
                        break;
                    }
                    case JsonTokenType.Null:
                    {
                        value = Storage.CreateNullValue();
                        if (EqualityComparer.Equals(parentMarker, Storage.ArrayMarker))
                        {
                            Parents.Pop();
                            newParentArray = Storage.AppendArrayValue(parent, value);
                            Parents.Push(newParentArray);
                        }
                        else
                        {
                            Storage.Attach(parent, value);
                        }
                        break;
                    }
                }
                if (tokenType != JsonTokenType.PropertyName && tokenType !=
                ↪  JsonTokenType.StartObject && tokenType != JsonTokenType.StartArray)
                {
                    PopIfParentIsMember();
                }
            }
            return document;
        }
    }
}
```

## 1.7 ./csharp/Platform.Data.Doublets.Json/JsonImporterCli.cs

```
using System;
using System.IO;
using System.Text;
using Platform.Data.Doublets.Memory.United.Generic;
using Platform.IO;
using System.Text.Json;
using Platform.Data.Doublets.Memory;
using Platform.Data.Doublets.Sequences.Converters;
using Platform.Memory;

#pragma warning disable CS1591 // Missing XML comment for publicly visible type or member

namespace Platform.Data.Doublets.Json
{
    /// <summary>
    /// <para>
    /// Represents the json importer cli.
    /// </para>
    /// <para></para>
    /// </summary>
    public class JsonImporterCli<TLink>
        where TLink : struct
    {
        /// <summary>
        /// <para>
        /// Runs the args.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="args">
        /// <para>The args.</para>
        /// <para></para>
        /// </param>
        public void Run(params string[] args)
        {
            var argumentIndex = 0;
            var jsonFilePath = ConsoleHelpers.GetOrReadArgument(argumentIndex++, "JSON file
            ↪  path", args);
            var linksFilePath = ConsoleHelpers.GetOrReadArgument(argumentIndex++, "Links file
            ↪  path", args);
            var defaultDocumentName = Path.GetFileNameWithoutExtension(jsonFilePath);
            var documentName = ConsoleHelpers.GetOrReadArgument(argumentIndex, $"Document name
            ↪  (default: {defaultDocumentName})", args);
```

```
            if (string.IsNullOrWhiteSpace(documentName))
            {
                documentName = defaultDocumentName;
            }
            if (!File.Exists(jsonFilePath))
            {
                Console.WriteLine($"${jsonFilePath} file does not exist.");
            }
            var json = File.ReadAllText(jsonFilePath);
            var encodedJson = Encoding.UTF8.GetBytes(json);
            ReadOnlySpan<byte> readOnlySpanEncodedJson = new(encodedJson);
            Utf8JsonReader utf8JsonReader = new(readOnlySpanEncodedJson);
            LinksConstants<TLink> linksConstants = new(enableExternalReferencesSupport: true);
            FileMappedResizableDirectMemory fileMappedResizableDirectMemory = new(linksFilePath);
            var unitedMemoryLinks = UnitedMemoryLinks<TLink>.DefaultLinksSizeStep;
            const IndexTreeType indexTreeType = IndexTreeType.Default;
            using UnitedMemoryLinks<TLink> memoryAdapter = new(fileMappedResizableDirectMemory,
            ↪  unitedMemoryLinks, linksConstants, indexTreeType);
            var links = memoryAdapter.DecorateWithAutomaticUniquenessAndUsagesResolution();
            BalancedVariantConverter<TLink> balancedVariantConverter = new(links);
            DefaultJsonStorage<TLink> storage = new(links, balancedVariantConverter);
            JsonImporter<TLink> importer = new(storage);
            using ConsoleCancellation cancellation = new();
            var cancellationToken = cancellation.Token;
            Console.WriteLine("Press CTRL+C to stop.");
            try
            {
                importer.Import(documentName, ref utf8JsonReader, in cancellationToken);
            }
            catch (Exception exception)
            {
                Console.WriteLine(exception);
                return;
            }
            Console.WriteLine("Import completed successfully.");
        }
    }
}
```

## 1.8 ./csharp/Platform.Data.Doublets.Json.Tests/JsonImportAndExportTests.cs

```
using System.Text;
using System.Text.Json;
using System.Threading;
using System.IO;
using Xunit;
using TLink = System.UInt64;
using Platform.Data.Doublets.Memory.United.Generic;
using Platform.Memory;
using Platform.Data.Doublets.Memory;
using System.Text.RegularExpressions;
using Platform.Data.Doublets.Sequences.Converters;

namespace Platform.Data.Doublets.Json.Tests
{
    /// <summary>
    /// <para>
    /// Represents the json import and export tests.
    /// </para>
    /// <para></para>
    /// </summary>
    public class JsonImportAndExportTests
    {
        /// <summary>
        /// <para>
        /// The balanced variant converter.
        /// </para>
        /// <para></para>
        /// </summary>
        public static BalancedVariantConverter<TLink> BalancedVariantConverter;

        /// <summary>
        /// <para>
        /// Creates the links.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <returns>
        /// <para>A links of t link</para>
        /// <para></para>
```

```
        /// </returns>
        public static ILinks<TLink> CreateLinks() => CreateLinks<TLink>(new IO.TemporaryFile());

        /// <summary>
        /// <para>
        /// Creates the links using the specified data db filename.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <typeparam name="TLink">
        /// <para>The link.</para>
        /// <para></para>
        /// </typeparam>
        /// <param name="dataDBFilename">
        /// <para>The data db filename.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>A links of t link</para>
        /// <para></para>
        /// </returns>
        public static ILinks<TLink> CreateLinks<TLink>(string dataDBFilename)
        {
            var linksConstants = new LinksConstants<TLink>(enableExternalReferencesSupport:
            ↪  true);
            return new UnitedMemoryLinks<TLink>(new
            ↪  FileMappedResizableDirectMemory(dataDBFilename),
            ↪  UnitedMemoryLinks<TLink>.DefaultLinksSizeStep, linksConstants,
            ↪  IndexTreeType.Default);
        }

        /// <summary>
        /// <para>
        /// Creates the json storage using the specified links.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="links">
        /// <para>The links.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>A default json storage of t link</para>
        /// <para></para>
        /// </returns>
        public static DefaultJsonStorage<TLink> CreateJsonStorage(ILinks<TLink> links) => new
        ↪  (links, BalancedVariantConverter);

        /// <summary>
        /// <para>
        /// Imports the storage.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="storage">
        /// <para>The storage.</para>
        /// <para></para>
        /// </param>
        /// <param name="documentName">
        /// <para>The document name.</para>
        /// <para></para>
        /// </param>
        /// <param name="json">
        /// <para>The json.</para>
        /// <para></para>
        /// </param>
        /// <returns>
        /// <para>The link</para>
        /// <para></para>
        /// </returns>
        public TLink Import(IJsonStorage<TLink> storage, string documentName, byte[] json)
        {
            Utf8JsonReader utf8JsonReader = new(json);
            JsonImporter<TLink> jsonImporter = new(storage);
            CancellationTokenSource importCancellationTokenSource = new();
            CancellationToken cancellationToken = importCancellationTokenSource.Token;
            return jsonImporter.Import(documentName, ref utf8JsonReader, in cancellationToken);
        }
```

```
113
114         /// <summary>
115         /// <para>
116         /// Exports the document link.
117         /// </para>
118         /// <para></para>
119         /// </summary>
120         /// <param name="documentLink">
121         /// <para>The document link.</para>
122         /// <para></para>
123         /// </param>
124         /// <param name="storage">
125         /// <para>The storage.</para>
126         /// <para></para>
127         /// </param>
128         /// <param name="stream">
129         /// <para>The stream.</para>
130         /// <para></para>
131         /// </param>
132         public void Export(TLink documentLink, IJsonStorage<TLink> storage, in MemoryStream
            ↪ stream)
133         {
134             Utf8JsonWriter writer = new(stream);
135             JsonExporter<TLink> jsonExporter = new(storage);
136             CancellationTokenSource exportCancellationTokenSource = new();
137             CancellationToken exportCancellationToken = exportCancellationTokenSource.Token;
138             jsonExporter.Export(documentLink, ref writer, in exportCancellationToken);
139             writer.Dispose();
140         }
141
142         /// <summary>
143         /// <para>
144         /// Tests that test.
145         /// </para>
146         /// <para></para>
147         /// </summary>
148         /// <param name="initialJson">
149         /// <para>The initial json.</para>
150         /// <para></para>
151         /// </param>
152         [Theory]
153         [InlineData("{}")]
154         [InlineData("\"stringValue\"")]
155         [InlineData("228")]
156         [InlineData("0.5")]
157         [InlineData("[]")]
158         [InlineData("true")]
159         [InlineData("false")]
160         [InlineData("null")]
161         [InlineData("{ \"string\": \"string\" }")]
162         [InlineData("{ \"null\": null }")]
163         [InlineData("{ \"boolean\": false }")]
164         [InlineData("{ \"boolean\": true }")]
165         [InlineData("{ \"array\": [] }")]
166         [InlineData("{ \"array\": [1] }")]
167         [InlineData("{ \"object\": {} }")]
168         [InlineData("{ \"number\": 1 }")]
169         [InlineData("{ \"decimal\": 0.5 }")]
170         [InlineData("[null]")]
171         [InlineData("[true]")]
172         [InlineData("[false]")]
173         [InlineData("[[]]")]
174         [InlineData("[[1]]")]
175         [InlineData("[[0.5]]")]
176         [InlineData("[{}]")]
177         [InlineData("[\"The Venus Project\"]")]
178         [InlineData("[{ \"title\": \"The Venus Project\" }]")]
179         [InlineData("[1,2,3,4]")]
180         [InlineData("[-0.5, 0.5]")]
181         public void Test(string initialJson)
182         {
183             var links = CreateLinks();
184             BalancedVariantConverter = new(links);
185             var storage = CreateJsonStorage(links);
186             var json = Encoding.UTF8.GetBytes(initialJson);
187             var documentLink = Import(storage, "documentName", json);
188             MemoryStream stream = new();
189             Export(documentLink, storage, in stream);
```

```
            string exportedJson = Encoding.UTF8.GetString(stream.ToArray());
            stream.Dispose();
            var minimizedInitialJson = Regex.Replace(initialJson,
            ↪  "(\"(?:[^\"\\\\]|\\\\.)*\")|\\s+", "$1");
            Assert.Equal(minimizedInitialJson, exportedJson);
        }
    }
}
```

## 1.9 ./csharp/Platform.Data.Doublets.Json.Tests/JsonStorageTests.cs

```
using Xunit;
using Platform.Data.Doublets.Memory.United.Generic;
using Platform.Data.Doublets.Memory;
using Platform.Memory;
using TLink = System.UInt32;
using Xunit.Abstractions;
using Platform.Collections.Stacks;
using Platform.Data.Doublets.Sequences.Walkers;
using System.Collections.Generic;
using Platform.Data.Doublets.Sequences.Converters;

namespace Platform.Data.Doublets.Json.Tests
{
    /// <summary>
    /// <para>
    /// Represents the json storage tests.
    /// </para>
    /// <para></para>
    /// </summary>
    public class JsonStorageTests
    {
        private readonly ITestOutputHelper output;
        /// <summary>
        /// <para>
        /// The balanced variant converter.
        /// </para>
        /// <para></para>
        /// </summary>
        public static BalancedVariantConverter<TLink> BalancedVariantConverter;

        /// <summary>
        /// <para>
        /// Initializes a new <see cref="JsonStorageTests"/> instance.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <param name="output">
        /// <para>A output.</para>
        /// <para></para>
        /// </param>
        public JsonStorageTests(ITestOutputHelper output)
        {
            this.output = output;
        }

        /// <summary>
        /// <para>
        /// Creates the links.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <returns>
        /// <para>A links of t link</para>
        /// <para></para>
        /// </returns>
        public static ILinks<TLink> CreateLinks() => CreateLinks<TLink>(new
        ↪  Platform.IO.TemporaryFile());

        /// <summary>
        /// <para>
        /// Creates the links using the specified data db filename.
        /// </para>
        /// <para></para>
        /// </summary>
        /// <typeparam name="TLink">
        /// <para>The link.</para>
        /// <para></para>
        /// </typeparam>
        /// <param name="dataDBFilename">
```

```
69          /// <para>The data db filename.</para>
70          /// <para></para>
71          /// </param>
72          /// <returns>
73          /// <para>A links of t link</para>
74          /// <para></para>
75          /// </returns>
76          public static ILinks<TLink> CreateLinks<TLink>(string dataDBFilename)
77          {
78              var linksConstants = new LinksConstants<TLink>(enableExternalReferencesSupport:
                ↪  true);
79              return new UnitedMemoryLinks<TLink>(new
                ↪  FileMappedResizableDirectMemory(dataDBFilename),
                ↪  UnitedMemoryLinks<TLink>.DefaultLinksSizeStep, linksConstants,
                ↪  IndexTreeType.Default);
80          }
81
82          /// <summary>
83          /// <para>
84          /// Creates the json storage.
85          /// </para>
86          /// <para></para>
87          /// </summary>
88          /// <returns>
89          /// <para>A default json storage of t link</para>
90          /// <para></para>
91          /// </returns>
92          public static DefaultJsonStorage<TLink> CreateJsonStorage()
93          {
94              var links = CreateLinks();
95              return CreateJsonStorage(links);
96          }
97
98          /// <summary>
99          /// <para>
100         /// Creates the json storage using the specified links.
101         /// </para>
102         /// <para></para>
103         /// </summary>
104         /// <param name="links">
105         /// <para>The links.</para>
106         /// <para></para>
107         /// </param>
108         /// <returns>
109         /// <para>A default json storage of t link</para>
110         /// <para></para>
111         /// </returns>
112         public static DefaultJsonStorage<TLink> CreateJsonStorage(ILinks<TLink> links)
113         {
114             BalancedVariantConverter = new(links);
115             return new DefaultJsonStorage<TLink>(links, BalancedVariantConverter);
116         }
117
118         /// <summary>
119         /// <para>
120         /// Tests that constructors test.
121         /// </para>
122         /// <para></para>
123         /// </summary>
124         [Fact]
125         public void ConstructorsTest() => CreateJsonStorage();
126
127         /// <summary>
128         /// <para>
129         /// Tests that create document test.
130         /// </para>
131         /// <para></para>
132         /// </summary>
133         [Fact]
134         public void CreateDocumentTest()
135         {
136             var defaultJsonStorage = CreateJsonStorage();
137             defaultJsonStorage.CreateDocument("documentName");
138         }
139
140         /// <summary>
141         /// <para>
142         /// Tests that get document test.
```

```
        /// </para>
        /// <para></para>
        /// </summary>
        [Fact]
        public void GetDocumentTest()
        {
            var defaultJsonStorage = CreateJsonStorage();
            var createdDocumentLink = defaultJsonStorage.CreateDocument("documentName");
            var foundDocumentLink = defaultJsonStorage.GetDocumentOrDefault("documentName");
            Assert.Equal(createdDocumentLink, foundDocumentLink);
        }

        /// <summary>
        /// <para>
        /// Tests that create object test.
        /// </para>
        /// <para></para>
        /// </summary>
        [Fact]
        public void CreateObjectTest()
        {
            var defaultJsonStorage = CreateJsonStorage();
            var object0 = defaultJsonStorage.CreateObjectValue();
            var object1 = defaultJsonStorage.CreateObjectValue();
            Assert.NotEqual(object0, object1);
        }

        /// <summary>
        /// <para>
        /// Tests that create string test.
        /// </para>
        /// <para></para>
        /// </summary>
        [Fact]
        public void CreateStringTest()
        {
            var defaultJsonStorage = CreateJsonStorage();
            defaultJsonStorage.CreateString("string");
        }

        /// <summary>
        /// <para>
        /// Tests that create member test.
        /// </para>
        /// <para></para>
        /// </summary>
        [Fact]
        public void CreateMemberTest()
        {
            var defaultJsonStorage = CreateJsonStorage();
            var document = defaultJsonStorage.CreateDocument("documentName");
            defaultJsonStorage.AttachObject(document);
            defaultJsonStorage.CreateMember("keyName");
        }

        /// <summary>
        /// <para>
        /// Tests that attach object value to document test.
        /// </para>
        /// <para></para>
        /// </summary>
        [Fact]
        public void AttachObjectValueToDocumentTest()
        {
            var links = CreateLinks();
            var defaultJsonStorage =CreateJsonStorage(links);
            TLink document = defaultJsonStorage.CreateDocument("documentName");
            TLink documentValueLink = defaultJsonStorage.AttachObject(document);
            TLink createdObjectValue = links.GetTarget(documentValueLink);

            TLink valueMarker = links.GetSource(createdObjectValue);
            Assert.Equal(valueMarker, defaultJsonStorage.ValueMarker);

            TLink createdObject = links.GetTarget(createdObjectValue);
            TLink objectMarker = links.GetSource(createdObject);
            Assert.Equal(objectMarker, defaultJsonStorage.ObjectMarker);

            TLink foundDocumentValue = defaultJsonStorage.GetValueLink(document);
```

```
            Assert.Equal(createdObjectValue, foundDocumentValue);
        }

        /// <summary>
        /// <para>
        /// Tests that attach string value to document test.
        /// </para>
        /// <para></para>
        /// </summary>
        [Fact]
        public void AttachStringValueToDocumentTest()
        {
            var links = CreateLinks();
            var defaultJsonStorage =CreateJsonStorage(links);
            TLink document = defaultJsonStorage.CreateDocument("documentName");
            TLink documentStringLink = defaultJsonStorage.AttachString(document, "stringName");
            TLink createdStringValue = links.GetTarget(documentStringLink);

            TLink valueMarker = links.GetSource(createdStringValue);
            Assert.Equal(valueMarker, defaultJsonStorage.ValueMarker);

            TLink createdString = links.GetTarget(createdStringValue);
            TLink stringMarker = links.GetSource(createdString);
            Assert.Equal(stringMarker, defaultJsonStorage.StringMarker);

            TLink foundStringValue = defaultJsonStorage.GetValueLink(document);
            Assert.Equal(createdStringValue, foundStringValue);
        }

        /// <summary>
        /// <para>
        /// Tests that attach number to document test.
        /// </para>
        /// <para></para>
        /// </summary>
        [Fact]
        public void AttachNumberToDocumentTest()
        {
            var links = CreateLinks();
            var defaultJsonStorage = CreateJsonStorage(links);
            TLink document = defaultJsonStorage.CreateDocument("documentName");
            TLink documentNumberLink = defaultJsonStorage.AttachNumber(document, 2021);
            TLink createdNumberValue = links.GetTarget(documentNumberLink);

            TLink valueMarker = links.GetSource(createdNumberValue);
            Assert.Equal(valueMarker, defaultJsonStorage.ValueMarker);

            TLink createdNumber = links.GetTarget(createdNumberValue);
            TLink numberMarker = links.GetSource(createdNumber);
            Assert.Equal(numberMarker, defaultJsonStorage.NumberMarker);

            TLink foundNumberValue = defaultJsonStorage.GetValueLink(document);
            Assert.Equal(createdNumberValue, foundNumberValue);
        }

        /// <summary>
        /// <para>
        /// Tests that attach true value to document test.
        /// </para>
        /// <para></para>
        /// </summary>
        [Fact]
        public void AttachTrueValueToDocumentTest()
        {
            var links = CreateLinks();
            var defaultJsonStorage =CreateJsonStorage(links);
            TLink document = defaultJsonStorage.CreateDocument("documentName");

            TLink documentTrueValueLink = defaultJsonStorage.AttachBoolean(document, true);
            TLink createdTrueValue = links.GetTarget(documentTrueValueLink);

            TLink valueMarker = links.GetSource(createdTrueValue);
            Assert.Equal(valueMarker, defaultJsonStorage.ValueMarker);

            TLink trueMarker = links.GetTarget(createdTrueValue);
            Assert.Equal(trueMarker, defaultJsonStorage.TrueMarker);

            TLink foundTrueValue = defaultJsonStorage.GetValueLink(document);
            Assert.Equal(createdTrueValue, foundTrueValue);
```

```
300         }
301
302         /// <summary>
303         /// <para>
304         /// Tests that attach false value to document test.
305         /// </para>
306         /// <para></para>
307         /// </summary>
308         [Fact]
309         public void AttachFalseValueToDocumentTest()
310         {
311             var links = CreateLinks();
312             var defaultJsonStorage =CreateJsonStorage(links);
313             TLink document = defaultJsonStorage.CreateDocument("documentName");
314
315             TLink documentFalseValueLink = defaultJsonStorage.AttachBoolean(document, false);
316             TLink createdFalseValue = links.GetTarget(documentFalseValueLink);
317
318             TLink valueMarker = links.GetSource(createdFalseValue);
319             Assert.Equal(valueMarker, defaultJsonStorage.ValueMarker);
320
321             TLink falseMarker = links.GetTarget(createdFalseValue);
322             Assert.Equal(falseMarker, defaultJsonStorage.FalseMarker);
323
324             TLink foundFalseValue = defaultJsonStorage.GetValueLink(document);
325             Assert.Equal(createdFalseValue, foundFalseValue);
326         }
327
328         /// <summary>
329         /// <para>
330         /// Tests that attach null value to document test.
331         /// </para>
332         /// <para></para>
333         /// </summary>
334         [Fact]
335         public void AttachNullValueToDocumentTest()
336         {
337             var links = CreateLinks();
338             var defaultJsonStorage =CreateJsonStorage(links);
339             TLink document = defaultJsonStorage.CreateDocument("documentName");
340
341             TLink documentNullValueLink = defaultJsonStorage.AttachNull(document);
342             TLink createdNullValue = links.GetTarget(documentNullValueLink);
343
344             TLink valueMarker = links.GetSource(createdNullValue);
345             Assert.Equal(valueMarker, defaultJsonStorage.ValueMarker);
346
347             TLink nullMarker = links.GetTarget(createdNullValue);
348             Assert.Equal(nullMarker, defaultJsonStorage.NullMarker);
349
350             TLink foundNullValue = defaultJsonStorage.GetValueLink(document);
351             Assert.Equal(createdNullValue, foundNullValue);
352         }
353
354         /// <summary>
355         /// <para>
356         /// Tests that attach empty array value to document test.
357         /// </para>
358         /// <para></para>
359         /// </summary>
360         [Fact]
361         public void AttachEmptyArrayValueToDocumentTest()
362         {
363             var links = CreateLinks();
364             var defaultJsonStorage =CreateJsonStorage(links);
365             TLink document = defaultJsonStorage.CreateDocument("documentName");
366
367             TLink documentArrayValueLink = defaultJsonStorage.AttachArray(document, new
                ↪  TLink[0]);
368             TLink createdArrayValue = links.GetTarget(documentArrayValueLink);
369             output.WriteLine(links.Format(createdArrayValue));
370
371
372             TLink valueMarker = links.GetSource(createdArrayValue);
373             Assert.Equal(valueMarker, defaultJsonStorage.ValueMarker);
374
375             TLink createdArrayLink = links.GetTarget(createdArrayValue);
376             TLink arrayMarker = links.GetSource(createdArrayLink);
377             Assert.Equal(arrayMarker, defaultJsonStorage.ArrayMarker);
```

```
            TLink createArrayContents = links.GetTarget(createdArrayLink);
            Assert.Equal(createArrayContents, defaultJsonStorage.EmptyArrayMarker);

            TLink foundArrayValue = defaultJsonStorage.GetValueLink(document);
            Assert.Equal(createdArrayValue, foundArrayValue);
        }

        /// <summary>
        /// <para>
        /// Tests that attach array value to document test.
        /// </para>
        /// <para></para>
        /// </summary>
        [Fact]
        public void AttachArrayValueToDocumentTest()
        {
            var links = CreateLinks();
            var defaultJsonStorage =CreateJsonStorage(links);
            TLink document = defaultJsonStorage.CreateDocument("documentName");

            TLink arrayElement = defaultJsonStorage.CreateString("arrayElement");
            TLink[] array = new TLink[] { arrayElement, arrayElement, arrayElement };


            TLink documentArrayValueLink = defaultJsonStorage.AttachArray(document, array);
            TLink createdArrayValue = links.GetTarget(documentArrayValueLink);

            DefaultStack<TLink> stack = new();
            RightSequenceWalker<TLink> rightSequenceWalker = new(links, stack, arrayElementLink
            ↪  => links.GetSource(arrayElementLink) == defaultJsonStorage.ValueMarker);
            IEnumerable<TLink> arrayElementsValuesLink =
            ↪  rightSequenceWalker.Walk(createdArrayValue);
            Assert.NotEmpty(arrayElementsValuesLink);

            output.WriteLine(links.Format(createdArrayValue));


            TLink valueMarker = links.GetSource(createdArrayValue);
            Assert.Equal(valueMarker, defaultJsonStorage.ValueMarker);

            TLink createdArrayLink = links.GetTarget(createdArrayValue);
            TLink arrayMarker = links.GetSource(createdArrayLink);
            Assert.Equal(arrayMarker, defaultJsonStorage.ArrayMarker);

            TLink createdArrayContents = links.GetTarget(createdArrayLink);
            Assert.Equal(links.GetTarget(createdArrayContents), arrayElement);


            TLink foundArrayValue = defaultJsonStorage.GetValueLink(document);
            Assert.Equal(createdArrayValue, foundArrayValue);
        }

        /// <summary>
        /// <para>
        /// Tests that get object from document object value link test.
        /// </para>
        /// <para></para>
        /// </summary>
        [Fact]
        public void GetObjectFromDocumentObjectValueLinkTest()
        {
            ILinks<TLink> links = CreateLinks();
            var defaultJsonStorage =CreateJsonStorage(links);
            TLink document = defaultJsonStorage.CreateDocument("documentName");
            TLink documentObjectValueLink = defaultJsonStorage.AttachObject(document);
            TLink objectValueLink = links.GetTarget(documentObjectValueLink);
            TLink objectFromGetObject = defaultJsonStorage.GetObject(documentObjectValueLink);
            output.WriteLine(links.Format(objectValueLink));
            output.WriteLine(links.Format(objectFromGetObject));
            Assert.Equal(links.GetTarget(objectValueLink), objectFromGetObject);
        }

        /// <summary>
        /// <para>
        /// Tests that get object from object value link test.
        /// </para>
        /// <para></para>
        /// </summary>
```

```
455         [Fact]
456         public void GetObjectFromObjectValueLinkTest()
457         {
458             ILinks<TLink> links = CreateLinks();
459             var defaultJsonStorage =CreateJsonStorage(links);
460             TLink document = defaultJsonStorage.CreateDocument("documentName");
461             TLink documentObjectValueLink = defaultJsonStorage.AttachObject(document);
462             TLink objectValueLink = links.GetTarget(documentObjectValueLink);
463             TLink objectFromGetObject = defaultJsonStorage.GetObject(objectValueLink);
464             Assert.Equal(links.GetTarget(objectValueLink), objectFromGetObject);
465         }
466 
467         /// <summary>
468         /// <para>
469         /// Tests that attach string value to key.
470         /// </para>
471         /// <para></para>
472         /// </summary>
473         [Fact]
474         public void AttachStringValueToKey()
475         {
476             ILinks<TLink> links = CreateLinks();
477             var defaultJsonStorage =CreateJsonStorage(links);
478             TLink document = defaultJsonStorage.CreateDocument("documentName");
479             TLink documentObjectValue = defaultJsonStorage.AttachObject(document);
480             TLink @object = defaultJsonStorage.GetObject(documentObjectValue);
481             TLink memberLink = defaultJsonStorage.AttachMemberToObject(@object, "keyName");
482             TLink memberStringValueLink = defaultJsonStorage.AttachString(memberLink,
                ↪  "stringValue");
483             TLink stringValueLink = links.GetTarget(memberStringValueLink);
484             List<TLink> objectMembersLinks = defaultJsonStorage.GetMembersLinks(@object);
485             Assert.Equal(memberLink, objectMembersLinks[0]);
486             Assert.Equal(stringValueLink,
                ↪  defaultJsonStorage.GetValueLink(objectMembersLinks[0]));
487         }
488 
489         /// <summary>
490         /// <para>
491         /// Tests that attach number value to key.
492         /// </para>
493         /// <para></para>
494         /// </summary>
495         [Fact]
496         public void AttachNumberValueToKey()
497         {
498             ILinks<TLink> links = CreateLinks();
499             var defaultJsonStorage =CreateJsonStorage(links);
500             TLink document = defaultJsonStorage.CreateDocument("documentName");
501             TLink documentObjectValue = defaultJsonStorage.AttachObject(document);
502             TLink @object = defaultJsonStorage.GetObject(documentObjectValue);
503             TLink memberLink = defaultJsonStorage.AttachMemberToObject(@object, "keyName");
504             TLink memberNumberValueLink = defaultJsonStorage.AttachNumber(memberLink, 123);
505             TLink numberValueLink = links.GetTarget(memberNumberValueLink);
506             List<TLink> objectMembersLinks = defaultJsonStorage.GetMembersLinks(@object);
507             Assert.Equal(memberLink, objectMembersLinks[0]);
508             Assert.Equal(numberValueLink,
                ↪  defaultJsonStorage.GetValueLink(objectMembersLinks[0]));
509         }
510 
511         /// <summary>
512         /// <para>
513         /// Tests that attach object value to key.
514         /// </para>
515         /// <para></para>
516         /// </summary>
517         [Fact]
518         public void AttachObjectValueToKey()
519         {
520             ILinks<TLink> links = CreateLinks();
521             var defaultJsonStorage =CreateJsonStorage(links);
522             TLink document = defaultJsonStorage.CreateDocument("documentName");
523             TLink documentObjectValue = defaultJsonStorage.AttachObject(document);
524             TLink @object = defaultJsonStorage.GetObject(documentObjectValue);
525             TLink memberLink = defaultJsonStorage.AttachMemberToObject(@object, "keyName");
526             TLink memberObjectValueLink = defaultJsonStorage.AttachObject(memberLink);
527             TLink objectValueLink = links.GetTarget(memberObjectValueLink);
528             List<TLink> objectMembersLinks = defaultJsonStorage.GetMembersLinks(@object);
529             Assert.Equal(memberLink, objectMembersLinks[0]);
```

```
            Assert.Equal(objectValueLink,
            ↪  defaultJsonStorage.GetValueLink(objectMembersLinks[0]));
        }

        /// <summary>
        /// <para>
        /// Tests that attach array value to key.
        /// </para>
        /// <para></para>
        /// </summary>
        [Fact]
        public void AttachArrayValueToKey()
        {
            ILinks<TLink> links = CreateLinks();
            var defaultJsonStorage =CreateJsonStorage(links);
            TLink document = defaultJsonStorage.CreateDocument("documentName");
            TLink documentObjectValue = defaultJsonStorage.AttachObject(document);
            TLink @object = defaultJsonStorage.GetObject(documentObjectValue);
            TLink memberLink = defaultJsonStorage.AttachMemberToObject(@object, "keyName");
            TLink arrayElement = defaultJsonStorage.CreateString("arrayElement");
            TLink[] array = { arrayElement, arrayElement, arrayElement };
            TLink memberArrayValueLink = defaultJsonStorage.AttachArray(memberLink, array);
            TLink arrayValueLink = links.GetTarget(memberArrayValueLink);
            List<TLink> objectMembersLinks = defaultJsonStorage.GetMembersLinks(@object);
            Assert.Equal(memberLink, objectMembersLinks[0]);
            Assert.Equal(arrayValueLink, defaultJsonStorage.GetValueLink(objectMembersLinks[0]));
        }

        /// <summary>
        /// <para>
        /// Tests that attach true value to key.
        /// </para>
        /// <para></para>
        /// </summary>
        [Fact]
        public void AttachTrueValueToKey()
        {
            ILinks<TLink> links = CreateLinks();
            var defaultJsonStorage =CreateJsonStorage(links);
            TLink document = defaultJsonStorage.CreateDocument("documentName");
            TLink documentObjectValue = defaultJsonStorage.AttachObject(document);
            TLink @object = defaultJsonStorage.GetObject(documentObjectValue);
            TLink memberLink = defaultJsonStorage.AttachMemberToObject(@object, "keyName");
            TLink memberTrueValueLink = defaultJsonStorage.AttachBoolean(memberLink, true);
            TLink trueValueLink = links.GetTarget(memberTrueValueLink);
            List<TLink> objectMembersLinks = defaultJsonStorage.GetMembersLinks(@object);
            Assert.Equal(memberLink, objectMembersLinks[0]);
            Assert.Equal(trueValueLink, defaultJsonStorage.GetValueLink(objectMembersLinks[0]));
        }

        /// <summary>
        /// <para>
        /// Tests that attach false value to key.
        /// </para>
        /// <para></para>
        /// </summary>
        [Fact]
        public void AttachFalseValueToKey()
        {
            ILinks<TLink> links = CreateLinks();
            var defaultJsonStorage =CreateJsonStorage(links);
            TLink document = defaultJsonStorage.CreateDocument("documentName");
            TLink documentObjectValue = defaultJsonStorage.AttachObject(document);
            TLink @object = defaultJsonStorage.GetObject(documentObjectValue);
            TLink memberLink = defaultJsonStorage.AttachMemberToObject(@object, "keyName");
            TLink memberFalseValueLink = defaultJsonStorage.AttachBoolean(memberLink, false);
            TLink falseValueLink = links.GetTarget(memberFalseValueLink);
            List<TLink> objectMembersLinks = defaultJsonStorage.GetMembersLinks(@object);
            Assert.Equal(memberLink, objectMembersLinks[0]);
            Assert.Equal(falseValueLink, defaultJsonStorage.GetValueLink(objectMembersLinks[0]));
        }

        /// <summary>
        /// <para>
        /// Tests that attach null value to key.
        /// </para>
        /// <para></para>
        /// </summary>
```

```
607             [Fact]
608             public void AttachNullValueToKey()
609             {
610                 ILinks<TLink> links = CreateLinks();
611                 var defaultJsonStorage =CreateJsonStorage(links);
612                 TLink document = defaultJsonStorage.CreateDocument("documentName");
613                 TLink documentObjectValue = defaultJsonStorage.AttachObject(document);
614                 TLink @object = defaultJsonStorage.GetObject(documentObjectValue);
615                 TLink memberLink = defaultJsonStorage.AttachMemberToObject(@object, "keyName");
616                 TLink memberNullValueLink = defaultJsonStorage.AttachNull(memberLink);
617                 TLink nullValueLink = links.GetTarget(memberNullValueLink);
618                 List<TLink> objectMembersLinks = defaultJsonStorage.GetMembersLinks(@object);
619                 Assert.Equal(nullValueLink, defaultJsonStorage.GetValueLink(objectMembersLinks[0]));
620             }
621         }
622     }
```

## Index