1.1 ./csharp/Platform.Data.Doublets.Xml/DefaultXmlStorage.cs

```
using System.Collections.Generic;
using Platform.Numbers;
using Platform.Data.Numbers.Raw;
using Platform.Data.Doublets;
using Platform.Data.Doublets.Sequences.Converters;
using Platform.Data.Doublets.Sequences.Frequencies.Cache;
using Platform.Data.Doublets.Sequences.Indexes;
using Platform.Data.Doublets.Unicode;

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

namespace Platform.Data.Doublets.Xml
{
    public class DefaultXmlStorage<TLink> : IXmlStorage<TLink>
    {
        private static readonly TLink _zero = default;
        private static readonly TLink _one = Arithmetic.Increment(_zero);

        private readonly StringToUnicodeSequenceConverter<TLink>
        ↪  _stringToUnicodeSequenceConverter;
        private readonly ILinks<TLink> _links;
        private TLink _unicodeSymbolMarker;
        private TLink _unicodeSequenceMarker;
        private TLink _elementMarker;
        private TLink _textElementMarker;
        private TLink _documentMarker;

        private class Unindex : ISequenceIndex<TLink>
        {
            public bool Add(IList<TLink> sequence) => true;
            public bool MightContain(IList<TLink> sequence) => true;
        }

        public DefaultXmlStorage(ILinks<TLink> links, bool indexSequenceBeforeCreation,
        ↪  LinkFrequenciesCache<TLink> frequenciesCache)
        {
            var linkToItsFrequencyNumberConverter = new
            ↪  FrequenciesCacheBasedLinkToItsFrequencyNumberConverter<TLink>(frequenciesCache);
            var sequenceToItsLocalElementLevelsConverter = new
            ↪  SequenceToItsLocalElementLevelsConverter<TLink>(links,
            ↪  linkToItsFrequencyNumberConverter);
            var optimalVariantConverter = new OptimalVariantConverter<TLink>(links,
            ↪  sequenceToItsLocalElementLevelsConverter);
            InitConstants(links);
            var charToUnicodeSymbolConverter = new CharToUnicodeSymbolConverter<TLink>(links,
            ↪  new AddressToRawNumberConverter<TLink>(), _unicodeSymbolMarker);
            var index = indexSequenceBeforeCreation ? new
            ↪  CachedFrequencyIncrementingSequenceIndex<TLink>(frequenciesCache) :
            ↪  (ISequenceIndex<TLink>)new Unindex();
            _stringToUnicodeSequenceConverter = new
            ↪  StringToUnicodeSequenceConverter<TLink>(links, charToUnicodeSymbolConverter,
            ↪  index, optimalVariantConverter, _unicodeSequenceMarker);
            _links = links;
        }

        private void InitConstants(ILinks<TLink> links)
        {
            var markerIndex = _one;
            var meaningRoot = links.GetOrCreate(markerIndex, markerIndex);
            _unicodeSymbolMarker = links.GetOrCreate(meaningRoot, Arithmetic.Increment(ref
            ↪  markerIndex));
            _unicodeSequenceMarker = links.GetOrCreate(meaningRoot, Arithmetic.Increment(ref
            ↪  markerIndex));
            _elementMarker = links.GetOrCreate(meaningRoot, Arithmetic.Increment(ref
            ↪  markerIndex));
            _textElementMarker = links.GetOrCreate(meaningRoot, Arithmetic.Increment(ref
            ↪  markerIndex));
            _documentMarker = links.GetOrCreate(meaningRoot, Arithmetic.Increment(ref
            ↪  markerIndex));
        }
        public TLink CreateDocument(string name) => Create(_documentMarker, name);
        public TLink CreateElement(string name) => Create(_elementMarker, name);
        public TLink CreateTextElement(string content) => Create(_textElementMarker, content);
        private TLink Create(TLink marker, string content) => _links.GetOrCreate(marker,
        ↪  _stringToUnicodeSequenceConverter.Convert(content));
        public void AttachElementToParent(TLink elementToAttach, TLink parent) =>
        ↪  _links.GetOrCreate(parent, elementToAttach);
```

```
60
61          public TLink GetDocument(string name) => Get(_documentMarker, name);
62          public TLink GetTextElement(string content) => Get(_textElementMarker, content);
63          public TLink GetElement(string name) => Get(_elementMarker, name);
64          private TLink Get(TLink marker, string content) => _links.SearchOrDefault(marker,
            ↪  _stringToUnicodeSequenceConverter.Convert(content));
65          public IList<TLink> GetChildren(TLink parent) {
66              var childrens = new List<TLink>();
67              _links.Each((link) => {
68                  childrens.Add(_links.GetTarget(link));
69                  return this._links.Constants.Continue;
70              }, new Link<TLink>(_links.Constants.Any, parent, _links.Constants.Any));
71              return childrens;
72          }
73      }
74  }
```

1.2 ./csharp/Platform.Data.Doublets.Xml/ICommandLineInterface.cs

```
1  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
2
3  namespace Platform.Data.Doublets.Xml
4  {
5      public interface ICommandLineInterface
6      {
7          void Run(params string[] args);
8      }
9  }
```

1.3 ./csharp/Platform.Data.Doublets.Xml/IXmlStorage.cs

```
1  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
2
3  using System.Collections.Generic;
4
5  namespace Platform.Data.Doublets.Xml
6  {
7      public interface IXmlStorage<TLink>
8      {
9          TLink CreateDocument(string name);
10         TLink CreateElement(string name);
11         TLink CreateTextElement(string content);
12         TLink GetDocument(string name);
13         TLink GetElement(string name);
14         TLink GetTextElement(string content);
15         IList<IList<TLink>> GetChildren(TLink parent);
16         void AttachElementToParent(TLink elementToAttach, TLink parent);
17     }
18 }
```

1.4 ./csharp/Platform.Data.Doublets.Xml/XmlElementContext.cs

```
1  using System.Collections.Generic;
2
3  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5  namespace Platform.Data.Doublets.Xml
6  {
7      internal class XmlElementContext
8      {
9          public readonly Dictionary<string, int> ChildrenNamesCounts;
10         public int TotalChildren;
11
12         public XmlElementContext() => ChildrenNamesCounts = new Dictionary<string, int>();
13
14         public void IncrementChildNameCount(string name)
15         {
16             if (ChildrenNamesCounts.TryGetValue(name, out int count))
17             {
18                 ChildrenNamesCounts[name] = count + 1;
19             }
20             else
21             {
22                 ChildrenNamesCounts[name] = 0;
23             }
24             TotalChildren++;
25         }
26     }
27 }
```

1.5 ./csharp/Platform.Data.Doublets.Xml/XmlElementCounter.cs

```
using System;
using System.Collections.Generic;
using System.Threading;
using System.Threading.Tasks;
using System.Xml;
using System.Linq;
using Platform.Exceptions;
using Platform.IO;

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

namespace Platform.Data.Doublets.Xml
{
    public class XmlElementCounter
    {
        public XmlElementCounter() { }

        public Task Count(string file, string elementName, CancellationToken token)
        {
            return Task.Factory.StartNew(() =>
            {
                try
                {
                    var context = new RootElementContext();
                    using (var reader = XmlReader.Create(file))
                    {
                        Count(reader, elementName, token, context);
                    }
                    Console.WriteLine($"Total elements with specified name:
                    ↪ {context.TotalElements}, total content length:
                    ↪ {context.TotalContentsLength}.");
                }
                catch (Exception ex)
                {
                    Console.WriteLine(ex.ToStringWithAllInnerExceptions());
                }
            }, token);
        }

        private void Count(XmlReader reader, string elementNameToCount, CancellationToken token,
        ↪ XmlElementContext context)
        {
            var rootContext = (RootElementContext)context;
            var parentContexts = new Stack<XmlElementContext>();
            var elements = new Stack<string>(); // Path
            // TODO: If path was loaded previously, skip it.
            while (reader.Read())
            {
                if (token.IsCancellationRequested)
                {
                    return;
                }
                switch (reader.NodeType)
                {
                    case XmlNodeType.Element:
                        var elementName = reader.Name;
                        context.IncrementChildNameCount(elementName);
                        elementName =
                        ↪ $"{elementName}[{context.ChildrenNamesCounts[elementName]}]";
                        if (!reader.IsEmptyElement)
                        {
                            elements.Push(elementName);
                            ConsoleHelpers.Debug("{0} starting...", elements.Count <= 20 ?
                            ↪ ToXPath(elements) : elementName); // XPath
                            parentContexts.Push(context);
                            context = new XmlElementContext();
                        }
                        else
                        {
                            ConsoleHelpers.Debug("{0} finished.", elementName);
                        }
                        break;

                    case XmlNodeType.EndElement:
                        ConsoleHelpers.Debug("{0} finished.", elements.Count <= 20 ?
                        ↪ ToXPath(elements) : elements.Peek()); // XPath
                        var topElement = elements.Pop();
                        // Restoring scope
```

```
                            context = parentContexts.Pop();
                            if (topElement.StartsWith(elementNameToCount))
                            {
                                rootContext.TotalElements++;
                                // TODO: Check for 0x00 part/symbol at 198102797 line and 13
                                ↪  position.
                                //if (rootContext.TotalPages > 3490000)
                                //    selfCancel = true;
                                if (context.ChildrenNamesCounts[elementNameToCount] % 10000 == 0)
                                {
                                    Console.WriteLine(topElement);
                                }
                            }
                            break;

                        case XmlNodeType.Text:
                            ConsoleHelpers.Debug("Starting text element...");
                            var content = reader.Value;
                            rootContext.TotalContentsLength += (ulong)content.Length;
                            ConsoleHelpers.Debug($"Content length is: {content.Length}");
                            ConsoleHelpers.Debug("Text element finished.");
                            break;
                    }
                }
            }

            private string ToXPath(Stack<string> path) => string.Join("/", path.Reverse());

            private class RootElementContext : XmlElementContext
            {
                public ulong TotalElements;
                public ulong TotalContentsLength;
            }
        }
    }
```

1.6 ./csharp/Platform.Data.Doublets.Xml/XmlElementCounterCLI.cs

```
using System;
using System.IO;
using Platform.IO;

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

namespace Platform.Data.Doublets.Xml
{
    public class XmlElementCounterCLI : ICommandLineInterface
    {
        public void Run(params string[] args)
        {
            var file = ConsoleHelpers.GetOrReadArgument(0, "Xml file", args);
            var elementName = ConsoleHelpers.GetOrReadArgument(1, "Element name to count", args);
            if (!File.Exists(file))
            {
                Console.WriteLine("Entered xml file does not exists.");
            }
            else if (string.IsNullOrEmpty(elementName))
            {
                Console.WriteLine("Entered element name is empty.");
            }
            else
            {
                using (var cancellation = new ConsoleCancellation())
                {
                    Console.WriteLine("Press CTRL+C to stop.");
                    new XmlElementCounter().Count(file, elementName, cancellation.Token).Wait();
                }
            }
        }
    }
}
```

1.7 ./csharp/Platform.Data.Doublets.Xml/XmlExporter.cs

```
using System;
using System.Linq;
using System.Collections.Generic;
using System.Threading;
using System.Threading.Tasks;
using System.Xml;
using Platform.Exceptions;
```

```

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

namespace Platform.Data.Doublets.Xml
{
    class XmlExporter<TLink>
    {
        private readonly IXmlStorage<TLink> _storage;

        public XmlExporter(IXmlStorage<TLink> storage) => _storage = storage;

        public Task Export(string documentName, string fileName, CancellationToken token)
        {
            return Task.Factory.StartNew(() =>
            {
                try
                {
                    var document = _storage.GetDocument(documentName);
                    using (var writer = XmlWriter.Create(fileName))
                    {
                        Write(writer, token, new ElementContext(document));
                    }
                }
                catch (Exception ex)
                {
                    Console.WriteLine(ex.ToStringWithAllInnerExceptions());
                }
            }, token);
        }

        private void Write(XmlWriter writer, CancellationToken token, ElementContext context)
        {
            var parentContexts = new Stack<ElementContext>();
            var elements = new Stack<string>(); // Path
                                                // TODO: If path was loaded previously, skip it.
            foreach(TLink lvl in _storage.GetChildren(parent: context.Parent))
            {
                Write(writer: writer, token: token, context: new ElementContext(lvl));
            }
        }

        private class ElementContext : XmlElementContext
        {
            public readonly TLink Parent;

            public ElementContext(TLink parent) => Parent = parent;
        }

    }
}
```

1.8 ./csharp/Platform.Data.Doublets.Xml/XmlImporter.cs

```

using System;
using System.Linq;
using System.Collections.Generic;
using System.Threading;
using System.Threading.Tasks;
using System.Xml;
using Platform.Exceptions;
using Platform.Collections;
using Platform.IO;

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

namespace Platform.Data.Doublets.Xml {
    public class XmlImporter<TLink>
    {
        private readonly IXmlStorage<TLink> _storage;

        public XmlImporter(IXmlStorage<TLink> storage) => _storage = storage;

        public Task Import(string file, CancellationToken token)
        {
            return Task.Factory.StartNew(() =>
            {
                try
                {
                    var document = _storage.CreateDocument(file);

                    using (var reader = XmlReader.Create(file))
```

```
                {
                    Read(reader, token, new ElementContext(document));
                }
            }
            catch (Exception ex)
            {
                Console.WriteLine(ex.ToStringWithAllInnerExceptions());
            }

        }, token);
    }

    private void Read(XmlReader reader, CancellationToken token, ElementContext context)
    {
        var parentContexts = new Stack<ElementContext>();
        var elements = new Stack<string>(); // Path
        // TODO: If path was loaded previously, skip it.
        while (reader.Read())
        {
            if (token.IsCancellationRequested)
            {
                return;
            }
            switch (reader.NodeType)
            {
                case XmlNodeType.Element:
                    var elementName = reader.Name;
                    context.IncrementChildNameCount(elementName);
                    elementName =
                    ↪  $"{elementName}[{context.ChildrenNamesCounts[elementName]}]";
                    if (!reader.IsEmptyElement)
                    {
                        elements.Push(elementName);
                        ConsoleHelpers.Debug("{0} starting...", elements.Count <= 20 ?
                        ↪  ToXPath(elements) : elementName); // XPath
                        var element = _storage.CreateElement(name: elementName);
                        parentContexts.Push(context);
                        _storage.AttachElementToParent(elementToAttach: element, parent:
                        ↪  context.Parent);
                        context = new ElementContext(element);
                    }
                    else
                    {
                        ConsoleHelpers.Debug("{0} finished.", elementName);
                    }
                    break;
                case XmlNodeType.EndElement:
                    ConsoleHelpers.Debug("{0} finished.", elements.Count <= 20 ?
                    ↪  ToXPath(elements) : elements.Peek()); // XPath
                    elements.Pop();
                    // Restoring scope
                    context = parentContexts.Pop();
                    if (elements.Count == 1)
                    {
                        if (context.TotalChildren % 10 == 0)
                            Console.WriteLine(context.TotalChildren);
                    }
                    break;
                case XmlNodeType.Text:
                    ConsoleHelpers.Debug("Starting text element...");
                    var content = reader.Value;
                    ConsoleHelpers.Debug("Content: {0}{1}", content.Truncate(50),
                    ↪  content.Length >= 50 ? "..." : "");
                    var textElement = _storage.CreateTextElement(content: content);
                    _storage.AttachElementToParent(textElement, context.Parent);
                    ConsoleHelpers.Debug("Text element finished.");
                    break;
            }
        }
    }

    private string ToXPath(Stack<string> path) => string.Join("/", path.Reverse());

    private class ElementContext : XmlElementContext
    {
        public readonly TLink Parent;

        public ElementContext(TLink parent) => Parent = parent;
    }
```

```
    }
}
```

1.9 ./csharp/Platform.Data.Doublets.Xml/XmlImporterCLI.cs

```
using System;
using System.IO;
using Platform.IO;
using Platform.Data.Doublets.Memory.United.Generic;

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

namespace Platform.Data.Doublets.Xml
{
    public class XmlImporterCLI : ICommandLineInterface
    {
        public void Run(params string[] args)
        {
            var linksFile = ConsoleHelpers.GetOrReadArgument(0, "Links file", args);
            var file = ConsoleHelpers.GetOrReadArgument(1, "Xml file", args);

            if (!File.Exists(file))
            {
                Console.WriteLine("Entered xml file does not exists.");
            }
            else
            {
                //const long gb32 = 34359738368;

                using (var cancellation = new ConsoleCancellation())
                using (var memoryAdapter = new UnitedMemoryLinks<uint>(linksFile))
                //using (var memoryAdapter = new UInt64UnitedMemoryLinks(linksFile, gb32))
                //using (var links = new UInt64Links(memoryAdapter))
                {
                    Console.WriteLine("Press CTRL+C to stop.");
                    var links =
                    ↪  memoryAdapter.DecorateWithAutomaticUniquenessAndUsagesResolution();
                    var indexer = new XmlIndexer<uint>(links);
                    var indexingImporter = new XmlImporter<uint>(indexer);
                    indexingImporter.Import(file, cancellation.Token).Wait();
                    if (cancellation.NotRequested)
                    {
                        var cache = indexer.Cache;
                        //var counter = new TotalSequenceSymbolFrequencyCounter<uint>(links);
                        //var cache = new LinkFrequenciesCache<uint>(links, counter);
                        Console.WriteLine("Frequencies cache ready.");
                        var storage = new DefaultXmlStorage<uint>(links, false, cache);
                        var importer = new XmlImporter<uint>(storage);
                        importer.Import(file, cancellation.Token).Wait();
                    }
                }
            }
        }
    }
}
```

1.10 ./csharp/Platform.Data.Doublets.Xml/XmlIndexer.cs

```
using System.Collections.Generic;
using Platform.Numbers;
using Platform.Data.Numbers.Raw;
using Platform.Data.Doublets;
using Platform.Data.Doublets.Sequences.Frequencies.Cache;
using Platform.Data.Doublets.Sequences.Frequencies.Counters;
using Platform.Data.Doublets.Sequences.Indexes;
using Platform.Data.Doublets.Unicode;

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

namespace Platform.Data.Doublets.Xml
{
    public class XmlIndexer<TLink> : IXmlStorage<TLink>
    {
        private static readonly TLink _zero = default;
        private static readonly TLink _one = Arithmetic.Increment(_zero);

        private readonly CachedFrequencyIncrementingSequenceIndex<TLink> _index;
        private readonly CharToUnicodeSymbolConverter<TLink> _charToUnicodeSymbolConverter;
        private TLink _unicodeSymbolMarker;
        private readonly TLink _nullConstant;

        public LinkFrequenciesCache<TLink> Cache { get; }
```

```
25
26          public XmlIndexer(ILinks<TLink> links)
27          {
28              _nullConstant = links.Constants.Null;
29              var totalSequenceSymbolFrequencyCounter = new
                ↪  TotalSequenceSymbolFrequencyCounter<TLink>(links);
30              Cache = new LinkFrequenciesCache<TLink>(links, totalSequenceSymbolFrequencyCounter);
31              _index = new CachedFrequencyIncrementingSequenceIndex<TLink>(Cache);
32              var addressToRawNumberConverter = new AddressToRawNumberConverter<TLink>();
33              InitConstants(links);
34              _charToUnicodeSymbolConverter = new CharToUnicodeSymbolConverter<TLink>(links,
                ↪  addressToRawNumberConverter, _unicodeSymbolMarker);
35          }
36
37          private void InitConstants(ILinks<TLink> links)
38          {
39              var markerIndex = _one;
40              var meaningRoot = links.GetOrCreate(markerIndex, markerIndex);
41              _unicodeSymbolMarker = links.GetOrCreate(meaningRoot,
                ↪  Arithmetic.Increment(markerIndex));
42              _ = links.GetOrCreate(meaningRoot, Arithmetic.Increment(markerIndex));
43              _ = links.GetOrCreate(meaningRoot, Arithmetic.Increment(markerIndex));
44              _ = links.GetOrCreate(meaningRoot, Arithmetic.Increment(markerIndex));
45              _ = links.GetOrCreate(meaningRoot, Arithmetic.Increment(markerIndex));
46          }
47
48          public void AttachElementToParent(TLink elementToAttach, TLink parent)
49          {
50          }
51
52          public IList<TLink> ToElements(string @string)
53          {
54              var elements = new TLink[@string.Length];
55              for (int i = 0; i < @string.Length; i++)
56              {
57                  elements[i] = _charToUnicodeSymbolConverter.Convert(@string[i]);
58              }
59              return elements;
60          }
61
62          public TLink CreateDocument(string name)
63          {
64              _index.Add(ToElements(name));
65              return _nullConstant;
66          }
67
68          public TLink CreateElement(string name)
69          {
70              _index.Add(ToElements(name));
71              return _nullConstant;
72          }
73
74          public TLink CreateTextElement(string content)
75          {
76              _index.Add(ToElements(content));
77              return _nullConstant;
78          }
79
80          public TLink GetDocument(string name)
81          {
82              throw new System.NotImplementedException();
83          }
84
85          public TLink GetElement(string name)
86          {
87              throw new System.NotImplementedException();
88          }
89
90          public TLink GetTextElement(string content)
91          {
92              throw new System.NotImplementedException();
93          }
94
95          public IList<IList<TLink>> GetChildren(TLink parent)
96          {
97              throw new System.NotImplementedException();
98          }
99      }
100 }
```

Index