delb Documentation

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CONTENTS

`delb` is a library that provides an ergonomic model for XML encoded text documents (e.g. TEI-XML) for the Python programming language. It fills a gap for the humanities-related field of software development towards the excellent (scientific) communities in the Python ecosystem.

For a more elaborated discussion see the *Design* chapter of the documentation.

CHAPTER

ONE

FEATURES

- Loads documents from various source types. This is customizable and extensible.
- XML DOM types are represented by distinct classes.
- A completely type-annotated API.
- Consistent design regarding names and callables' signatures.
- Shadows comments and processing instructions by default.
- Querying with XPath and CSS expressions.

CHAPTER

TWO

DEVELOPMENT STATUS

You're invited to submit tests that reflect desired use cases or are merely of theoretical nature. Of course, any kind of proposals for or implementations of improvements are welcome as well.

CHAPTER

THREE

RELATED PROJECTS & TESTIMONIALS

snakesist is an eXist-db client that uses `delb` to expose database resources.

Kurt Raschke noted in 2010:

```
In a DOM-based implementation, it would be relatively easy [...]
But lxml doesn't use text nodes; instead it uses [text] and [tail]
properties to hold text content.
```

3.1 About the design

3.1.1 tl;dr

lxml resp. libxml2 are powerful tools, but have an unergonomic data model to work with encoded text. Let's build a DOM API inspired wrapper around it.

3.1.2 Aspects & Caveats

The library is partly opinionated to encourage good practices and to be more pythonic. Therefore its behaviour deviates from lxml and ignores stuff:

- Serializations of documents are UTF-8 encoded by default and always start with an XML declaration.
- Comment and processing instruction nodes are shadowed by default, see *`delb.altered_default_filters()`* on how to make them accessible.
- CDATA nodes are not accessible at all, but are retained and appear in serializations; unless you **[DANGER ZONE]** manipulate the tree. Depending on your actions you might encounter no alterations or a complete loss of these nodes within the root node. **[/DANGER ZONE]**

If you need to apply bad practices anyway, you can fall back to tinker with the lxml objects that are bound to `TagNode._etree_obj`.

3.1.3 Reasoning

XML can be used to encode text documents, examples for such uses would be the Open Document Format and XML-TEI. It's more prevalent use however is to encode data that is to be consumed by algorithms as configuration, measurements, application events, various metadata and so on.

Python is a high-level, general programming language with a vast ecosystem, notably including diverse scientific communities and tools. As such it is well suited to solve and cause problems in the humanities related field of Research Software Engineering by programmers with diverse educational background and expertise.

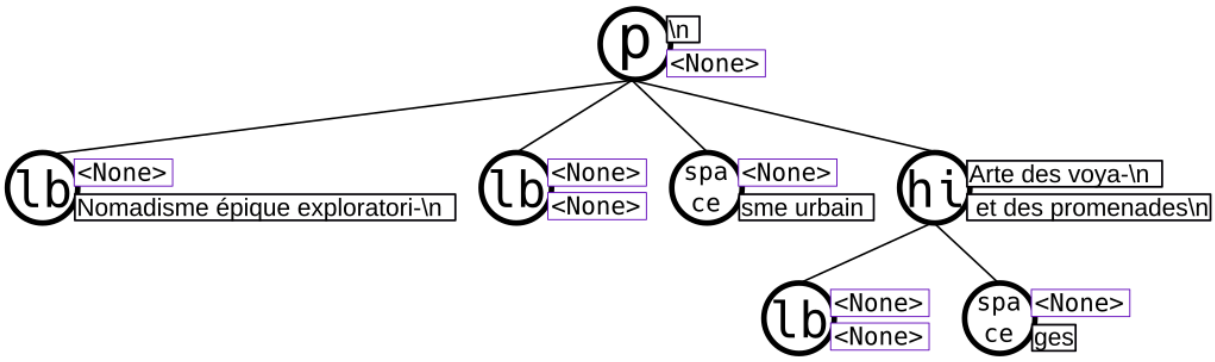
The commonly used Python library to parse and interact with a representation of an XML document is lxml. Other libraries like the `xml.etree.ElementTree` module from the Python standard library shall not be discussed due to their insignificance and shortcomings. It is notable that at least these two share significant design aspects of Java APIs which is perceived as weird and clumsy in Python code. lxml is a wrapper around libxml2 which was developed by the GNOME developers for other data than text documents. Data that is strictly structured and expectable. Text documents are different in these regards as natural languages and variety of media allow and lead to unprecedented manifestations for which an encoding mixes different abstracted encapsulations of text fragments. And they are formulated and structured for human consumers, and often printing devices.

So, what's wrong with lxml? Not much, it's a rock-solid, fast API for XML documents with known issues and known workarounds that represents the full glory of what a full-fledged family of specification implies - of which a lot is not of concern for the problems at hand and occasionally make solutions complicated. The one aspect that's very wrong in the context of text processing is unfortunately its central model of elements and data/text that is attached to it in two different relations. In particular the notion of an element *tail* makes the whole enchilada tricky to traverse / navigate. The existence of this attribute is due to the insignificance of these fragments of an XML stream in the aforementioned, common uses of XML.

Now it is time for an example, given this document snippet:

```
<p rendition="#justify">
  <lb/>Nomadisme épique exploratori-
  <lb/><space dim="horizontal" quantity="2" units="chars"/>sme urbain <hi rendition="#b">
↪Art des voya-
  <lb/><space dim="horizontal" quantity="2" units="chars"/>ges</hi> et des promenades
</p>
```

Here's a graphical representation of the markup with etree's elements and their text and tail attributes:



When thinking about a paragraph of text, a way to conceptualize it is as a sequence of sentences, formed by a series of words, a sequence of graphemes, and punctuation. That's a quite simple cascade of categories which can be very well anticipated when processing text. With that mental model, line beginnings would rather be considered to be on the same level as signs, but "Nomadisme …" turns out *not* to be a sibling object of the object that represents the line beginning and is *not* in direct relation with the paragraph. In lxml's model it is rather an attribute `tail` assigned to that

line beginning. The text contents of the object that represents the `hi` element and its children give a good impression how hairy simple tasks can become.

An algorithm that shall remove line beginnings, space representations and concatenate broken words would need a function that removes the element objects in question while preserving the text fragments in its meaningful sequence attached to the `text` and `tail` properties. In case these have no content, their value of `None` leads to different operations to concatenate strings. Here's a working implementation from the inxs library[1] for that data model:

```
def remove_elements(
    *elements: etree.ElementBase,
    keep_children=False,
    preserve_text=False,
    preserve_tail=False
 ) -> None:
    """ Removes the given elements from its tree. Unless ``keep_children`` is
        passed as ``True``, its children vanish with it into void. If
        ``preserve_text`` is ``True``, the text and tail of a deleted element
        will be preserved either in its left sibling's tail or its parent's
        text. """
    for element in elements:
        if preserve_text and element.text:
            previous = element.getprevious()
            if previous is None:

                parent = element.getparent()
                if parent.text is None:
                    parent.text = ''
                parent.text += element.text
            else:
                if previous.tail is None:
                    previous.tail = element.text
                else:
                    previous.tail += element.text

        if preserve_tail and element.tail:
            if keep_children and len(element):
                if element[-1].tail:
                    element[-1].tail += element.tail
                else:
                    element[-1].tail = element.tail
            else:
                previous = element.getprevious()
                if previous is None:
                    parent = element.getparent()
                    if parent.text is None:
                        parent.text = ''
                    parent.text += element.tail
                else:
                    if len(element):
                        if element[-1].tail is None:
                            element[-1].tail = element.tail
                        else:
```

(continues on next page)

[1] The `inxs` library failed. Yet it made clear which layer in Python XML Text handling needs to be fixed.

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```
                        element[-1].tail += element.tail
                else:
                    if previous.tail is None:
                        previous.tail = ''
                    previous.tail += element.tail

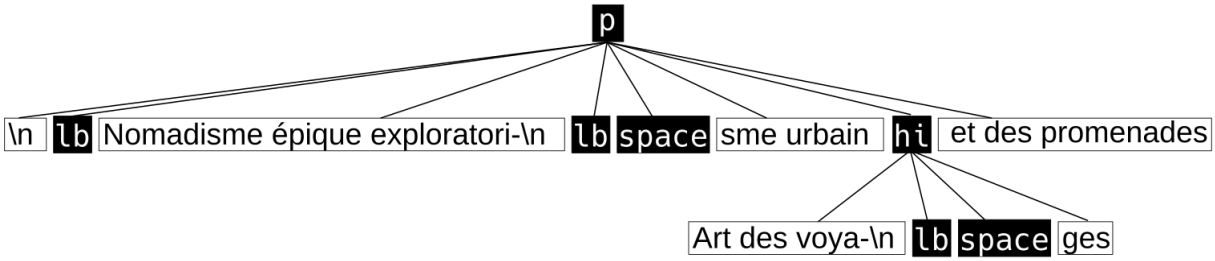
        if keep_children:
            for child in element:
                element.addprevious(child)
        element.getparent().remove(element)
```

That by itself is enough to simply remove the `space` elements, but also considering word-breaking dashes to wrap everything up is a similar piece of routine of its own. And these quirks come back to you steadily while actual markup is regularly more complex.

Now obviously, the data model that lxml / libxml2 provides is not up to standard Python ergonomics to solve text encoding problems.

There must be a better way.

There is a notable other markup parser that wraps around lxml, BeautifulSoup4. It carries some interesting ideas, but is overall too opinionated and partly ambiguous to implement a stringent data model. A notable specification of a solid model for text documents is the DOM API that is even implemented in the standard library's `xml.dom.minidom` module. But it lacks an XPath interface and rumours say it's slow. To illustrate the more accessible model with a better locatability, here's another graphical representation of the markup example from above with text content in an emancipated, dedicated node type:



Note that text containing attributes appear in document order which promises an eased lookaround. So, the obvious (?) idea is to wrap lxml in a layer that takes the DOM API as paradigmatic inspiration, looks and behaves pythonic while keeping the wrapped powers accessible.

Now with that API available, this is what an equivalent of the horribly complicated function seen above would look like:

```
@altered_default_filters()
def remove_nodes(*nodes: NodeBase, keep_children=False):
    """ Removes the given nodes from its tree. Unless ``keep_children`` is
        passed as ``True``, its children vanish with it into void. """
    for node in nodes:
        node.detach(retain_child_nodes=keep_children)
```

3.1.4 Frequently Asked Questions

Isn't XML an obsolete format for text encoding, invented by boomers and cynically held up by their Generation X apologists? Why don't you put your efforts in developing new approaches such as storing text in a graph database?

> We think that XML-based encodings are actually very well suited for long-term usable text representations with a broad potential for granularity of capturing and semantic annotations. Not only is the data format simple enough to hold a full artifact in a self-contained file, but we also consider the duality of a format that can be handled both as stream and as tree as a helpful feature to address the physical and logical dimensions of a text and its manifestation. That is advantageous over depending on a heavy-weight database system. We acknowledge unquestionably that the specifications in the XML universe are often over-engineered, partly stuck in the times of their genesis and thus (euphemistically put) no fun. As a direct result of that the availability of implementations for contemporary development contexts and their ergonomics are poor, if available at all for a platform. That is what *delb* is addressing.

What are your long-term goals with this project?

> Currently we want to flesh out a concluded user interface that lets developers concentrate on their tasks and not on the shortcomings and idiosyncrasies of available tools in the Pythoniverse. After modeling that API as a wrapper around lxml the aim is now to replace it piece by piece with a Pure Python™ implementation that will later be transpiled to C extension code with mypyc.
>
> Eventually we'd like to re-conquer the world wide web and make unagitated, long texts and Stooges clips its predominant content again. On that occasion, fuck you Mark, fuck off Jeff, go fuck yourself Peter and all the other fucknut character masks. What a disgusting misery it is that the capital created from Tim's ideas.

3.2 Installation

3.2.1 From the Python Package Index

To install *delb* manually, not as dependency, use pip:

```
$ pip install delb
```

At the moment there's only one optional dependency to enable document loading via *http* and *https*, to include it use:

```
$ pip install delb[https-loader]
```

3.2.2 From source

Prerequisites:

- A virtual environment of your project is activated.
- That virtual environment houses an interpreter for Python 3.7 or later.

Obtain the code with roughly one of:

- `git clone git@github.com:delb-xml/delb-py.git`
- `curl -LosS https://github.com/delb-xml/delb-py/archive/main.tar.gz | tar xzf -`

To install it regularly:

```
.../delb-py $ pip install .
```

Again, to include the loading over *http(s)*:

```
.../delb-py $ pip install .[https-loader]
```

For developing purposes of `delb` itself, the library should be installed in editable mode:

```
.../delb-py $ pip install --editable .
```

Hint: Using git submodules is a great way to vendorize a lib for your project and to have a fork for your adjustments. Please offer the latter to upstream if done well.

3.2.3 Developer toolbox

The repository includes configurations so that beside a suited Python interpreter three tools need to be available globally. pipx is the recommended facilitation to install the Python implemented tools *black* and *hatch*.

just

just is a task runner that executes a variety of common *recipes*. This gives a list of all available ones:

```
.../delb-py $ just --list
```

Before committing changes, run the complete suite of quality checks by invoking the default recipe:

```
.../delb-py $ just
```

black

It's recommended to configure the used editors and IDEs to enforce black's code style, but it can also be applied with:

```
.../delb-py $ just black
```

hatch

Several of the *just* recipes rely on hatch.

3.3 API Documentation

Note: There are actually two packages that are installed with *delb*: `delb` and `_delb`. As the underscore indicates, the latter is exposing private parts of the API while the first is re-exposing what is deemed to be public from that one and additional contents. As a rule of thumb, use the public API in applications and the private API in *delb* extensions. By doing so, you can avoid circular dependencies if your extension (or other code that it depends on) uses contents from the `_delb` package.

3.3.1 Documents

class delb.**Document**(*source*, *collapse_whitespace=None*, *parser=None*, *parser_options=None*, *klass=None*, ***config*)

This class is the entrypoint to obtain a representation of an XML encoded text document. For instantiation any object can be passed. A suitable loader must be available for the given source. See *Document loaders* for the default loaders that come with this package. Plugins are capable to alter the available loaders, see *Extending delb*.

Nodes can be tested for membership in a document:

```
>>> document = Document("<root>text</root>")
>>> text_node = document.root[0]
>>> text_node in document
True
>>> text_node.clone() in document
False
```

The string coercion of a document yields an XML encoded stream, but unlike *Document.save()* and *Document.write()*, without an XML declaration:

```
>>> document = Document("<root/>")
>>> str(document)
'<root/>'
```

Parameters

- **source** – Anything that the configured loaders can make sense of to return a parsed document tree.
- **collapse_whitespace** – Deprecated. Use the argument with the same name on the `parser_options` object.
- **parser** – Deprecated.
- **parser_options** – A *delb.ParserOptions* class to configure the used parser.
- **klass** – Explicitly define the initilized class. This can be useful for applications that have *default document subclasses* in use.
- **config** – Additional keyword arguments for the configuration of extension classes.

Properties

config	Beside the used `parser` and `collapsed_whitespace` option, this property contains the namespaced data that extension classes and loaders may have stored.
head_nodes	A list-like accessor to the nodes that precede the document's root node.
namespaces	The namespace mapping of the document's *root* node.
root	The root node of a document tree.
source_url	The source URL where a loader obtained the document's contents or `None`.
tail_nodes	A list-like accessor to the nodes that follow the document's root node.

Uncategorized methods

cleanup_namespaces([namespaces, retain_prefixes])	Consolidates the namespace declarations in the document by removing unused and redundant ones.
clone()	**return** Another instance with the duplicated contents.
collapse_whitespace()	Collapses whitespace as described here: https://wiki.tei-c.org/index.php/XML_Whitespace#Recommendations
css_select(expression[, namespaces])	This method proxies to the *TagNode.css_select()* method of the document's *root* node.
merge_text_nodes()	This method proxies to the *TagNode.merge_text_nodes()* method of the document's *root* node.
new_tag_node(local_name[, attributes, namespace])	This method proxies to the *TagNode.new_tag_node()* method of the document's root node.
save(path[, pretty])	**param path** The path where the document shall be saved.
write(buffer[, pretty])	**param buffer** A file-like object that the document is written to.
xpath(expression[, namespaces])	This method proxies to the *TagNode.xpath()* method of the document's *root* node.
xslt(transformation)	**param transformation** A `lxml.etree.XSLT` instance that shall be

---

cleanup_namespaces(*namespaces: Optional[Mapping[Optional[str], str]] = None*, *retain_prefixes: Optional[Iterable[str]] = None*)

Consolidates the namespace declarations in the document by removing unused and redundant ones.

There are currently some caveats due to lxml/libxml2's implementations:

- prefixes cannot be set for the default namespace
- a namespace cannot be declared as default after a node's creation (where a namespace was specified that had been registered for a prefix with *register_namespace()*)
- there's no way to unregister a prefix for a namespace
- if there are other namespaces used as default namespaces (where a namespace was specified that had *not* been registered for a prefix) in the descendants of the root, their declarations are lost when this method is used

To ensure clean serializations, one should:

- register prefixes for all namespaces except the default one at the start of an application
- use only one default namespace within a document

Parameters

- **namespaces** – An optional mapping of prefixes (keys) to namespaces (values) that will be declared at the root element.
- **retain_prefixes** – An optional iterable that contains prefixes whose declarations shall be kept despite not being used.

`clone()` → *Document*

Returns
Another instance with the duplicated contents.

`collapse_whitespace()`

Collapses whitespace as described here: https://wiki.tei-c.org/index.php/XML_Whitespace#Recommendations

Implicitly merges all neighbouring text nodes.

`config: SimpleNamespace`

Beside the used `parser` and `collapsed_whitespace` option, this property contains the namespaced data that extension classes and loaders may have stored.

`css_select`(*expression: str*, *namespaces: Optional[Namespaces] = None*) → *QueryResults*

This method proxies to the *TagNode.css_select()* method of the document's *root* node.

`head_nodes`

A list-like accessor to the nodes that precede the document's root node. Note that nodes can't be removed or replaced.

`merge_text_nodes()`

This method proxies to the *TagNode.merge_text_nodes()* method of the document's *root* node.

`property namespaces: Namespaces`

The namespace mapping of the document's *root* node.

`new_tag_node`(*local_name: str*, *attributes: Optional[Dict[str, str]] = None*, *namespace: Optional[str] = None*) → *TagNode*

This method proxies to the *TagNode.new_tag_node()* method of the document's root node.

`property root: TagNode`

The root node of a document tree.

`save`(*path: Path*, *pretty: bool = False*, ***cleanup_namespaces_args*)

Parameters

- **path** – The path where the document shall be saved.
- **pretty** – Adds indentation for human consumers when `True`.
- **cleanup_namespaces_args** – Arguments that are a passed to *Document.cleanup_namespaces()* before saving.

source_url: Optional[str]

The source URL where a loader obtained the document's contents or None.

tail_nodes

A list-like accessor to the nodes that follow the document's root node. Note that nodes can't be removed or replaced.

write(*buffer: IO*, *pretty: bool = False*, ***cleanup_namespaces_args*)

Parameters

- **buffer** – A file-like object that the document is written to.
- **pretty** – Adds indentation for human consumers when True.
- **cleanup_namespaces_args** – Arguments that are a passed to *Document.cleanup_namespaces()* before writing.

xpath(*expression: str*, *namespaces: Optional[Namespaces] = None*) → *QueryResults*

This method proxies to the *TagNode.xpath()* method of the document's *root* node.

xslt(*transformation: XSLT*) → *Document*

Parameters

transformation – A lxml.etree.XSLT instance that shall be applied to the document.

Returns

A new instance with the transformation's result.

3.3.2 Document loaders

If you want or need to manipulate the availability of or order in which loaders are attempted, you can change the delb.plugins.plugin_manager.plugins.loaders object which is a list. Its state is reflected in your whole application. Please refer to this issue when you require finer controls over these aspects.

Core

The core_loaders module provides a set loaders to retrieve documents from various data sources.

_delb.plugins.core_loaders.**buffer_loader**(*data: Any*, *config: SimpleNamespace*) → _delb.typing.LoaderResult

This loader loads a document from a file-like object.

_delb.plugins.core_loaders.**etree_loader**(*data: Any*, *config: SimpleNamespace*) → _delb.typing.LoaderResult

This loader processes lxml.etree._Element and lxml.etree._ElementTree instances.

_delb.plugins.core_loaders.**ftp_loader**(*data: Any*, *config: SimpleNamespace*) → _delb.typing.LoaderResult

Loads a document from a URL with either the ftp schema. The URL will be bound to source_url on the document's Document.config attribute.

_delb.plugins.core_loaders.**path_loader**(*data: Any*, *config: SimpleNamespace*) → _delb.typing.LoaderResult

This loader loads from a file that is pointed at with a pathlib.Path instance. That instance will be bound to source_path on the document's Document.config attribute.

_delb.plugins.core_loaders.**tag_node_loader**(*data: Any*, *config: SimpleNamespace*) → _delb.typing.LoaderResult

This loader loads, or rather clones, a *delb.TagNode* instance and its descendant nodes.

_delb.plugins.core_loaders.**text_loader**(*data: Any*, *config: SimpleNamespace*) → _delb.typing.LoaderResult

Parses a string containing a full document.

Extra

If `delb` is installed with `https-loader` as extra, the required dependencies for this loader are installed as well. See *Installation*.

_delb.plugins.https_loader.**https_loader**(*data: ~typing.Any*, *config: ~types.SimpleNamespace*, *client: ~httpx.Client = <httpx.Client object>*) → _delb.typing.LoaderResult

This loader loads a document from a URL with the `http` and `https` scheme. Redirects are followed. The default httpx-client follows redirects and can partially be configured with environment variables. The URL will be bound to the name `source_url` on the document's `Document.config` attribute.

Loaders with specifically configured httpx-clients can build on this loader like so:

```
import httpx
from _delb.plugins import plugin_manager
from _delb.plugins.https_loader import https_loader


client = httpx.Client(follow_redirects=False, trust_env=False)

@plugin_manager.register_loader(before=https_loader)
def custom_https_loader(data, config):
    return https_loader(data, config, client=client)
```

3.3.3 Parser options

class delb.**ParserOptions**(*cleanup_namespaces: bool = False*, *collapse_whitespace: bool = False*, *remove_comments: bool = False*, *remove_processing_instructions: bool = False*, *resolve_entities: bool = True*, *unplugged: bool = False*)

The configuration options that define an XML parser's behaviour.

Parameters

- **cleanup_namespaces** – Consolidate XML namespace declarations.
- **collapse_whitespace** – *Collapse the content's whitespace*.
- **remove_comments** – Ignore comments.
- **remove_processing_instructions** – Don't include processing instructions in the parsed tree.
- **resolve_entities** – Resolve entities.
- **unplugged** – Don't load referenced resources over network.

3.3.4 Nodes

Comment

class delb.**CommentNode**(*etree_element: _Element*)

The instances of this class represent comment nodes of a tree.

To instantiate new nodes use *new_comment_node()*.

Properties

content	The comment's text.
depth	The depth (or level) of the node in its tree.
document	The *Document* instances that the node is associated with or `None`.
first_child	
full_text	The concatenated contents of all text node descendants in document order.
index	The node's index within the parent's collection of child nodes or `None` when the node has no parent.
last_child	
last_descendant	
namespaces	The prefix to namespace mapping of the node.
parent	The node's parent or `None`.

Fetching a single relative node

fetch_following(*filter)	**param filter** Any number of *filter* s.
fetch_following_sibling(*filter)	**param filter** Any number of *filter* s.
fetch_preceding(*filter)	**param filter** Any number of *filter* s.
fetch_preceding_sibling(*filter)	**param filter** Any number of *filter* s.

Iterating over relative nodes

iterate_ancestors(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_children(*filter[, recurse])	A generator iterator that yields nothing.
iterate_descendants(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_following(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_following_siblings(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_preceding(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_preceding_siblings(*filter)	**param filter** Any number of *filter* s that a node must match to be

Querying nodes

xpath(expression[, namespaces])	See *Queries with XPath & CSS* for details on the extent of the XPath implementation.

Adding nodes

add_following_siblings(*node[, clone])	Adds one or more nodes to the right of the node this method is called on.
add_preceding_siblings(*node[, clone])	Adds one or more nodes to the left of the node this method is called on.

Removing a node from its tree

detach([retain_child_nodes])	Removes the node from its tree.
replace_with(node[, clone])	Removes the node and places the given one in its tree location.

Uncategorized methods

clone([deep, quick_and_unsafe])	**param deep** Clones the whole subtree if `True`.
new_tag_node(local_name[, attributes, ...])	Creates a new *TagNode* instance in the node's context.

---

add_following_siblings(**node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*)

Adds one or more nodes to the right of the node this method is called on.

The nodes can be concrete instances of any node type or rather abstract descriptions in the form of strings or objects returned from the *tag()* function that are used to derive *TextNode* respectively *TagNode* instances from.

Parameters

- **node** – The node(s) to be added.
- **clone** – Clones the concrete nodes before adding if `True`.

add_preceding_siblings(**node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*)

Adds one or more nodes to the left of the node this method is called on.

The nodes can be concrete instances of any node type or rather abstract descriptions in the form of strings or objects returned from the *tag()* function that are used to derive *TextNode* respectively *TagNode* instances from.

Parameters

- **node** – The node(s) to be added.
- **clone** – Clones the concrete nodes before adding if `True`.

clone(*deep: bool = False*, *quick_and_unsafe: bool = False*) → _ElementWrappingNode

Parameters

- **deep** – Clones the whole subtree if `True`.
- **quick_and_unsafe** – Creates a deep clone in a quicker manner where text nodes may get lost. It should be safe with trees that don't contain subsequent text nodes, e.g. freshly parsed, unaltered documents of after *TagNode.merge_text_nodes()* has been applied.

Returns

A copy of the node.

property content: *str*

The comment's text.

property depth: int

The depth (or level) of the node in its tree.

detach(*retain_child_nodes: bool = False*) → _ElementWrappingNode

Removes the node from its tree.

Parameters
retain_child_nodes – Keeps the node's descendants in the originating tree if `True`.

Returns
The removed node.

property document: Optional[*Document*]

The *Document* instances that the node is associated with or `None`.

fetch_following(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The next node in document order that matches all filters or `None`.

fetch_following_sibling(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The next sibling to the right that matches all filters or `None`.

fetch_preceding(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The previous node in document order that matches all filters or `None`.

fetch_preceding_sibling(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The next sibling to the left that matches all filters or `None`.

first_child = None

property full_text: str

The concatenated contents of all text node descendants in document order.

property index: Optional[int]

The node's index within the parent's collection of child nodes or `None` when the node has no parent.

iterate_ancestors(**filter: _delb.typing.Filter*) → Iterator[*TagNode*]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the ancestor nodes from bottom to top.

iterate_children(**filter: _delb.typing.Filter*, *recurse: bool = False*) → Iterator[NodeBase]

A generator iterator that yields nothing.

iterate_descendants(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the descending nodes of the node.

iterate_following(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the following nodes in document order.

iterate_following_siblings(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the siblings to the node's right.

iterate_preceding(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the previous nodes in document order.

iterate_preceding_siblings(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the siblings to the node's left.

last_child = None

last_descendant = None

property namespaces: Namespaces

The prefix to namespace mapping of the node.

new_tag_node(*local_name: str*, *attributes: Optional[Dict[str, str]] = None*, *namespace: Optional[str] = None*, *children: Sequence[Union[str, NodeBase, _TagDefinition]] = ()*) → *TagNode*

Creates a new *TagNode* instance in the node's context.

Parameters

- **local_name** – The tag name.
- **attributes** – Optional attributes that are assigned to the new node.
- **namespace** – An optional tag namespace. If none is provided, the context node's namespace is inherited.

- **children** – An optional sequence of objects that will be appended as child nodes. This can be existing nodes, strings that will be inserted as text nodes and in-place definitions of *TagNode* instances from *tag()*. The latter will be assigned to the same namespace.

Returns
The newly created tag node.

property parent: Optional[*TagNode*]

The node's parent or None.

replace_with(*node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*) → NodeBase

Removes the node and places the given one in its tree location.

The node can be a concrete instance of any node type or a rather abstract description in the form of a string or an object returned from the *tag()* function that is used to derive a *TextNode* respectively *TagNode* instance from.

Parameters

- **node** – The replacing node.
- **clone** – A concrete, replacing node is cloned if True.

Returns
The removed node.

xpath(*expression: str*, *namespaces: Optional[Namespaces] = None*) → *QueryResults*

See *Queries with XPath & CSS* for details on the extent of the XPath implementation.

Parameters

- **expression** – A supported XPath 1.0 expression that contains one or more location paths.
- **namespaces** – A mapping of prefixes that are used in the expression to namespaces. If omitted, the node's definition is used.

Returns
All nodes that match the evaluation of the provided XPath expression.

Processing instruction

class delb.**ProcessingInstructionNode**(*etree_element: _Element*)

The instances of this class represent processing instruction nodes of a tree.

To instantiate new nodes use *new_processing_instruction_node()*.

Properties

content	The processing instruction's text.
depth	The depth (or level) of the node in its tree.
document	The *Document* instances that the node is associated with or `None`.
first_child	
full_text	The concatenated contents of all text node descendants in document order.
index	The node's index within the parent's collection of child nodes or `None` when the node has no parent.
last_child	
last_descendant	
namespaces	The prefix to namespace mapping of the node.
parent	The node's parent or `None`.
target	The processing instruction's target.

Fetching a single relative node

fetch_following(*filter)

param filter
Any number of *filter* s.

fetch_following_sibling(*filter)

param filter
Any number of *filter* s.

fetch_preceding(*filter)

param filter
Any number of *filter* s.

fetch_preceding_sibling(*filter)

param filter
Any number of *filter* s.

Iterating over relative nodes

iterate_ancestors(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_children(*filter[, recurse])	A generator iterator that yields nothing.
iterate_descendants(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_following(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_following_siblings(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_preceding(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_preceding_siblings(*filter)	**param filter** Any number of *filter* s that a node must match to be

Querying nodes

xpath(expression[, namespaces])	See *Queries with XPath & CSS* for details on the extent of the XPath implementation.

Adding nodes

add_following_siblings(*node[, clone])	Adds one or more nodes to the right of the node this method is called on.
add_preceding_siblings(*node[, clone])	Adds one or more nodes to the left of the node this method is called on.

Removing a node from its tree

detach([retain_child_nodes])	Removes the node from its tree.
replace_with(node[, clone])	Removes the node and places the given one in its tree location.

Uncategorized methods

clone([deep, quick_and_unsafe])	**param deep** Clones the whole subtree if `True`.
new_tag_node(local_name[, attributes, ...])	Creates a new *TagNode* instance in the node's context.

add_following_siblings(**node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*)

Adds one or more nodes to the right of the node this method is called on.

The nodes can be concrete instances of any node type or rather abstract descriptions in the form of strings or objects returned from the *tag()* function that are used to derive *TextNode* respectively *TagNode* instances from.

Parameters

- **node** – The node(s) to be added.
- **clone** – Clones the concrete nodes before adding if `True`.

add_preceding_siblings(**node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*)

Adds one or more nodes to the left of the node this method is called on.

The nodes can be concrete instances of any node type or rather abstract descriptions in the form of strings or objects returned from the *tag()* function that are used to derive *TextNode* respectively *TagNode* instances from.

Parameters

- **node** – The node(s) to be added.
- **clone** – Clones the concrete nodes before adding if `True`.

clone(*deep: bool = False*, *quick_and_unsafe: bool = False*) → _ElementWrappingNode

Parameters

- **deep** – Clones the whole subtree if `True`.
- **quick_and_unsafe** – Creates a deep clone in a quicker manner where text nodes may get lost. It should be safe with trees that don't contain subsequent text nodes, e.g. freshly parsed, unaltered documents of after *TagNode.merge_text_nodes()* has been applied.

Returns

A copy of the node.

property content: *str*

The processing instruction's text.

property depth: `int`

The depth (or level) of the node in its tree.

detach(*retain_child_nodes: bool = False*) → _ElementWrappingNode

Removes the node from its tree.

Parameters
retain_child_nodes – Keeps the node's descendants in the originating tree if `True`.

Returns
The removed node.

property document: `Optional[Document]`

The *Document* instances that the node is associated with or `None`.

fetch_following(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The next node in document order that matches all filters or `None`.

fetch_following_sibling(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The next sibling to the right that matches all filters or `None`.

fetch_preceding(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The previous node in document order that matches all filters or `None`.

fetch_preceding_sibling(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The next sibling to the left that matches all filters or `None`.

first_child = None

property full_text: `str`

The concatenated contents of all text node descendants in document order.

property index: `Optional[int]`

The node's index within the parent's collection of child nodes or `None` when the node has no parent.

iterate_ancestors(**filter: _delb.typing.Filter*) → Iterator[*TagNode*]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the ancestor nodes from bottom to top.

iterate_children(**filter: _delb.typing.Filter*, *recurse: bool = False*) → Iterator[NodeBase]

A generator iterator that yields nothing.

iterate_descendants(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the descending nodes of the node.

iterate_following(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the following nodes in document order.

iterate_following_siblings(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the siblings to the node's right.

iterate_preceding(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the previous nodes in document order.

iterate_preceding_siblings(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the siblings to the node's left.

last_child = None

last_descendant = None

property namespaces: Namespaces

The prefix to namespace mapping of the node.

new_tag_node(*local_name: str*, *attributes: Optional[Dict[str, str]] = None*, *namespace: Optional[str] = None*, *children: Sequence[Union[str, NodeBase, _TagDefinition]] = ()*) → *TagNode*

Creates a new *TagNode* instance in the node's context.

Parameters

- **local_name** – The tag name.
- **attributes** – Optional attributes that are assigned to the new node.
- **namespace** – An optional tag namespace. If none is provided, the context node's namespace is inherited.

- **children** – An optional sequence of objects that will be appended as child nodes. This can be existing nodes, strings that will be inserted as text nodes and in-place definitions of *TagNode* instances from *tag()*. The latter will be assigned to the same namespace.

Returns
The newly created tag node.

property parent: Optional[*TagNode*]

The node's parent or None.

replace_with(*node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*) → NodeBase

Removes the node and places the given one in its tree location.

The node can be a concrete instance of any node type or a rather abstract description in the form of a string or an object returned from the *tag()* function that is used to derive a *TextNode* respectively *TagNode* instance from.

Parameters

- **node** – The replacing node.
- **clone** – A concrete, replacing node is cloned if True.

Returns
The removed node.

property target: str

The processing instruction's target.

xpath(*expression: str*, *namespaces: Optional[Namespaces] = None*) → *QueryResults*

See *Queries with XPath & CSS* for details on the extent of the XPath implementation.

Parameters

- **expression** – A supported XPath 1.0 expression that contains one or more location paths.
- **namespaces** – A mapping of prefixes that are used in the expression to namespaces. If omitted, the node's definition is used.

Returns
All nodes that match the evaluation of the provided XPath expression.

Tag

class delb.**TagNode**(*etree_element: _Element*)

The instances of this class represent *tag node* s of a tree, the equivalent of DOM's elements.

To instantiate new nodes use *Document.new_tag_node*, *TagNode.new_tag_node*, *TextNode.new_tag_node* or *new_tag_node()*.

Some syntactic sugar is baked in:

Attributes and nodes can be tested for membership in a node.

```
>>> root = Document('<root ham="spam"><child/></root>').root
>>> child = root.first_child
>>> "ham" in root
True
>>> child in root
True
```

Nodes can be copied. Note that this relies on *TagNode.clone()*.

```
>>> from copy import copy, deepcopy
>>> root = Document("<root>Content</root>").root
>>> print(copy(root))
<root/>
>>> print(deepcopy(root))
<root>Content</root>
```

Nodes can be tested for equality regarding their qualified name and attributes.

```
>>> root = Document('<root><foo x="0"/><foo x="0"/><bar x="0"/></root>').root
>>> root[0] == root[1]
True
>>> root[0] == root[2]
False
```

Attribute values and child nodes can be obtained with the subscript notation.

```
>>> root = Document('<root x="0"><child_1/>child_2<child_3/></root>').root
>>> root["x"]
'0'
>>> print(root[0])
<child_1/>
>>> print(root[-1])
<child_3/>
>>> print([str(x) for x in root[1::-1]])
['child_2', '<child_1/>']
```

How much child nodes has this node anyway?

```
>>> root = Document("<root><child_1/><child_2/></root>").root
>>> len(root)
2
>>> len(root[0])
0
```

As seen in the examples above, a tag nodes string representation yields a serialized XML representation of a sub-/tree.

Properties

attributes	A mapping that can be used to query and alter the node's attributes.
depth	The depth (or level) of the node in its tree.
document	The *Document* instances that the node is associated with or `None`.
first_child	The node's first child node.
full_text	The concatenated contents of all text node descendants in document order.
id	This is a shortcut to retrieve and set the `id` attribute in the XML namespace.
index	The node's index within the parent's collection of child nodes or `None` when the node has no parent.
last_child	The node's last child node.
last_descendant	The node's last descendant.
local_name	The node's name.
location_path	An unambiguous XPath location path that points to this node from its tree root.
namespace	The node's namespace.
namespaces	The prefix to namespace mapping of the node.
parent	The node's parent or `None`.
prefix	The prefix that the node's namespace is currently mapped to.
universal_name	The node's qualified name in Clark notation.

Fetching a single relative node

fetch_following(*filter)

param filter
Any number of *filter* s.

fetch_following_sibling(*filter)

param filter
Any number of *filter* s.

fetch_preceding(*filter)

param filter
Any number of *filter* s.

fetch_preceding_sibling(*filter)

param filter
Any number of *filter* s.

Iterating over relative nodes

iterate_ancestors(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_children(*filter[, recurse])	**param filter** Any number of *filter* s that a node must match to be
iterate_descendants(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_following(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_following_siblings(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_preceding(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_preceding_siblings(*filter)	**param filter** Any number of *filter* s that a node must match to be

Querying nodes

css_select(expression[, namespaces])	See *Queries with XPath & CSS* regarding the extent of the supported grammar.
fetch_or_create_by_xpath(expression[, ...])	Fetches a single node that is locatable by the provided XPath expression.
xpath(expression[, namespaces])	See *Queries with XPath & CSS* for details on the extent of the XPath implementation.

Adding nodes

add_following_siblings(*node[, clone])	Adds one or more nodes to the right of the node this method is called on.
add_preceding_siblings(*node[, clone])	Adds one or more nodes to the left of the node this method is called on.
append_children(*node[, clone])	Adds one or more nodes as child nodes after any existing to the child nodes of the node this method is called on.
insert_children(index, *node[, clone])	Inserts one or more child nodes.
prepend_children(*node[, clone])	Adds one or more nodes as child nodes before any existing to the child nodes of the node this method is called on.

Removing a node from its tree

detach([retain_child_nodes])	Removes the node from its tree.
replace_with(node[, clone])	Removes the node and places the given one in its tree location.

Uncategorized methods

clone([deep, quick_and_unsafe])	**param deep** Clones the whole subtree if `True`.
merge_text_nodes()	Merges all consecutive text nodes in the subtree into one.
new_tag_node(local_name[, attributes, ...])	Creates a new *TagNode* instance in the node's context.
parse(text[, parser, parser_options, ...])	Parses the given string or bytes sequence into a new tree.

---

add_following_siblings(**node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*)

Adds one or more nodes to the right of the node this method is called on.

The nodes can be concrete instances of any node type or rather abstract descriptions in the form of strings or objects returned from the *tag()* function that are used to derive *TextNode* respectively *TagNode* instances from.

Parameters

- **node** – The node(s) to be added.
- **clone** – Clones the concrete nodes before adding if `True`.

add_preceding_siblings(**node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*)

Adds one or more nodes to the left of the node this method is called on.

The nodes can be concrete instances of any node type or rather abstract descriptions in the form of strings or objects returned from the *tag()* function that are used to derive *TextNode* respectively *TagNode* instances from.

Parameters

- **node** – The node(s) to be added.
- **clone** – Clones the concrete nodes before adding if `True`.

append_children(**node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*)

Adds one or more nodes as child nodes after any existing to the child nodes of the node this method is called on.

The nodes can be concrete instances of any node type or rather abstract descriptions in the form of strings or objects returned from the *tag()* function that are used to derive *TextNode* respectively *TagNode* instances from.

Parameters

- **node** – The node(s) to be added.
- **clone** – Clones the concrete nodes before adding if `True`.

property attributes: TagAttributes

A mapping that can be used to query and alter the node's attributes.

```
>>> node = new_tag_node("node", attributes={"foo": "0", "bar": "0"})
>>> node.attributes
{'foo': '0', 'bar': '0'}
>>> node.attributes.pop("bar")
'0'
>>> node.attributes["foo"] = "1"
>>> node.attributes["peng"] = "1"
>>> print(node)
<node foo="1" peng="1"/>
>>> node.attributes.update({"foo": "2", "zong": "2"})
>>> print(node)
<node foo="2" peng="1" zong="2"/>
```

Namespaced attributes can be accessed by using Python's slice notation. A default namespace can be provided optionally, but it's also found without.

```
>>> node = new_tag_node("node", {})
>>> node.attributes["http://namespace":"foo"] = "0"
>>> print(node)
<node xmlns:ns0="http://namespace" ns0:foo="0"/>
>>> node = Document('<node xmlns="default" foo="0"/>').root
>>> node.attributes["default":"foo"] is node.attributes["foo"]
True
```

Attributes behave like strings, but also expose namespace, local name and value for manipulation.

```
>>> node = new_tag_node("node")
>>> node.attributes["foo"] = "0"
>>> node.attributes["foo"].local_name = "bar"
>>> node.attributes["bar"].namespace = "http://namespace"
>>> node.attributes["http://namespace":"bar"].value = "1"
```

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```
>>> print(node)
<node xmlns:ns0="http://namespace" ns0:bar="1"/>
```

Unlike with typical Python mappings, requesting a non-existing attribute doesn't evoke a `KeyError`, instead `None` is returned.

clone(*deep: bool = False*, *quick_and_unsafe: bool = False*) → *TagNode*

Parameters

- **deep** – Clones the whole subtree if `True`.
- **quick_and_unsafe** – Creates a deep clone in a quicker manner where text nodes may get lost. It should be safe with trees that don't contain subsequent text nodes, e.g. freshly parsed, unaltered documents of after *`TagNode.merge_text_nodes()`* has been applied.

Returns
A copy of the node.

css_select(*expression: str*, *namespaces: Optional[Namespaces] = None*) → *QueryResults*

See *Queries with XPath & CSS* regarding the extent of the supported grammar.

Namespace prefixes are delimited with a `|` before a name test, for example `div svg|metadata` selects all descendants of `div` named nodes that belong to the default namespace or have no namespace and whose name is `metadata` and have a namespace that is mapped to the `svg` prefix.

Parameters

- **expression** – A CSS selector expression.
- **namespaces** – A mapping of prefixes that are used in the expression to namespaces. If omitted, the node's definition is used.

Returns
All nodes that match the evaluation of the provided CSS selector expression.

property depth: `int`

The depth (or level) of the node in its tree.

detach(*retain_child_nodes: bool = False*) → _ElementWrappingNode

Removes the node from its tree.

Parameters
retain_child_nodes – Keeps the node's descendants in the originating tree if `True`.

Returns
The removed node.

property document: `Optional[Document]`

The *`Document`* instances that the node is associated with or `None`.

fetch_following(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The next node in document order that matches all filters or `None`.

fetch_following_sibling(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The next sibling to the right that matches all filters or `None`.

fetch_or_create_by_xpath(*expression: str*, *namespaces: Union[Namespaces, None, Mapping[Optional[str], str]] = None*) → *TagNode*

Fetches a single node that is locatable by the provided XPath expression. If the node doesn't exist, the non-existing branch will be created. These rules are imperative in your endeavour:

- All location steps must use the child axis.
- Each step needs to provide a name test.
- Attributes must be compared against a literal.
- Multiple attribute comparisons must be joined with the *and* operator and / or more than one predicate expression.
- The logical validity of multiple attribute comparisons isn't checked. E.g. one could provide `foo[@p="her"][@p="him"]`, but expect an undefined behaviour.
- Other contents in predicate expressions are invalid.

```
>>> document = Document("<root/>")
>>> grandchild = document.root.fetch_or_create_by_xpath(
...     "child[@a='b']/grandchild"
... )
>>> grandchild is document.root.fetch_or_create_by_xpath(
...     "child[@a='b']/grandchild"
... )
True
>>> str(document)
'<root><child a="b"><grandchild/></child></root>'
```

Parameters

- **expression** – An XPath expression that can unambiguously locate a descending node in a tree that has any state.
- **namespaces** – An optional mapping of prefixes to namespaces. As default the node's one is used.

Returns
The existing or freshly created node descibed with `expression`.

fetch_preceding(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The previous node in document order that matches all filters or `None`.

fetch_preceding_sibling(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The next sibling to the left that matches all filters or `None`.

property first_child: Optional[NodeBase]

The node's first child node.

property full_text: str

The concatenated contents of all text node descendants in document order.

property id: Optional[str]

This is a shortcut to retrieve and set the `id` attribute in the XML namespace. The client code is responsible to pass properly formed id names.

property index: Optional[int]

The node's index within the parent's collection of child nodes or `None` when the node has no parent.

insert_children(*index: int*, **node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*)

Inserts one or more child nodes.

The nodes can be concrete instances of any node type or rather abstract descriptions in the form of strings or objects returned from the *tag()* function that are used to derive *TextNode* respectively *TagNode* instances from.

Parameters

- **index** – The index at which the first of the given nodes will be inserted, the remaining nodes are added afterwards in the given order.
- **node** – The node(s) to be added.
- **clone** – Clones the concrete nodes before adding if `True`.

iterate_ancestors(**filter: _delb.typing.Filter*) → Iterator[*TagNode*]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the ancestor nodes from bottom to top.

iterate_children(**filter: _delb.typing.Filter*, *recurse: bool = False*) → Iterator[NodeBase]

Parameters

- **filter** – Any number of *filter* s that a node must match to be yielded.
- **recurse** – Deprecated. Use `NodeBase.iterate_descendants()`.

Returns
A generator iterator that yields the child nodes of the node.

iterate_descendants(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the descending nodes of the node.

iterate_following(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the following nodes in document order.

iterate_following_siblings(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the siblings to the node's right.

iterate_preceding(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the previous nodes in document order.

iterate_preceding_siblings(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the siblings to the node's left.

property last_child: Optional[NodeBase]
The node's last child node.

property last_descendant: Optional[NodeBase]
The node's last descendant.

property local_name: str
The node's name.

property location_path: str
An unambiguous XPath location path that points to this node from its tree root.

merge_text_nodes()
Merges all consecutive text nodes in the subtree into one.

property namespace: Optional[str]
The node's namespace. Be aware, that while this property can be set to `None`, serializations will continue to render a previous default namespace declaration if the node had such.

property namespaces: Namespaces
The prefix to namespace mapping of the node.

new_tag_node(*local_name: str*, *attributes: Optional[Dict[str, str]] = None*, *namespace: Optional[str] = None*, *children: Sequence[Union[str, NodeBase, _TagDefinition]] = ()*) → *TagNode*
Creates a new *TagNode* instance in the node's context.

Parameters
- **local_name** – The tag name.
- **attributes** – Optional attributes that are assigned to the new node.
- **namespace** – An optional tag namespace. If none is provided, the context node's namespace is inherited.

- **children** – An optional sequence of objects that will be appended as child nodes. This can be existing nodes, strings that will be inserted as text nodes and in-place definitions of *TagNode* instances from *tag()*. The latter will be assigned to the same namespace.

Returns
The newly created tag node.

property parent: Optional[*TagNode*]

The node's parent or None.

static parse(*text: AnyStr*, *parser: Optional[XMLParser] = None*, *parser_options: Optional[*ParserOptions*] = None*, *collapse_whitespace: Optional[bool] = None*) → *TagNode*

Parses the given string or bytes sequence into a new tree.

Parameters

- **text** – A serialized XML tree.
- **parser** – Deprecated.
- **parser_options** – A *delb.ParserOptions* class to configure the used parser.
- **collapse_whitespace** – Deprecated. Use the argument with the same name on the parser_options object.

property prefix: Optional[str]

The prefix that the node's namespace is currently mapped to.

prepend_children(**node: NodeBase*, *clone: bool = False*) → None

Adds one or more nodes as child nodes before any existing to the child nodes of the node this method is called on.

The nodes can be concrete instances of any node type or rather abstract descriptions in the form of strings or objects returned from the *tag()* function that are used to derive *TextNode* respectively *TagNode* instances from.

Parameters

- **node** – The node(s) to be added.
- **clone** – Clones the concrete nodes before adding if True.

replace_with(*node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*) → NodeBase

Removes the node and places the given one in its tree location.

The node can be a concrete instance of any node type or a rather abstract description in the form of a string or an object returned from the *tag()* function that is used to derive a *TextNode* respectively *TagNode* instance from.

Parameters

- **node** – The replacing node.
- **clone** – A concrete, replacing node is cloned if True.

Returns
The removed node.

property universal_name: str

The node's qualified name in Clark notation.

xpath(*expression: str*, *namespaces: Optional[Namespaces] = None*) → *QueryResults*

See *Queries with XPath & CSS* for details on the extent of the XPath implementation.

Parameters

- **expression** – A supported XPath 1.0 expression that contains one or more location paths.
- **namespaces** – A mapping of prefixes that are used in the expression to namespaces. If omitted, the node's definition is used.

Returns

All nodes that match the evaluation of the provided XPath expression.

Tag attribute

class delb.nodes.**Attribute**(*attributes: TagAttributes*, *key: str*)

Attribute objects represent *tag node*'s attributes. See the *delb.TagNode.attributes()* documentation for capabilities.

property local_name: `str`

The attribute's local name.

property namespace: `Optional[str]`

The attribute's namespace

property universal_name: `str`

The attribute's namespace and local name in Clark notation.

property value: `str`

The attribute's value.

Text

class delb.**TextNode**(*reference_or_text: Union[_Element, str,* TextNode*]*, *position: int = 0*)

TextNodes contain the textual data of a document. The class shall not be initialized by client code, just throw strings into the trees.

Instances expose all methods of `str` except `str.index()`:

```
>>> node = TextNode("Show us the way to the next whisky bar.")
>>> node.split()
['Show', 'us', 'the', 'way', 'to', 'the', 'next', 'whisky', 'bar.']
```

Instances can be tested for inequality with other text nodes and strings:

```
>>> TextNode("ham") == TextNode("spam")
False
>>> TextNode("Patsy") == "Patsy"
True
```

And they can be tested for substrings:

```
>>> "Sir" in TextNode("Sir Bedevere the Wise")
True
```

Attributes that rely to child nodes yield nothing respectively `None`.

Properties

content	The node's text content.
depth	The depth (or level) of the node in its tree.
document	The *Document* instances that the node is associated with or None.
first_child	
full_text	The concatenated contents of all text node descendants in document order.
index	The node's index within the parent's collection of child nodes or None when the node has no parent.
last_child	
last_descendant	
namespaces	The prefix to namespace mapping of the node.
parent	The node's parent or None.

Fetching a single relative node

fetch_following(*filter)

param filter
Any number of *filter* s.

fetch_following_sibling(*filter)

param filter
Any number of *filter* s.

fetch_preceding(*filter)

param filter
Any number of *filter* s.

fetch_preceding_sibling(*filter)

param filter
Any number of *filter* s.

Iterating over relative nodes

iterate_ancestors(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_children(*filter[, recurse])	A generator iterator that yields nothing.
iterate_descendants(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_following(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_following_siblings(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_preceding(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_preceding_siblings(*filter)	**param filter** Any number of *filter* s that a node must match to be

Querying nodes

xpath(expression[, namespaces])	See *Queries with XPath & CSS* for details on the extent of the XPath implementation.

Adding nodes

add_following_siblings(*node[, clone])	Adds one or more nodes to the right of the node this method is called on.
add_preceding_siblings(*node[, clone])	Adds one or more nodes to the left of the node this method is called on.

Removing a node from its tree

detach([retain_child_nodes])	Removes the node from its tree.
replace_with(node[, clone])	Removes the node and places the given one in its tree location.

Uncategorized methods

clone([deep, quick_and_unsafe])	**param deep** Clones the whole subtree if `True`.
new_tag_node(local_name[, attributes, ...])	Creates a new *TagNode* instance in the node's context.

---

add_following_siblings(**node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*)

Adds one or more nodes to the right of the node this method is called on.

The nodes can be concrete instances of any node type or rather abstract descriptions in the form of strings or objects returned from the *tag()* function that are used to derive *TextNode* respectively *TagNode* instances from.

Parameters

- **node** – The node(s) to be added.
- **clone** – Clones the concrete nodes before adding if `True`.

add_preceding_siblings(**node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*)

Adds one or more nodes to the left of the node this method is called on.

The nodes can be concrete instances of any node type or rather abstract descriptions in the form of strings or objects returned from the *tag()* function that are used to derive *TextNode* respectively *TagNode* instances from.

Parameters

- **node** – The node(s) to be added.
- **clone** – Clones the concrete nodes before adding if `True`.

clone(*deep: bool = False*, *quick_and_unsafe: bool = False*) → NodeBase

Parameters

- **deep** – Clones the whole subtree if `True`.
- **quick_and_unsafe** – Creates a deep clone in a quicker manner where text nodes may get lost. It should be safe with trees that don't contain subsequent text nodes, e.g. freshly parsed, unaltered documents of after *TagNode.merge_text_nodes()* has been applied.

Returns

A copy of the node.

property content: *str*

The node's text content.

property depth: *int*

The depth (or level) of the node in its tree.

detach(*retain_child_nodes: bool = False*) → *TextNode*

Removes the node from its tree.

Parameters
retain_child_nodes – Keeps the node's descendants in the originating tree if `True`.

Returns
The removed node.

property document: *Optional[Document]*

The *Document* instances that the node is associated with or `None`.

fetch_following(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The next node in document order that matches all filters or `None`.

fetch_following_sibling(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The next sibling to the right that matches all filters or `None`.

fetch_preceding(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The previous node in document order that matches all filters or `None`.

fetch_preceding_sibling(**filter: _delb.typing.Filter*) → Optional[NodeBase]

Parameters
filter – Any number of *filter* s.

Returns
The next sibling to the left that matches all filters or `None`.

first_child = None

property full_text: *str*

The concatenated contents of all text node descendants in document order.

property index: *Optional[int]*

The node's index within the parent's collection of child nodes or `None` when the node has no parent.

iterate_ancestors(**filter: _delb.typing.Filter*) → Iterator[*TagNode*]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the ancestor nodes from bottom to top.

iterate_children(**filter: _delb.typing.Filter*, *recurse: bool = False*) → Iterator[NodeBase]

A generator iterator that yields nothing.

iterate_descendants(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the descending nodes of the node.

iterate_following(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the following nodes in document order.

iterate_following_siblings(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the siblings to the node's right.

iterate_preceding(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the previous nodes in document order.

iterate_preceding_siblings(**filter: _delb.typing.Filter*) → Iterator[NodeBase]

Parameters
filter – Any number of *filter* s that a node must match to be yielded.

Returns
A generator iterator that yields the siblings to the node's left.

last_child = None

last_descendant = None

property namespaces

The prefix to namespace mapping of the node.

new_tag_node(*local_name: str*, *attributes: Optional[Dict[str, str]] = None*, *namespace: Optional[str] = None*, *children: Sequence[Union[str, NodeBase, _TagDefinition]] = ()*) → *TagNode*

Creates a new *TagNode* instance in the node's context.

Parameters

- **local_name** – The tag name.
- **attributes** – Optional attributes that are assigned to the new node.
- **namespace** – An optional tag namespace. If none is provided, the context node's namespace is inherited.

- **children** – An optional sequence of objects that will be appended as child nodes. This can be existing nodes, strings that will be inserted as text nodes and in-place definitions of *TagNode* instances from *tag()*. The latter will be assigned to the same namespace.

Returns
The newly created tag node.

property parent: Optional[*TagNode*]

The node's parent or None.

replace_with(*node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*) → NodeBase

Removes the node and places the given one in its tree location.

The node can be a concrete instance of any node type or a rather abstract description in the form of a string or an object returned from the *tag()* function that is used to derive a *TextNode* respectively *TagNode* instance from.

Parameters

- **node** – The replacing node.
- **clone** – A concrete, replacing node is cloned if True.

Returns
The removed node.

xpath(*expression: str*, *namespaces: Optional[Namespaces] = None*) → *QueryResults*

See *Queries with XPath & CSS* for details on the extent of the XPath implementation.

Parameters

- **expression** – A supported XPath 1.0 expression that contains one or more location paths.
- **namespaces** – A mapping of prefixes that are used in the expression to namespaces. If omitted, the node's definition is used.

Returns
All nodes that match the evaluation of the provided XPath expression.

Node constructors

delb.**new_comment_node**(*content: str*) → *CommentNode*

Creates a new *CommentNode*.

Parameters
content – The comment's content a.k.a. as text.

Returns
The newly created comment node.

delb.**new_processing_instruction_node**(*target: str*, *content: str*) → *ProcessingInstructionNode*

Creates a new *ProcessingInstructionNode*.

Parameters

- **target** – The processing instruction's target name.
- **content** – The processing instruction's text.

Returns
The newly created processing instruction node.

delb.**new_tag_node**(*local_name: str*, *attributes: Optional[Dict[str, str]] = None*, *namespace: Optional[str] = None*, *children: Sequence[Union[str, NodeBase, _TagDefinition]] = ()*) → *TagNode*

Creates a new *TagNode* instance outside any context. It is preferable to use *new_tag_node()*, on instances of documents and nodes where the instance is the creation context.

Parameters

- **local_name** – The tag name.
- **attributes** – Optional attributes that are assigned to the new node.
- **namespace** – An optional tag namespace.
- **children** – An optional sequence of objects that will be appended as child nodes. This can be existing nodes, strings that will be inserted as text nodes and in-place definitions of *TagNode* instances from *tag()*. The latter will be assigned to the same namespace.

Returns

The newly created tag node.

3.3.5 Queries with XPath & CSS

delb allows querying of nodes with CSS selector and XPath expressions. CSS selectors are converted to XPath expressions with a third-party library before evaluation and they are only supported as far as their computed XPath equivalents are supported by *delb*'s very own XPath implementation.

This implementation is not fully compliant with one of the W3C's XPath specifications. It mostly covers the XPath 1.0 specs, but focuses on the querying via path expressions with simple constraints while it omits a broad employment of computations (that's what programming languages are for) and has therefore these intended deviations from that standard:

- Default namespaces can be addressed in node and attribute names, by simply using no prefix.
- The attribute and namespace axes are not supported in location steps (see also below).
- In predicates only the attribute axis can be used in its abbreviated form (`@name`).
- Path evaluations within predicates are not available.
- **Only these predicate functions are provided and tested:**
  - `boolean`
  - `concat`
  - `contains`
  - `last`
  - `not`
  - `position`
  - `starts-with`
  - **`text`**
    - Behaves as if deployed as a single step location path that only tests for the node type *text*. Hence it returns the contents of the context node's first child node that is a text node or an empty string when there is none.
  - Please refrain from extension requests without a proper, concrete implementation proposal.

If you're accustomed to retrieve attribute values with XPath expressions, employ the functionality of the higher programming language at hand like this:

```
>>> [x.attributes["target"] for x in root.xpath(".//foo")
...  if "target" in x.attributes ]
```

Instead of:

```
>>> root.xpath(".//foo/@target")
```

See *_delb.plugins.PluginManager.register_xpath_function()* regarding the use of custom functions.

class _delb.xpath.**EvaluationContext**(*node: NodeBase*, *position: int*, *size: int*, *namespaces: Namespaces*)

Instances of this type are passed to XPath functions in order to pass contextual information.

count(*value*, */*)

Return number of occurrences of value.

index(*value*, *start=0*, *stop=9223372036854775807*, */*)

Return first index of value.

Raises ValueError if the value is not present.

property namespaces

A mapping of prefixes to namespaces that is used in the whole evaluation.

property node

The node that is evaluated.

property position

The node's position within all nodes that matched a location step's node test in order of the step's axis' direction. The first position is 1.

property size

The number of all nodes all nodes that matched a location step's node test.

class _delb.xpath.**QueryResults**(*results: Iterable[NodeBase]*)

A container that includes the results of a CSS selector or XPath query with some helpers for better readable Python expressions.

as_list() → List[NodeBase]

The contained nodes as a new `list`.

property as_tuple: Tuple[NodeBase, ...]

The contained nodes in a `tuple`.

count(*value*) → integer -- return number of occurrences of value

filtered_by(**filters: _delb.typing.Filter*) → *QueryResults*

Returns another *`QueryResults`* instance that contains all nodes filtered by the provided *filter* s.

property first: Optional[NodeBase]

The first node from the results or `None` if there are none.

in_document_order() → *QueryResults*

Returns another *`QueryResults`* instance where the contained nodes are sorted in document order.

index(*value*[, *start*[, *stop*]]) → integer -- return first index of value.

Raises ValueError if the value is not present.

Supporting start and stop arguments is optional, but recommended.

property last: Optional[NodeBase]

The last node from the results or `None` if there are none.

property size: int

The amount of contained nodes.

3.3.6 Filters

Default filters

delb.**altered_default_filters**(**filter: _delb.typing.Filter*, *extend: bool = False*)

This function can be either used as as context manager or decorator to define a set of `default_filters` for the encapsuled code block or callable. These are then applied in all operations that allow node filtering, like `TagNode.next_node()`. Mind that they also affect a node's index property and indexed access to child nodes.

```
>>> root = Document(
...     '<root xmlns="foo"><a/><!--x--><b/><!--y--><c/></root>'
... ).root
>>> with altered_default_filters(is_comment_node):
...     print([x.content for x in root.iterate_children()])
['x', 'y']
```

As the default filters shadow comments and processing instructions by default, use no argument to unset this in order to access all type of nodes.

Parameters

extend – Extends the currently active filters with the given ones instead of replacing them.

Contributed filters

delb.**any_of**(**filter: _delb.typing.Filter*) → _delb.typing.Filter

A node filter wrapper that matches when any of the given filters is matching, like a boolean `or`.

delb.**is_comment_node**(*node: NodeBase*) → bool

A node filter that matches *CommentNode* instances.

delb.**is_processing_instruction_node**(*node: NodeBase*) → bool

A node filter that matches *ProcessingInstructionNode* instances.

delb.**is_tag_node**(*node: NodeBase*) → bool

A node filter that matches *TagNode* instances.

delb.**is_text_node**(*node: NodeBase*) → bool

A node filter that matches *TextNode* instances.

delb.**not_**(**filter: _delb.typing.Filter*) → _delb.typing.Filter

A node filter wrapper that matches when the given filter is not matching, like a boolean `not`.

3.3.7 Transformations

This module offers a canonical interface with the aim to make re-use of transforming algorithms easier.

Let's look at it with examples:

```
from delb.transform import Transformation


class ResolveCopyOf(Transformation):
    def transform(self):
        for node in self.root.css_select("*[copyOf]"):
            source_id = node["copyOf"]
            source_node = self.origin_document.xpath(
                f'//*[@xml:id="{source_id[1:]}"]'
            ).first
            cloned_node = source_node.clone(deep=True)
            cloned_node.id = None
            node.replace_with(cloned_node)
```

From such defined transformations instances can be called with a (sub-)tree and an optional document where that tree originates from:

```
resolve_copy_of = ResolveCopyOf()
tree = resolve_copy_of(tree)  # where tree is an instance of TagNode
```

`typing.NamedTuple` are used to define options for transformations:

```
from typing import NamedTuple


class ResolveChoiceOptions(NamedTuple):
    corr: bool = True
    reg: bool = True


class ResolveChoice(Transformation):
    options_class = ResolveChoiceOptions

    def __init__(self, options):
        super().__init__(options)
        self.keep_selector = ",".join(
            (
                "corr" if self.options.corr else "sic",
                "reg" if self.options.reg else "orig"
            )
         )
        self.drop_selector = ",".join(
            (
                "sic" if self.options.corr else "corr",
                "orig" if self.options.reg else "reg"
            )
        )
```

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```
    def transform(self):
        for choice_node in self.root.css_select("choice"):
            node_to_drop = choice_node.css_select(self.drop_selector).first
            node_to_drop.detach()

            node_to_keep = choice_node.css_select(self.keep_selector).first
            node_to_keep.detach(retain_child_nodes=True)

            choice_node.detach(retain_child_nodes=True)
```

A transformation class that defines an `option_class` property can then either be used with its defaults or with alternate options:

```
resolve_choice = ResolveChoice()
tree = resolve_choice(tree)

resolve_choice = ResolveChoice(ResolveChoiceOptions(reg=False))
tree = resolve_choice(tree)
```

Finally, concrete transformations can be chained, both as classes or instances. The interface allows also to chain multiple chains:

```
from delb.transform import TransformationSequence

tidy_up = TransformationSequence(ResolveCopyOf, resolve_choice)
tree = tidy_up(tree)
```

Attention: This is an experimental feature. It might change significantly in the future or be removed altogether.

class delb.transform.**Transformation**(*options: Optional[NamedTuple] = None*)

This is a base class for any transformation algorithm.

abstract transform()

This method needs to implement the transformation logic. When it is called, the instance has two attributes assigned from its call:

`root` is the node that the transformation was called to transform with. `origin_document` is the document that was possibly passed as second argument.

class delb.transform.**TransformationBase**

This base class defines the calling interface of transformations.

class delb.transform.**TransformationSequence**(**transformations: Union[*TransformationBase, *Type[*TransformationBase*]]*)

A transformation sequence can be used to combine any number of both *`Transformation`* (provided as class or instantiated with options) and other *`TransformationSequence`* instances or classes.

3.3.8 Various helpers

delb.**first**(*iterable: Iterable*) → Optional[Any]

Returns the first item of the given iterable or `None` if it's empty. Note that the first item is consumed when the iterable is an iterator.

delb.**get_traverser**(*from_left=True*, *depth_first=True*, *from_top=True*)

Returns a function that can be used to traverse a (sub)tree with the given node as root. While traversing the given root node is yielded at some point.

The returned functions have this signature:

```
def traverser(root: NodeBase, *filters: Filter) -> Iterator[NodeBase]:
    ...
```

Parameters

- **from_left** – The traverser yields sibling nodes from left to right if `True`, or starting from the right if `False`.
- **depth_first** – The child nodes resp. the parent node are yielded before the siblings of a node by a traverser if `True`. Siblings are favored if `False`.
- **from_top** – The traverser starts yielding nodes with the lowest depth if `True`. When `False`, again, the opposite is in effect.

delb.**last**(*iterable: Iterable*) → Optional[Any]

Returns the last item of the given iterable or `None` if it's empty. Note that the whole iterator is consumed when such is given.

delb.**register_namespace**(*prefix: str*, *namespace: str*)

Registers a namespace prefix that newly created *TagNode* instances in that namespace will use in serializations.

The registry is global, and any existing mapping for either the given prefix or the namespace URI will be removed. It has however no effect on the serialization of existing nodes, see `Document.cleanup_namespace()` for that.

Parameters

- **prefix** – The prefix to register.
- **namespace** – The targeted namespace.

delb.**tag**(*local_name: str*)

delb.**tag**(*local_name: str*, *attributes: Mapping[str, str]*)

delb.**tag**(*local_name: str*, *child: Union[str, NodeBase, _TagDefinition]*)

delb.**tag**(*local_name: str*, *children: Sequence[Union[str, NodeBase, _TagDefinition]]*)

delb.**tag**(*local_name: str*, *attributes: Mapping[str, str]*, *child: Union[str, NodeBase, _TagDefinition]*)

delb.**tag**(*local_name: str*, *attributes: Mapping[str, str]*, *children: Sequence[Union[str, NodeBase, _TagDefinition]]*)

This function can be used for in-place creation (or call it templating if you want to) of *TagNode* instances as:

- `node` argument to methods that add nodes to a tree
- items in the `children` argument of *new_tag_node()* and `NodeBase.new_tag_node()`

The first argument to the function is always the local name of the tag node. Optionally, the second argument can be a mapping that specifies attributes for that node. The optional last argument is either a single object that will

be appended as child node or a sequence of such, these objects can be node instances of any type, strings (for derived *TextNode* instances) or other definitions from this function (for derived *TagNode* instances).

The actual nodes that are constructed always inherit the namespace of the context node they are created in.

```
>>> root = new_tag_node('root', children=[
...     tag("head", {"lvl": "1"}, "Hello!"),
...     tag("items", (
...         tag("item1"),
...         tag("item2"),
...         )
...     )
... ])
>>> str(root)
'<root><head lvl="1">Hello!</head><items><item1/><item2/></items></root>'
>>> root.append_children(tag("addendum"))
>>> str(root)[-26:]
'</items><addendum/></root>'
```

3.3.9 Exceptions

exception delb.exceptions.**AmbiguousTreeError**(*message: str*)

Raised when a single node shall be fetched or created by an XPath expression in a tree where the target position can't be clearly determined.

with_traceback()

Exception.with_traceback(tb) – set self.__traceback__ to tb and return self.

exception delb.exceptions.**DelbBaseException**

with_traceback()

Exception.with_traceback(tb) – set self.__traceback__ to tb and return self.

exception delb.exceptions.**FailedDocumentLoading**(*source: Any*, *excuses: Dict[Callable[[Any, SimpleNamespace], Union[_ElementTree, str]], Union[str, Exception]]*)

with_traceback()

Exception.with_traceback(tb) – set self.__traceback__ to tb and return self.

exception delb.exceptions.**InvalidCodePath**

Raised when a code path that is not expected to be executed is reached.

with_traceback()

Exception.with_traceback(tb) – set self.__traceback__ to tb and return self.

exception delb.exceptions.**InvalidOperation**

Raised when an invalid operation is attempted by the client code.

with_traceback()

Exception.with_traceback(tb) – set self.__traceback__ to tb and return self.

exception delb.exceptions.**XPathEvaluationError**(*message: str*)

with_traceback()

Exception.with_traceback(tb) – set self.__traceback__ to tb and return self.

exception delb.exceptions.**XPathParsingError**(*expression: Optional[str] = None*, *position: Optional[int] = None*, *message: Optional[str] = None*)

Raised when an XPath expression can't be parsed.

with_traceback()

Exception.with_traceback(tb) – set self.__traceback__ to tb and return self.

exception delb.exceptions.**XPathUnsupportedStandardFeature**(*position: int*, *feature_description: str*)

Raised when an unsupported XPath expression feature is recognized.

with_traceback()

Exception.with_traceback(tb) – set self.__traceback__ to tb and return self.

3.4 Extending delb

Note: There are actually two packages that are installed with *delb*: `delb` and `_delb`. As the underscore indicates, the latter is exposing private parts of the API while the first is re-exposing what is deemed to be public from that one and additional contents. As a rule of thumb, use the public API in applications and the private API in *delb* extensions. By doing so, you can avoid circular dependencies if your extension (or other code that it depends on) uses contents from the `_delb` package.

`delb` offers a plugin system to facilitate the extendability of a few of its mechanics with Python packages. A package that extends its functionality must provide entrypoint metadata for an entrypoint group named `delb` that points to modules that contain extensions. Some extensions have to be decorated with specific methods of the plugin manager object. Authors are encouraged to prefix their package names with `delb-` in order to increase discoverability.

These extension types are currently available:

- document loaders
- document mixin classes
- document subclasses
- XPath functions

Loaders are functions that try to make sense of any given input value, and if they can they return a parsed document.

Mixin classes add functionality / attributes to the `delb.Document` class (instead of inheriting from it). That allows applications to rely optionally on the availability of plugins and to combine various extensions.

Subclasses can be used to provide distinct models of arbitrary aspects for contents that are represented by a specific encoding. They can optionally implement a test method to qualify them as default class for recognized contents.

The designated means of communication between extensions is the `config` argument to the loader respectively the instance property of a document instance with that name.

Warning: A module that contains plugins and any module it is explicitly or implicitly importing **must not** import anything from the `delb` module itself, because that would initiate the collection of plugin implementations. And these wouldn't have been completely registered at that point. Import from the `_delb` module instead.

Caution: Mind to re-install a package in development when its entrypoint specification changed.

There's a repository that outlines the mechanics as developer reference: https://github.com/delb-xml/delb-py-reference-plugins

There's also the snakesist project that implements the loader and document mixin plugin types to interact with eXist-db as storage.

3.4.1 Document loaders

Loaders are registered with this decorator:

_delb.plugins.plugin_manager.**register_loader**(*before: Optional[Union[Callable[[Any, SimpleNamespace], Union[_ElementTree, str]], Iterable[Callable[[Any, SimpleNamespace], Union[_ElementTree, str]]]]] = None*, *after: Optional[Union[Callable[[Any, SimpleNamespace], Union[_ElementTree, str]], Iterable[Callable[[Any, SimpleNamespace], Union[_ElementTree, str]]]]] = None*) → Callable

Registers a document loader.

An example module that is specified as `delb` plugin for an IPFS loader might look like this:

```
from os import getenv
from types import SimpleNamespace
from typing import Any

from _delb.plugins import plugin_manager
from _delb.plugins.https_loader import https_loader
from _delb.typing import LoaderResult


IPFS_GATEWAY = getenv("IPFS_GATEWAY_PREFIX", "https://ipfs.io/ipfs/")


@plugin_manager.register_loader()
def ipfs_loader(source: Any, config: SimpleNamespace) -> LoaderResult:
    if isinstance(source, str) and source.startswith("ipfs://"):

        config.source_url = source
        config.ipfs_gateway_source_url = IPFS_GATEWAY + source[7:]

        return https_loader(config.ipfs_gateway_source_url, config)

    # return an indication why this loader didn't attempt to load in order
    # to support debugging
    return "The input value is not an URL with the ipfs scheme."
```

The `source` argument is what a `Document` instance is initialized with as input data.

Note that the `config` argument that is passed to a loader function contains configuration data, it's the *delb.Document.config* property after `_init_config` has been processed.

Loaders that retrieve a document from an URL should add the origin as string to the `config` object as `source_url`.

You might want to specify a loader to be considered before or after another one. Let's assume a loader shall figure out what to load from a remote XML resource that contains a reference to the actual document. That one would have to be considered before the one that loads XML documents from a URL with the *https* scheme:

```
from _delb.plugins import plugin_manager
from _delb.plugins.https_loader import https_loader


@plugin_manager.register_loader(before=https_loader)
def mets_loader(source, config) -> LoaderResult:
    # loading logic here
    pass
```

3.4.2 Document extensions

Document mixin classes are registered by subclassing them from this base class:

class _delb.plugins.**DocumentMixinBase**

By deriving a subclass from this one, a document extension class is registered as plugin. These are supposed to add additional attributes to a document, e.g. derived data or methods to interact with storage systems. All attributes of an extension should share a common prefix that terminates with an underscore, e.g. *storage_load*, *storage_save*, etc.

This base class also acts as termination for methods that can be implemented by mixin classes. Any implementation of a method must call a base class' one, e.g.:

```
from types import SimpleNamespace

from _delb.plugins import DocumentMixinBase
from magic_wonderland import play_disco


class MyExtension(DocumentMixinBase):

    # this method can be implemented by any extension class
    @classmethod
    def _init_config(cls, config, kwargs):
        config.my_extension = SimpleNamespace(conf=kwargs.pop(
            "my_extension_conf"))
        super()._init_config(config, kwargs)

    # this method is specific to this extension
    def my_extension_makes_magic(self):
        play_disco()
```

classmethod _init_config(*config: SimpleNamespace*, *kwargs: Dict[str, Any]*)

The `kwargs` argument contains the additional keyword arguments that a `Document` instance is called with. Extension classes that expect configuration data *must* process their specific arguments by clearing them from the `kwargs` dictionary, e.g. with `dict.pop()`, and preferably storing the final configuration data in a `types.SimpleNamespace` and adding it to the `types.SimpleNamespace` passed as `config` with the

extension's name. The initially mentioned keyword arguments *should* be prefixed with that name as well. This method is called before the loaders try to read and parse the given source for a document.

3.4.3 Document subclasses

Of course one can simply subclass *delb.Document* to add functionality. Beside using a subclass directly, you can let *delb.Document* figure out which subclass is an appropriate representation of the content. Subclasses can claim that by implementing a staticmethod() named `__class_test__` that takes the document's root node and the configuration to return a boolean that indicates the subclass is suited. The first class to return a `True` value will immediately be chosen, so be aware of the possible ambiguity in complex setups. It is only ensured that subclasses are considered before others that they derive from.

Subclasses are registered by importing them into an application, they must not be pointed to by entrypoint definitions.

Here's an example:

```
class TEIDocument(Document):
    def __init__(self, *args, **kwargs):
        super().__init__(*args, **{**kwargs, "collapse_whitespace": True})

    @staticmethod
    def __class_test__(root: TagNode, config: types.SimpleNamespace) -> bool:
        return root.universal_name == "{http://www.tei-c.org/ns/1.0}TEI"

    @property
    def title(self) -> str:
        return self.css_select('titleStmt title[type="main"]').first.full_text

document = Document("""\
<?xml version="1.0" encoding="UTF-8"?>
<TEI xmlns="http://www.tei-c.org/ns/1.0"><teiHeader><fileDesc><titleStmt>
<title type="main">The Document's Title</title>
</titleStmt></fileDesc></teiHeader></TEI>
""")

if isinstance(document, TEIDocument):
    print(document.title)
else:
    print("Sorry, I don't know how to retrieve the document's title.")
```

```
The Document's Title
```

The recommendations as laid out for `DocumentMixinHooks._init_config` also apply for subclasses who would process configuration arguments in their `__init__` method before calling the super class' one.

3.4.4 XPath functions

Custom XPath functions are registered with this decorator:

_delb.plugins.PluginManager.**register_xpath_function**(*self*, *arg: Union[Callable, str]*) → Callable

Custom XPath functions can be defined as shown in the following example. The first argument to a function is always an instance of *_delb.xpath.EvaluationContext* followed by the expression's arguments.

```
from delb import Document
from _delb.plugins import plugin_manager
from _delb.xpath import EvaluationContext


@plugin_manager.register_xpath_function("is-last")
def is_last(context: EvaluationContext) -> bool:
    return context.position == context.size

@plugin_manager.register_xpath_function
def lowercase(_, string: str) -> str:
    return string.lower()


document = Document("<root><node/><node foo='BAR'/></root>")
print(document.xpath("/*[is-last() and lowercase(@foo)='bar']").first)
```

```
<node foo="BAR"/>
```

3.5 Changes

Every time I thought I'd got it made

It seemed the taste was not so sweet

The listed updates resemble rather a Best Of than a full record of changes. Intentionally.

3.5.1 0.4 (2022-11-02)

News

- *delb* now uses its own XPath implementation, please investigate *_delb.xpath* for details.
- Many of the nodes' methods that relate to relative nodes have been renamed. Watch out for DeprecationWarnings!
- The method `delb.NodeBase.iterate_descendants()` is added as a replacement for the former `delb.NodeBase.child_nodes()` invoked with the now deprecated argument `recurse`.
- The `https-loader` extensions is now required for loading documents via plain and secured HTTP connections.
- Under the hood httpx is now employed as HTTP/S client.
- The contributed loader for FTP connections is marked as deprecated.
- The `parser` argument to *delb.Document* and *delb.TagNode.parse()* is deprecated and replaced by `parser_options`.

- *delb.Document.xslt()* is marked as deprecated.
- Evoked exceptions changed in various places.
- Document mixin extensions are now facilitated by subclassing *_delb.plugins.DocumentMixinBase*. It replaces `_delb.plugins.DocumentExtensionHooks` and `_delb.plugins.PluginManager.register_document_mixin()` without a backward-compatible mechanic.
- Support for the very good Python 3.10 and the even better 3.11 is added.
- The code repository is now part of an umbrella namespace for related projects: https://github.com/delb-xml/
- A `CITATTION.cff` is available in the repository and shipped with source distributions for researchers that are citing their employed software.

3.5.2 0.3 (2022-01-31)

News

- **Adds the *delb.TagNode.fetch_or_create_by_xpath()* method.**
  - Because of that a pre-mature parser of XPath expressions has been implemented and you can expect some expressions to cause failures, e.g. with functions that take more than one argument.
- Subclasses of *delb.Document* can claim to be the default class based on the evaluation of a document's content and configuration by implementing `__class_test__`.
- `_delb.plugins.PluginManager._register_document_extension()` is renamed to `_delb.plugins.PluginManager._register_document_mixin()`.
- `_delb.plugins.DocumentExtensionHooks()` is renamed to `_delb.plugins.DocumentMixinHooks()`.
- `_delb.plugins.DocumentMixinHooks._init_config()` is now a `classmethod()` and now also takes the config namespace as first argument.
- Adds *delb.Document.collapse_whitespace()* and the initialization option for *delb.Document* instances with the same name.
- Adds the `retain_child_nodes` argument to `delb.NodeBase.detach()`.
- Adds the `delb.NodeBase.last_descendant` property.
- Adds the *delb.TagNode.id* property.
- Adds the *delb.TagNode.parse()* method.
- `TagNode.qualified_name()` is marked deprecated and the same property is now available as `TagNode.universal_name()`.
- Adds support for Python 3.9 & 3.10.
- Drops support for Python 3.6
- Uses GitHub actions for CI checks.

Fixes

- Detached *delb.TagNode* s now drop references to *delb.TextNode* siblings.
- Ensures that *delb.TagNode.location_path* always consists of indexed steps (`/*[i]`) only.
- Avoids hitting the interpreter's recursion limit when iterating in stream dimension.

3.5.3 0.2 (2020-07-26)

News

- Adds a logo. Gracious thanks to sm!
- Adds *plugin mechanics*. Graciae ad infinitum, TC!
- CSS and XPath query results are wrapped in `delb.QueryResults`.
- Adds *delb.Document.head_nodes* and *delb.Document.tail_nodes* that allow access to the siblings of a root node.
- Adds the *delb.Document.source_url* property.
- Adds *delb.get_traverser()* and two traverser implementations that yield nodes related to a root node according to their defined order.
- Document loaders report back the reason why they would or could not load a document from the given object.
- Various documentation improvements, including table of contents for class members.

3.5.4 0.1.2 (2019-09-14)

There's nothing super-exciting to report here. It's just getting better.

3.5.5 0.1.1 (2019-08-15)

This was quiet boring, it serves updated dependencies for what it's worth.

3.5.6 0.1 (2019-05-26)

The initial release with a set and sound data model and API.

3.6 Glossary

filter
: Filter functions can be used as arguments with various methods on node instances that return other nodes. They are called with a node instance as only argument and they should return a `bool` to indicate whether the node matches the filter. Have a look at the *Filters* source code for examples.

tag node
: Tag nodes are the equivalent to the DOM's element node. Its name shall make it distinguishable from the ElementTree API and relates to the nodes' functionality of tagging text.

3.7 Index

3.8 License

```
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                       Version 3, 19 November 2007

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    (including a physical distribution medium), accompanied by a
    written offer, valid for at least three years and valid for as
    long as you offer spare parts or customer support for that product
    model, to give anyone who possesses the object code either (1) a
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    medium customarily used for software interchange, for a price no
    more than your reasonable cost of physically performing this
    conveying of source, or (2) access to copy the
    Corresponding Source from a network server at no charge.
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    c) Convey individual copies of the object code with a copy of the
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    alternative is allowed only occasionally and noncommercially, and
    only if you received the object code with such an offer, in accord
    with subsection 6b.

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specifically for use in, a User Product, and the conveying occurs as
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part of a transaction in which the right of possession and use of the
User Product is transferred to the recipient in perpetuity or for a
fixed term (regardless of how the transaction is characterized), the
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