lxml-domeqsque 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.
- Applying XSL Transformations.

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 and properties to hold text
content.
```

CHAPTER

FOUR

ROADMAPISH

- gain insights from usage experience
- implement the API in Rust
- provide bindings for Python and Javascript to the Rust implementation, while nurturing the lxml-based implementation as reference for some time
- be finished before the Digital Humanities community realizes how to foster a viable software ecosystem and fund such efforts

4.1 Installation

4.1.1 From the Python Package Index

Before you install the library manually you might consider to use a project management tool like pipenv or poetry, or still use pip:

```
pip install delb
```

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

```
# in a poetry managed project
poetry add --extras=https-loader delb
# otherwise
pip install delb[https-loader]
```

4.1.2 From source

Prerequisites:

- poetry is available (`pip install --user poetry` should often work)
- a virtual environment of your project is activated
- that virtual environment houses an interpreter for Python 3.6 or later

Obtain the code with roughly one of:

- `git clone --recurse-submodules git@github.com:funkyfuture/delb.git`
- `curl -LosS https://github.com/funkyfuture/delb/archive/master.tar.gz | tar xzf -`

To install it regularly:

```
.../delb $ pip install .
```

For developing purposes of `delb` itself, poetry should be used which install the library in editable mode and all employed development tools:

```
.../delb $ poetry install
```

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.

4.2 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 thumb of rule, 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` API.

4.2.1 Documents

class delb.**Document**(*source: Any*, *parser: lxml.etree.XMLParser = <lxml.etree.XMLParser object>*, ***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.

- **parser** – An optional `lxml.etree.XMLParser` instance that is used to parse a document stream.
- **config** – Additional keyword arguments for the configuration of extension classes.

Properties

namespaces	The namespace mapping of the document's *root* node.
root	The root node of a document tree.
head_nodes	A list-like accessor to the nodes that precede the document's root node.
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

`__init__`(source[, parser])	Initialize self.
`__contains__`(node)	
`__str__`()	Return str(self).
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.
css_select(expression)	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)	This method proxies to the *TagNode.xpath()* method of the document's *root* node.

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Table 2 – continued from previous page

xslt(transformation)	**param transformation** A `lxml.etree.XSLT` instance that shall be

cleanup_namespaces(*namespaces: Optional[etree._NSMap] = 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() → *delb.Document*

Returns Another instance with the duplicated contents.

config: SimpleNamespace

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

css_select(*expression: str*) → _delb.nodes.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

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

property root
The root node of a document tree.

save(*path: pathlib.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*) → _delb.nodes.QueryResults
This method proxies to the *TagNode.xpath()* method of the document's *root* node.

xslt(*transformation: lxml.etree.XSLT*) → *delb.Document*

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

Returns A new instance with the transformation's result.

4.2.2 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: types.SimpleNamespace*) → Union[Tuple[Optional[lxml.etree._ElementTree], Dict[int, _ElementWrappingNode]], str]

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

`_delb.plugins.core_loaders.`**`etree_loader`**(*data: Any*, *config: types.SimpleNamespace*) → Union[Tuple[Optional[lxml.etree._ElementTree], Dict[int, _ElementWrappingNode]], str]

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

`_delb.plugins.core_loaders.`**`ftp_http_loader`**(*data: Any*, *config: types.SimpleNamespace*) → Union[Tuple[Optional[lxml.etree._ElementTree], Dict[int, _ElementWrappingNode]], str]

Loads a document from a URL with either the `ftp` or `http` 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: types.SimpleNamespace*) → Union[Tuple[Optional[lxml.etree._ElementTree], Dict[int, _ElementWrappingNode]], str]

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: types.SimpleNamespace*) → Union[Tuple[Optional[lxml.etree._ElementTree], Dict[int, _ElementWrappingNode]], str]

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

`_delb.plugins.core_loaders.`**`text_loader`**(*data: Any*, *config: types.SimpleNamespace*) → Union[Tuple[Optional[lxml.etree._ElementTree], Dict[int, _ElementWrappingNode]], str]

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: Any*, *config: types.SimpleNamespace*) → Union[Tuple[Optional[lxml.etree._ElementTree], Dict[int, _ElementWrappingNode]], str]

This loader loads a document from a URL with the `https` scheme. The URL will be bound to `source_url` on the document's `Document.config` attribute.

4.2.3 Nodes

Comment

class delb.**CommentNode**(*etree_element: lxml.etree._Element*, *cache: Dict[int, _ElementWrappingNode]*)

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

To instantiate new nodes use *new_comment_node()*.

Properties

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	
parent	The node's parent or None.
content	The comment's text.

Fetching a single relative node

next_node(*filter)

param filter Any number of *filter* s.

next_node_in_stream(*filter)

param filter Any number of *filter* s.

previous_node(*filter)

param filter Any number of *filter* s.

previous_node_in_stream(*filter)

param filter Any number of *filter* s.

Iterating over relative nodes

ancestors(*filter)

param filter Any number of *filter* s that a node must match to be

child_nodes(*filter[, recurse])	A generator iterator that yields nothing.

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iterate_next_nodes(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_next_nodes_in_stream(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_previous_nodes(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_previous_nodes_in_stream(*filter)	**param filter** Any number of *filter* s that a node must match to be

Adding nodes

add_next(*node[, clone])	Adds one or more nodes to the right of the node this method is called on.
add_previous(*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()	Removes the node, including its descendants, from its tree.
replace_with(node[, clone])	Removes the node and places the given one in its tree location.

Uncategorized methods

__init__(etree_element, cache)	Initialize self.
clone([deep])	**param deep** Clones the whole subtree if `True`.
new_tag_node(local_name[, attributes, ...])	Creates a new *TagNode* instance in the node's context.
__copy__()	
__deepcopy__([memodict])	
__eq__(other)	Return self==value.
__str__()	Return str(self).
__repr__()	Return repr(self).

add_next (**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_previous (**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`.

ancestors (**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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.

child_nodes (**filter: Callable[[NodeBase], bool], recurse: bool = False*) → Iterator[_delb.nodes.NodeBase]
A generator iterator that yields nothing.

clone (*deep: bool = False*) → _delb.nodes._ElementWrappingNode

Parameters **deep** – Clones the whole subtree if `True`.

Returns A copy of the node.

property content
The comment's text.

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

detach () → _ElementWrappingNode
Removes the node, including its descendants, from its tree.

Returns The removed node.

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

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

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

iterate_next_nodes (**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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_next_nodes_in_stream(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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_previous_nodes(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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.

iterate_previous_nodes_in_stream(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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.

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

next_node(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

next_node_in_stream(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

property parent

The node's parent or `None`.

previous_node(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

previous_node_in_stream(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

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

Processing instruction

class delb.**ProcessingInstructionNode**(*etree_element: lxml.etree._Element*, *cache: Dict[int, _ElementWrappingNode]*)

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

To instantiate new nodes use *new_processing_instruction_node()*.

Properties

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	
parent	The node's parent or `None`.
content	The processing instruction's text.
target	The processing instruction's target.

Fetching a single relative node

next_node(*filter)	**param filter** Any number of *filter* s.
next_node_in_stream(*filter)	**param filter** Any number of *filter* s.
previous_node(*filter)	**param filter** Any number of *filter* s.

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previous_node_in_stream(*filter)	**param filter** Any number of *filter* s.

Iterating over relative nodes

ancestors(*filter)	**param filter** Any number of *filter* s that a node must match to be
child_nodes(*filter[, recurse])	A generator iterator that yields nothing.
iterate_next_nodes(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_next_nodes_in_stream(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_previous_nodes(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_previous_nodes_in_stream(*filter)	**param filter** Any number of *filter* s that a node must match to be

Adding nodes

add_next(*node[, clone])	Adds one or more nodes to the right of the node this method is called on.
add_previous(*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()	Removes the node, including its descendants, from its tree.
replace_with(node[, clone])	Removes the node and places the given one in its tree location.

Uncategorized methods

`__init__`(etree_element, cache)	Initialize self.
clone([deep])	**param deep** Clones the whole subtree if `True`.
new_tag_node(local_name[, attributes, ...])	Creates a new *TagNode* instance in the node's context.
`__copy__`()	
`__deepcopy__`([memodict])	
`__eq__`(other)	Return self==value.
`__str__`()	Return str(self).
`__repr__`()	Return repr(self).

add_next (**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_previous (**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`.

ancestors (**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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.

child_nodes (**filter: Callable[[NodeBase], bool], recurse: bool = False*) → Iterator[_delb.nodes.NodeBase]
A generator iterator that yields nothing.

clone (*deep: bool = False*) → _delb.nodes._ElementWrappingNode

Parameters **deep** – Clones the whole subtree if `True`.

Returns A copy of the node.

property content
The processing instruction's text.

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

detach() → _ElementWrappingNode
Removes the node, including its descendants, from its tree.

Returns The removed node.

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

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

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

iterate_next_nodes(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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_next_nodes_in_stream(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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_previous_nodes(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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.

iterate_previous_nodes_in_stream(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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.

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

next_node(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

next_node_in_stream(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

property parent
The node's parent or `None`.

previous_node(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

previous_node_in_stream(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

replace_with(*node: Union[str, NodeBase, _TagDefinition]*, *clone: bool = False*) → _delb.nodes.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
The processing instruction's target.

Tag

class delb.**TagNode**(*etree_element: lxml.etree._Element*, *cache: Dict[int, _ElementWrappingNode]*)
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

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.
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.
parent	The node's parent or None.
attributes	A mapping that can be used to query and alter the node's attributes.
local_name	The node's name.

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Table 15 – continued from previous page

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

Fetching a single relative node

next_node(*filter)

param filter Any number of *filter* s.

next_node_in_stream(*filter)

param filter Any number of *filter* s.

previous_node(*filter)

param filter Any number of *filter* s.

previous_node_in_stream(*filter)

param filter Any number of *filter* s.

Iterating over relative nodes

ancestors(*filter)

param filter Any number of *filter* s that a node must match to be

child_nodes(*filter[, recurse])

param filter Any number of *filter* s that a node must match to be

iterate_next_nodes(*filter)

param filter Any number of *filter* s that a node must match to be

iterate_next_nodes_in_stream(*filter)

param filter Any number of *filter* s that a node must match to be

iterate_previous_nodes(*filter)

param filter Any number of *filter* s that a node must match to be

continues on next page

Table 17 – continued from previous page

iterate_previous_nodes_in_stream(*filter)	**param filter** Any number of *filter* s that a node must match to be

Querying descending nodes

css_select(expression)	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.
xpath(expression)	Returns all *tag node* s that match the evaluation of an XPath expression.

Adding nodes

add_next(*node[, clone])	Adds one or more nodes to the right of the node this method is called on.
add_previous(*node[, clone])	Adds one or more nodes to the left of the node this method is called on.
append_child(*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_child(index, *node[, clone])	Inserts one or more child nodes.
prepend_child(*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()	Removes the node, including its descendants, from its tree.
replace_with(node[, clone])	Removes the node and places the given one in its tree location.

Uncategorized methods

`__init__`(etree_element, cache)	Initialize self.
clone([deep])	**param deep** Clones the whole subtree if `True`.
new_tag_node(local_name[, attributes, ...])	Creates a new *TagNode* instance in the node's context.
`__copy__`()	
`__deepcopy__`([memodict])	
`__contains__`(item)	
`__eq__`(other)	Return self==value.
`__getitem__`()	
`__hash__`()	Return hash(self).
`__len__`()	
`__str__`()	Return str(self).
`__repr__`()	Return repr(self).
merge_text_nodes()	Merges all consecutive text nodes in the subtree into one.

add_next (**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_previous (**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`.

ancestors (**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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.

append_child (**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

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({"bar": "2", "zong": "2"})
>>> print(node)
<node foo="1" peng="1" bar="2" zong="2"/>
```

child_nodes(**filter: Callable[[NodeBase], bool], recurse: bool = False*) → Iterator[_delb.nodes.NodeBase]

Parameters

- **filter** – Any number of *filter* s that a node must match to be yielded.
- **recurse** – Also returns the children's children and so on in document order if `True`.

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

clone(*deep: bool = False*) → TagNode

Parameters **deep** – Clones the whole subtree if `True`.

Returns A copy of the node.

css_select(*expression: str*) → _delb.nodes.QueryResults

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.

Returns A list of matching *tag node* s.

property depth

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

detach() → _delb.nodes._ElementWrappingNode

Removes the node, including its descendants, from its tree.

Returns The removed node.

property document

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

property first_child

The node's first child node.

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

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

insert_child(*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_next_nodes(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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_next_nodes_in_stream(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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_previous_nodes(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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.

iterate_previous_nodes_in_stream(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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.

property last_child
The node's last child node.

property local_name
The node's name.

property location_path
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
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
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, _delb.nodes.NodeBase, _TagDefinition]] = ()*) → _delb.nodes.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.

next_node(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

next_node_in_stream(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

property parent

The node's parent or `None`.

property prefix

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

prepend_child(**node: _delb.nodes.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`.

previous_node(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

previous_node_in_stream(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

property qualified_name

The node's qualified name.

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

Returns all *tag node* s that match the evaluation of an XPath expression.

Mind to start any the expression with a `.` when the node you call it on is supposed to be the initial context node in the path evaluation.

As this API is for a real programming language, the full XPath specification is not intended to be supported. For example, instead of querying attributes with an XPath expression, one must use a comprehension like:

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

Instead of:

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

Having that said, implementing retrieval of attributes may actually happen if there are convincing user stories. But other things like addressing processing instructions and higher level operations are out of scope.

This method includes a workaround for a bug in XPath 1.0 that concerns its lack of default namespace support. It is extensively described in this lxml issue: https://github.com/lxml/lxml/pull/236

Parameters **expression** – An XPath 1.0 location path.

Text

class delb.**TextNode**(*reference_or_text: Union[lxml.etree._Element, str, TextNode], position: int = 0, cache: Optional[Dict[int, _ElementWrappingNode]] = None*)

TextNodes contain the textual data of a document.

Instances expose all methods of `str`:

```
>>> 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

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	
parent	The node's parent or `None`.
content	The node's text content.

Fetching a single relative node

next_node(*filter)

param filter Any number of *filter* s.

next_node_in_stream(*filter)

param filter Any number of *filter* s.

previous_node(*filter)

param filter Any number of *filter* s.

previous_node_in_stream(*filter)

param filter Any number of *filter* s.

Iterating over relative nodes

ancestors(*filter)

param filter Any number of *filter* s that a node must match to be

child_nodes(*filter[, recurse])	A generator iterator that yields nothing.

iterate_next_nodes(*filter)

param filter Any number of *filter* s that a node must match to be

continues on next page

Table 24 – continued from previous page

iterate_next_nodes_in_stream(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_previous_nodes(*filter)	**param filter** Any number of *filter* s that a node must match to be
iterate_previous_nodes_in_stream(*filter)	**param filter** Any number of *filter* s that a node must match to be

Adding nodes

add_next(*node[, clone])	Adds one or more nodes to the right of the node this method is called on.
add_previous(*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()	Removes the node, including its descendants, from its tree.
replace_with(node[, clone])	Removes the node and places the given one in its tree location.

Uncategorized methods

__init__(reference_or_text[, position, cache])	Initialize self.
clone([deep])	**param deep** Clones the whole subtree if `True`.
new_tag_node(local_name[, attributes, ...])	Creates a new *TagNode* instance in the node's context.
__contains__(item)	
__eq__(other)	Return self==value.
__getattr__(item)	
__getitem__(item)	
__repr__()	Return repr(self).
__str__()	Return str(self).

add_next(**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_previous(**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`.

ancestors(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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.

child_nodes(**filter: Callable[[NodeBase], bool]*, *recurse: bool = False*) → Iterator[_delb.nodes.NodeBase]
A generator iterator that yields nothing.

clone(*deep: bool = False*) → _delb.nodes.NodeBase

Parameters **deep** – Clones the whole subtree if `True`.

Returns A copy of the node.

property content
The node's text content.

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

detach() → _delb.nodes.TextNode
Removes the node, including its descendants, from its tree.

Returns The removed node.

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

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

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

iterate_next_nodes(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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_next_nodes_in_stream(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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_previous_nodes(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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.

iterate_previous_nodes_in_stream(**filter: Callable[[NodeBase], bool]*) → Iterator[_delb.nodes.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.

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

next_node(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

next_node_in_stream(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

property parent

The node's parent or `None`.

previous_node(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

previous_node_in_stream(**filter: Callable[[NodeBase], bool]*) → Optional[_delb.nodes.NodeBase]

Parameters **filter** – Any number of *filter* s.

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

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

Node constructors

delb.**new_comment_node**(*content: str*) → _delb.nodes.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*) → _delb.nodes.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]] = ()*) → _delb.nodes.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.

Query results

class delb.**QueryResults**(*results: Iterator[_delb.nodes._ElementWrappingNode]*)
A sequence with the results of a CSS or XPath query with some helpers for readable Python expressions.

as_list() → List[_delb.nodes.TagNode]
The contained nodes as a new `list`.

as_set() → Set[_delb.nodes.TagNode]
The contained nodes as a new `set`.

property as_tuple
The contained nodes in a `tuple`.

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

filtered_by(**filters: Callable[[NodeBase], bool]*) → _delb.nodes.QueryResults
Returns another *`QueryResults`* instance that contains all nodes filtered by the provided *filter* s.

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

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

property size
The amount of contained nodes.

4.2.4 Filters

Default filters

delb.**altered_default_filters**(**filter: Callable[[NodeBase], bool]*, *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.child_nodes()])
['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: Callable[[NodeBase], bool]*) → Callable[[_delb.nodes.NodeBase], bool]
A node filter wrapper that matches when any of the given filters is matching, like a boolean `or`.

delb.**is_comment_node**(*node: _delb.nodes.NodeBase*) → bool
A node filter that matches *CommentNode* instances.

delb.**is_processing_instruction_node**(*node: _delb.nodes.NodeBase*) → bool
A node filter that matches *ProcessingInstructionNode* instances.

delb.**is_tag_node**(*node: _delb.nodes.NodeBase*) → bool
A node filter that matches *TagNode* instances.

delb.**is_text_node**(*node: _delb.nodes.NodeBase*) → bool
A node filter that matches *TextNode* instances.

delb.**not_**(*filter: Callable[[NodeBase], bool]*) → Callable[[_delb.nodes.NodeBase], bool]
A node filter wrapper that matches when the given filter is not matching, like a boolean `not`.

4.2.5 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: NodeSource*)
delb.**tag**(*local_name: str*, *children: Sequence[NodeSource]*)
delb.**tag**(*local_name: str*, *attributes: Mapping[str, str]*, *child: NodeSource*)
delb.**tag**(*local_name: str*, *attributes: Mapping[str, str]*, *children: Sequence[NodeSource]*)

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_child(tag("addendum"))
>>> str(root)[-26:]
'</items><addendum/></root>'
```

4.2.6 Exceptions

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.

4.3 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 thumb of rule, 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` API.

`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. The individual extensions have to be decorated with specific methods of the plugin manager object (see the following sections).

Authors are encouraged to prefix their package names with `delb-` in order to increase discoverability.

There are currently two distinct plugin types: *loaders* and *document extension classes*. *Loaders* are functions that try to make sense of any given input value, and if they can they return a parsed document. *Extension classes* add functionality / attributes to the *`delb.Document`* class as *mixin classes* (instead of inheriting from it). That allows applications to rely optionally on the availability of plugins. The designated means of communication between these two extension types 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.

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/funkyfuture/delb-reference-plugins

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

4.3.1 Document loaders

Loaders are registered with this decorator:

_delb.plugins.plugin_manager.**register_loader**(*before: Optional[Union[Callable[[Any, types.SimpleNamespace], Union[Tuple[Optional[lxml.etree._ElementTree], Dict[int, _ElementWrappingNode]], str]], Iterable[Callable[[Any, types.SimpleNamespace], Union[Tuple[Optional[lxml.etree._ElementTree], Dict[int, _ElementWrappingNode]], str]]]]] = None*, *after: Optional[Union[Callable[[Any, types.SimpleNamespace], Union[Tuple[Optional[lxml.etree._ElementTree], Dict[int, _ElementWrappingNode]], str]], Iterable[Callable[[Any, types.SimpleNamespace], Union[Tuple[Optional[lxml.etree._ElementTree], Dict[int, _ElementWrappingNode]], 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 *`_delb.plugins.DocumentExtensionHooks._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
```

4.3.2 Document extensions

Document extension classes are registered with *_delb.plugins.plugin_manager.register_document_extension()*:

_delb.plugins.plugin_manager.**register_document_extension**(*extension: Type*) → Type

This decorator registers document extension classes which 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.

There are hook methods that an extension can implement, they are declared in *_delb.plugins.DocumentExtensionHooks*.

Extension classes are *mixin classes* in Python OOP jargon.

They can implement methods that are called from builtin *delb.Document* methods:

class _delb.plugins.**DocumentExtensionHooks**

This class acts as termination for methods that can be implemented by extension classes. Any implementation of a method must call a base class' one with `super()`.

_init_config(*config_args: Dict[str, Any]*)

The `config_args` 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 `config_args` dictionary, e.g. with `dict.pop()`, and preferably storing the final configuration data in a `types.SimpleNamespace` and bind it to the instance's `Document.config` property 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.

4.4 Design

4.4.1 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.

4.4.2 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 (and you want that often). 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`.

4.4.3 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.

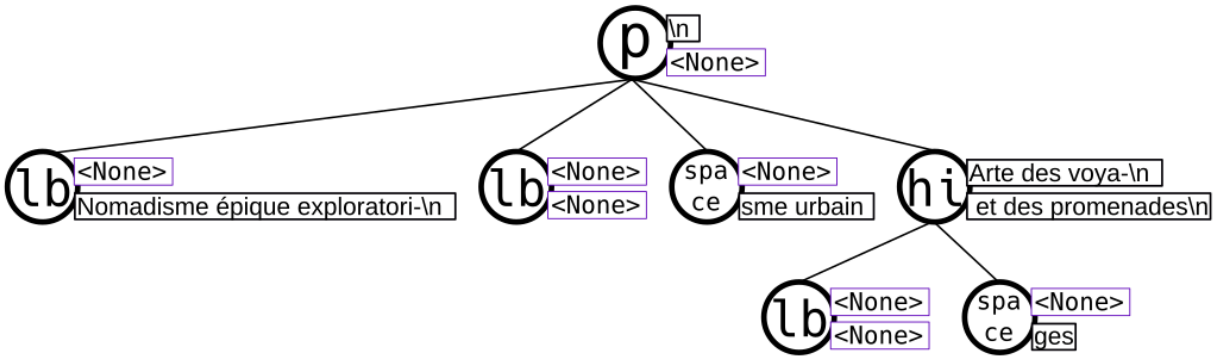
Python is a high-level, general programming language with a vast ecosystem, notably including diverse scientific communities and tools. As such it is well suited to solve and cause problems in the humanities related field of Research Software Engineering by programmers with different educational background 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 the encoding mixes different abstracted encapsulations of logical and physical 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 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. 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 that is used by a variety of more specific functions:

```
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
```

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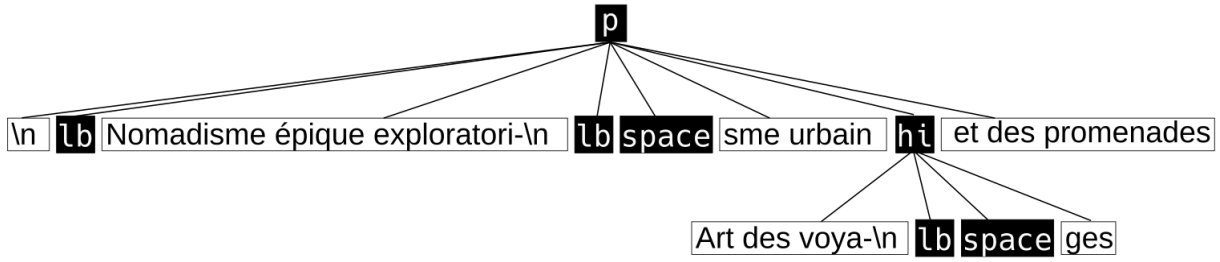
```
            else:
                previous = element.getprevious()
                if previous is None:
                    parent = element.getparent()
                    if parent.text is None:
                        parent.text = ''
                    parent.text += element.tail
          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

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 two different types of nodes:



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 at hand, this is what an equivalent of the horribly complicated function would look like:

```
def remove_nodes(*nodes: NodeBase, keep_children=False):
    """ Removes the given nodes from its tree. Unless ``keep_children`` is
```

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```
        passed as ``True``, its children vanish with it into void. """

    for node in nodes:
        parent = node.parent
        index = node.index
        node.detach()
        if keep_children:
            with altered_default_filters():
                parent.insert_node(
                    index,
                    *tuple(x.detach() for x in node.child_nodes())
                )
```

4.5 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.

4.6 Index

4.7 License

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    b) Convey the object code in, or embodied in, a physical product
    (including a physical distribution medium), accompanied by a
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    long as you offer spare parts or customer support for that product
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    medium customarily used for software interchange, for a price no
    more than your reasonable cost of physically performing this
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    conveying of source, or (2) access to copy the
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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.

    d) Convey the object code by offering access from a designated
    place (gratis or for a charge), and offer equivalent access to the
    Corresponding Source in the same way through the same place at no
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    that supports equivalent copying facilities, provided you maintain
    clear directions next to the object code saying where to find the
    Corresponding Source.  Regardless of what server hosts the
    Corresponding Source, you remain obligated to ensure that it is
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doubtful cases shall be resolved in favor of coverage.  For a particular
product received by a particular user, "normally used" refers to a
typical or common use of that class of product, regardless of the status
of the particular user or of the way in which the particular user
actually uses, or expects or is expected to use, the product.  A product
is a consumer product regardless of whether the product has substantial
commercial, industrial or non-consumer uses, unless such uses represent
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  "Installation Information" for a User Product means any methods,
procedures, authorization keys, or other information required to install
and execute modified versions of a covered work in that User Product from
a modified version of its Corresponding Source.  The information must
suffice to ensure that the continued functioning of the modified object
code is in no case prevented or interfered with solely because
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specifically for use in, a User Product, and the conveying occurs as
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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Corresponding Source conveyed under this section must be accompanied
by the Installation Information.  But this requirement does not apply
if neither you nor any third party retains the ability to install
modified object code on the User Product (for example, the work has
been installed in ROM).

  The requirement to provide Installation Information does not include a
requirement to continue to provide support service, warranty, or updates
for a work that has been modified or installed by the recipient, or for
the User Product in which it has been modified or installed.  Access to a
network may be denied when the modification itself materially and
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