Python Tree Data

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Contents

Simple, lightweight and extensible Tree data structure.

Feel free to share infos about your anytree project.

CHAPTER 1

Installation

To install the *anytree* module run:

```
pip install anytree
```

If you do not have write-permissions to the python installation, try:

```
pip install anytree --user
```

CHAPTER 2

Introduction

2.1 Overview

anytree is splitted into the following parts:

Node Classes

- `Node`: a simple tree node with at least a name attribute and any number of additional attributes.
- `AnyNode`: a generic tree node and any number of additional attributes.
- `NodeMixin`: extends any python class to a tree node.

Node Resolution

- `Resolver`: retrieve node via absolute or relative path.
- `Walker`: walk from one node to an other.

Tree Iteration Strategies

- `PreOrderIter`: iterate over tree using pre-order strategy
- `PostOrderIter`: iterate over tree using post-order strategy
- `LevelOrderIter`: iterate over tree using level-order strategy
- `LevelOrderGroupIter`: iterate over tree using level-order strategy returning group for every level
- `ZigZagGroupIter`: iterate over tree using level-order strategy returning group for every level

Tree Rendering

- **`RenderTree` using the following styles:**
  - `AsciiStyle`
  - `ContStyle`
  - `ContRoundStyle`
  - `DoubleStyle`

2.2 Basics

The only tree relevant information is the *parent* attribute. If *None* the node is root node. If set to another node, the node becomes the child of it.

```
>>> from anytree import Node, RenderTree
>>> udo = Node("Udo")
>>> marc = Node("Marc")
>>> lian = Node("Lian", parent=marc)
>>> print(RenderTree(udo))
Node('/Udo')
>>> print(RenderTree(marc))
Node('/Marc')
└── Node('/Marc/Lian')
```

Every node has an `children` attribute with a tuple of all children:

```
>>> udo.children
()
>>> marc.children
(Node('/Marc/Lian'),)
>>> lian.children
()
```

Single Node Attach

```
>>> marc.parent = udo
>>> print(RenderTree(udo))
Node('/Udo')
└── Node('/Udo/Marc')
    └── Node('/Udo/Marc/Lian')
```

Single Node Detach

To make a node to a root node, just set this attribute to *None*.

```
>>> marc.is_root
False
>>> marc.parent = None
>>> marc.is_root
True
```

Modify Multiple Child Nodes

```
>>> n = Node("n")
>>> a = Node("a", parent=n)
>>> b = Node("b", parent=n)
>>> c = Node("c", parent=n)
>>> d = Node("d")
>>> n.children
(Node('/n/a'), Node('/n/b'), Node('/n/c'))
```

Modifying the children attribute modifies multiple child nodes. It can be set to any iterable.

```
>>> n.children = [a, b]
>>> n.children
(Node('/n/a'), Node('/n/b'))
```

Node *c* is removed from the tree. In case of an existing reference, the node *c* does not vanish and is the root of its own tree.

```
>>> c
Node('/c')
```

Adding works likewise.

```
>>> d
Node('/d')
>>> n.children = [a, b, d]
>>> n.children
(Node('/n/a'), Node('/n/b'), Node('/n/d'))
>>> d
Node('/n/d')
```

2.3 Detach/Attach Protocol

A node class implementation might implement the notification slots `_pre_detach(parent)`, `_post_detach(parent)`, `_pre_attach(parent)`, `_post_attach(parent)`.

These methods are *protected* methods, intended to be overwritten by child classes of `NodeMixin`/`Node`. They are called on modifications of a nodes *parent* attribute. Never call them directly from API. This will corrupt the logic behind these methods.

```
>>> class NotifiedNode(Node):
...     def _pre_detach(self, parent):
...         print("_pre_detach", parent)
...     def _post_detach(self, parent):
...         print("_post_detach", parent)
...     def _pre_attach(self, parent):
...         print("_pre_attach", parent)
...     def _post_attach(self, parent):
...         print("_post_attach", parent)
```

Notification on attach:

```
>>> a = NotifiedNode("a")
>>> b = NotifiedNode("b")
>>> c = NotifiedNode("c")
>>> c.parent = a
_pre_attach NotifiedNode('/a')
_post_attach NotifiedNode('/a')
```

Notification on change:

```
>>> c.parent = b
_pre_detach NotifiedNode('/a')
_post_detach NotifiedNode('/a')
_pre_attach NotifiedNode('/b')
_post_attach NotifiedNode('/b')
```

If the parent equals the old value, the notification is not triggered:

```
>>> c.parent = b
```

Notification on detach:

```
>>> c.parent = None
_pre_detach NotifiedNode('/b')
_post_detach NotifiedNode('/b')
```

Important: An exeception raised by `_pre_detach(parent)` and `_pre_attach(parent)` will **prevent** the tree structure to be updated. The node keeps the old state. An exeception raised by `_post_detach(parent)` and `_post_attach(parent)` does **not rollback** the tree structure modification.

2.4 Custom Separator

By default a slash character (/) separates nodes. This separator can be overwritten:

```
>>> class MyNode(Node):
...     separator = "|"
```

```
>>> udo = MyNode("Udo")
>>> dan = MyNode("Dan", parent=udo)
>>> marc = MyNode("Marc", parent=udo)
>>> print(RenderTree(udo))
MyNode('|Udo')
├── MyNode('|Udo|Dan')
└── MyNode('|Udo|Marc')
```

The resolver takes the custom separator also into account:

```
>>> from anytree import Resolver
>>> r = Resolver()
>>> r.glob(udo, "|Udo|*")
[MyNode('|Udo|Dan'), MyNode('|Udo|Marc')]
```

CHAPTER 3

API

3.1 Node Classes

Node Classes.

- *AnyNode*: a generic tree node with any number of attributes.
- *Node*: a simple tree node with at least a name attribute and any number of additional attributes.
- *NodeMixin*: extends any python class to a tree node.

class anytree.node.anynode.**AnyNode**(*parent=None*, *children=None*, ***kwargs*)

Bases: *anytree.node.nodemixin.NodeMixin*, object

A generic tree node with any *kwargs*.

The *parent* attribute refers the parent node:

```
>>> from anytree import AnyNode, RenderTree
>>> root = AnyNode(id="root")
>>> s0 = AnyNode(id="sub0", parent=root)
>>> s0b = AnyNode(id="sub0B", parent=s0, foo=4, bar=109)
>>> s0a = AnyNode(id="sub0A", parent=s0)
>>> s1 = AnyNode(id="sub1", parent=root)
>>> s1a = AnyNode(id="sub1A", parent=s1)
>>> s1b = AnyNode(id="sub1B", parent=s1, bar=8)
>>> s1c = AnyNode(id="sub1C", parent=s1)
>>> s1ca = AnyNode(id="sub1Ca", parent=s1c)
```

```
>>> root
AnyNode(id='root')
>>> s0
AnyNode(id='sub0')
>>> print(RenderTree(root))
AnyNode(id='root')
├── AnyNode(id='sub0')
```

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```
│   ├── AnyNode(bar=109, foo=4, id='sub0B')
│   └── AnyNode(id='sub0A')
└── AnyNode(id='sub1')
    ├── AnyNode(id='sub1A')
    ├── AnyNode(bar=8, id='sub1B')
    └── AnyNode(id='sub1C')
        └── AnyNode(id='sub1Ca')
```

The same tree can be constructed by using the *children* attribute:

```
>>> root = AnyNode(id="root", children=[
...     AnyNode(id="sub0", children=[
...         AnyNode(id="sub0B", foo=4, bar=109),
...         AnyNode(id="sub0A"),
...     ]),
...     AnyNode(id="sub1", children=[
...         AnyNode(id="sub1A"),
...         AnyNode(id="sub1B", bar=8),
...         AnyNode(id="sub1C", children=[
...             AnyNode(id="sub1Ca"),
...         ]),
...     ]),
... ])
```

```
>>> print(RenderTree(root))
AnyNode(id='root')
├── AnyNode(id='sub0')
│   ├── AnyNode(bar=109, foo=4, id='sub0B')
│   └── AnyNode(id='sub0A')
└── AnyNode(id='sub1')
    ├── AnyNode(id='sub1A')
    ├── AnyNode(bar=8, id='sub1B')
    └── AnyNode(id='sub1C')
        └── AnyNode(id='sub1Ca')
```

class anytree.node.node.**Node**(*name*, *parent=None*, *children=None*, ***kwargs*)

Bases: *anytree.node.nodemixin.NodeMixin*, object

A simple tree node with a *name* and any *kwargs*.

The *parent* attribute refers the parent node:

```
>>> from anytree import Node, RenderTree
>>> root = Node("root")
>>> s0 = Node("sub0", parent=root)
>>> s0b = Node("sub0B", parent=s0, foo=4, bar=109)
>>> s0a = Node("sub0A", parent=s0)
>>> s1 = Node("sub1", parent=root)
>>> s1a = Node("sub1A", parent=s1)
>>> s1b = Node("sub1B", parent=s1, bar=8)
>>> s1c = Node("sub1C", parent=s1)
>>> s1ca = Node("sub1Ca", parent=s1c)
```

```
>>> print(RenderTree(root))
Node('/root')
├── Node('/root/sub0')
```

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```
│   ├── Node('/root/sub0/sub0B', bar=109, foo=4)
│   └── Node('/root/sub0/sub0A')
└── Node('/root/sub1')
    ├── Node('/root/sub1/sub1A')
    ├── Node('/root/sub1/sub1B', bar=8)
    └── Node('/root/sub1/sub1C')
        └── Node('/root/sub1/sub1C/sub1Ca')
```

The same tree can be constructed by using the *children* attribute:

```
>>> root = Node("root", children=[
...     Node("sub0", children=[
...         Node("sub0B", bar=109, foo=4),
...         Node("sub0A", children=None),
...     ]),
...     Node("sub1", children=[
...         Node("sub1A"),
...         Node("sub1B", bar=8, children=[]),
...         Node("sub1C", children=[
...             Node("sub1Ca"),
...         ]),
...     ]),
... ])
```

```
>>> print(RenderTree(root))
Node('/root')
├── Node('/root/sub0')
│   ├── Node('/root/sub0/sub0B', bar=109, foo=4)
│   └── Node('/root/sub0/sub0A')
└── Node('/root/sub1')
    ├── Node('/root/sub1/sub1A')
    ├── Node('/root/sub1/sub1B', bar=8)
    └── Node('/root/sub1/sub1C')
        └── Node('/root/sub1/sub1C/sub1Ca')
```

class anytree.node.nodemixin.**NodeMixin**

Bases: object

separator = '/'

The *NodeMixin* class extends any Python class to a tree node.

The only tree relevant information is the *parent* attribute. If *None* the *NodeMixin* is root node. If set to another node, the *NodeMixin* becomes the child of it.

The *children* attribute can be used likewise. If *None* the *NodeMixin* has no children (unless the node is set *as* parent). If set to any iterable of *NodeMixin* instances, the nodes become children.

```
>>> from anytree import NodeMixin, RenderTree
>>> class MyBaseClass(object):
...     foo = 4
>>> class MyClass(MyBaseClass, NodeMixin):  # Add Node feature
...     def __init__(self, name, length, width, parent=None, children=None):
...         super(MyClass, self).__init__()
...         self.name = name
...         self.length = length
...         self.width = width
...         self.parent = parent
```

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```
...         if children:
...             self.children = children
```

Construction via *parent*:

```
>>> my0 = MyClass('my0', 0, 0)
>>> my1 = MyClass('my1', 1, 0, parent=my0)
>>> my2 = MyClass('my2', 0, 2, parent=my0)
```

```
>>> for pre, _, node in RenderTree(my0):
...     treestr = u"%s%s" % (pre, node.name)
...     print(treestr.ljust(8), node.length, node.width)
my0      0 0
├── my1  1 0
└── my2  0 2
```

Construction via *children*:

```
>>> my0 = MyClass('my0', 0, 0, children=[
...     MyClass('my1', 1, 0),
...     MyClass('my2', 0, 2),
... ]
```

```
>>> for pre, _, node in RenderTree(my0):
...     treestr = u"%s%s" % (pre, node.name)
...     print(treestr.ljust(8), node.length, node.width)
my0      0 0
├── my1  1 0
└── my2  0 2
```

Both approaches can be mixed:

```
>>> my0 = MyClass('my0', 0, 0, children=[
...     MyClass('my1', 1, 0),
... ]
>>> my2 = MyClass('my2', 0, 2, parent=my0)
```

```
>>> for pre, _, node in RenderTree(my0):
...     treestr = u"%s%s" % (pre, node.name)
...     print(treestr.ljust(8), node.length, node.width)
my0      0 0
├── my1  1 0
└── my2  0 2
```

parent

Parent Node.

On set, the node is detached from any previous parent node and attached to the new node.

```
>>> from anytree import Node, RenderTree
>>> udo = Node("Udo")
>>> marc = Node("Marc")
>>> lian = Node("Lian", parent=marc)
>>> print(RenderTree(udo))
Node('/Udo')
```

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```
>>> print(RenderTree(marc))
Node('/Marc')
└── Node('/Marc/Lian')
```

Attach

```
>>> marc.parent = udo
>>> print(RenderTree(udo))
Node('/Udo')
└── Node('/Udo/Marc')
    └── Node('/Udo/Marc/Lian')
```

Detach

To make a node to a root node, just set this attribute to *None*.

```
>>> marc.is_root
False
>>> marc.parent = None
>>> marc.is_root
True
```

children

All child nodes.

```
>>> from anytree import Node
>>> n = Node("n")
>>> a = Node("a", parent=n)
>>> b = Node("b", parent=n)
>>> c = Node("c", parent=n)
>>> n.children
(Node('/n/a'), Node('/n/b'), Node('/n/c'))
```

Modifying the children attribute modifies the tree.

Detach

The children attribute can be updated by setting to an iterable.

```
>>> n.children = [a, b]
>>> n.children
(Node('/n/a'), Node('/n/b'))
```

Node *c* is removed from the tree. In case of an existing reference, the node *c* does not vanish and is the root of its own tree.

```
>>> c
Node('/c')
```

Attach

```
>>> d = Node("d")
>>> d
Node('/d')
>>> n.children = [a, b, d]
>>> n.children
(Node('/n/a'), Node('/n/b'), Node('/n/d'))
```

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```
>>> d
Node('/n/d')
```

Duplicate

A node can just be the children once. Duplicates cause a `TreeError`:

```
>>> n.children = [a, b, d, a]
Traceback (most recent call last):
    ...
anytree.node.exceptions.TreeError: Cannot add node Node('/n/a') multiple␣
↪times as child.
```

path

Path of this *Node*.

```
>>> from anytree import Node
>>> udo = Node("Udo")
>>> marc = Node("Marc", parent=udo)
>>> lian = Node("Lian", parent=marc)
>>> udo.path
(Node('/Udo'),)
>>> marc.path
(Node('/Udo'), Node('/Udo/Marc'))
>>> lian.path
(Node('/Udo'), Node('/Udo/Marc'), Node('/Udo/Marc/Lian'))
```

ancestors

All parent nodes and their parent nodes.

```
>>> from anytree import Node
>>> udo = Node("Udo")
>>> marc = Node("Marc", parent=udo)
>>> lian = Node("Lian", parent=marc)
>>> udo.ancestors
()
>>> marc.ancestors
(Node('/Udo'),)
>>> lian.ancestors
(Node('/Udo'), Node('/Udo/Marc'))
```

anchestors

All parent nodes and their parent nodes - see `ancestors`.

The attribute *anchestors* is just a typo of *ancestors*. Please use *ancestors*. This attribute will be removed in the 2.0.0 release.

descendants

All child nodes and all their child nodes.

```
>>> from anytree import Node
>>> udo = Node("Udo")
>>> marc = Node("Marc", parent=udo)
>>> lian = Node("Lian", parent=marc)
>>> loui = Node("Loui", parent=marc)
>>> soe = Node("Soe", parent=lian)
>>> udo.descendants
```

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```
(Node('/Udo/Marc'), Node('/Udo/Marc/Lian'), Node('/Udo/Marc/Lian/Soe'), Node(
↪'/Udo/Marc/Loui'))
>>> marc.descendants
(Node('/Udo/Marc/Lian'), Node('/Udo/Marc/Lian/Soe'), Node('/Udo/Marc/Loui'))
>>> lian.descendants
(Node('/Udo/Marc/Lian/Soe'),)
```

root

Tree Root Node.

```
>>> from anytree import Node
>>> udo = Node("Udo")
>>> marc = Node("Marc", parent=udo)
>>> lian = Node("Lian", parent=marc)
>>> udo.root
Node('/Udo')
>>> marc.root
Node('/Udo')
>>> lian.root
Node('/Udo')
```

siblings

Tuple of nodes with the same parent.

```
>>> from anytree import Node
>>> udo = Node("Udo")
>>> marc = Node("Marc", parent=udo)
>>> lian = Node("Lian", parent=marc)
>>> loui = Node("Loui", parent=marc)
>>> lazy = Node("Lazy", parent=marc)
>>> udo.siblings
()
>>> marc.siblings
()
>>> lian.siblings
(Node('/Udo/Marc/Loui'), Node('/Udo/Marc/Lazy'))
>>> loui.siblings
(Node('/Udo/Marc/Lian'), Node('/Udo/Marc/Lazy'))
```

leaves

Tuple of all leaf nodes.

```
>>> from anytree import Node
>>> udo = Node("Udo")
>>> marc = Node("Marc", parent=udo)
>>> lian = Node("Lian", parent=marc)
>>> loui = Node("Loui", parent=marc)
>>> lazy = Node("Lazy", parent=marc)
>>> udo.leaves
(Node('/Udo/Marc/Lian'), Node('/Udo/Marc/Loui'), Node('/Udo/Marc/Lazy'))
>>> marc.leaves
(Node('/Udo/Marc/Lian'), Node('/Udo/Marc/Loui'), Node('/Udo/Marc/Lazy'))
```

is_leaf

Node has no children (External Node).

```
>>> from anytree import Node
>>> udo = Node("Udo")
>>> marc = Node("Marc", parent=udo)
>>> lian = Node("Lian", parent=marc)
>>> udo.is_leaf
False
>>> marc.is_leaf
False
>>> lian.is_leaf
True
```

is_root

Node is tree root.

```
>>> from anytree import Node
>>> udo = Node("Udo")
>>> marc = Node("Marc", parent=udo)
>>> lian = Node("Lian", parent=marc)
>>> udo.is_root
True
>>> marc.is_root
False
>>> lian.is_root
False
```

height

Number of edges on the longest path to a leaf *Node*.

```
>>> from anytree import Node
>>> udo = Node("Udo")
>>> marc = Node("Marc", parent=udo)
>>> lian = Node("Lian", parent=marc)
>>> udo.height
2
>>> marc.height
1
>>> lian.height
0
```

depth

Number of edges to the root *Node*.

```
>>> from anytree import Node
>>> udo = Node("Udo")
>>> marc = Node("Marc", parent=udo)
>>> lian = Node("Lian", parent=marc)
>>> udo.depth
0
>>> marc.depth
1
>>> lian.depth
2
```

exception `anytree.node.exceptions.`**TreeError**

Bases: `exceptions.RuntimeError`

Tree Error.

exception anytree.node.exceptions.**LoopError**

Bases: *anytree.node.exceptions.TreeError*

Tree contains infinite loop.

3.2 Tree Iteration

Tree Iteration.

- *PreOrderIter*: iterate over tree using pre-order strategy (self, children)
- *PostOrderIter*: iterate over tree using post-order strategy (children, self)
- *LevelOrderIter*: iterate over tree using level-order strategy
- *LevelOrderGroupIter*: iterate over tree using level-order strategy returning group for every level
- *ZigZagGroupIter*: iterate over tree using level-order strategy returning group for every level

class anytree.iterators.preorderiter.**PreOrderIter**(*node*, *filter_=None*, *stop=None*, *maxlevel=None*)

Bases: anytree.iterators.abstractiter.AbstractIter

Iterate over tree applying pre-order strategy starting at *node*.

Start at root and go-down until reaching a leaf node. Step upwards then, and search for the next leafs.

```
>>> from anytree import Node, RenderTree, AsciiStyle, PreOrderIter
>>> f = Node("f")
>>> b = Node("b", parent=f)
>>> a = Node("a", parent=b)
>>> d = Node("d", parent=b)
>>> c = Node("c", parent=d)
>>> e = Node("e", parent=d)
>>> g = Node("g", parent=f)
>>> i = Node("i", parent=g)
>>> h = Node("h", parent=i)
>>> print(RenderTree(f, style=AsciiStyle()).by_attr())
f
|-- b
|   |-- a
|   +-- d
|       |-- c
|       +-- e
+-- g
    +-- i
        +-- h
>>> [node.name for node in PreOrderIter(f)]
['f', 'b', 'a', 'd', 'c', 'e', 'g', 'i', 'h']
>>> [node.name for node in PreOrderIter(f, maxlevel=3)]
['f', 'b', 'a', 'd', 'g', 'i']
>>> [node.name for node in PreOrderIter(f, filter_=lambda n: n.name not in ('e',
↪'g'))]
['f', 'b', 'a', 'd', 'c', 'i', 'h']
>>> [node.name for node in PreOrderIter(f, stop=lambda n: n.name == 'd')]
['f', 'b', 'a', 'g', 'i', 'h']
```

Base class for all iterators.

Iterate over tree starting at *node*.

Keyword Arguments

- **filter** – function called with every *node* as argument, *node* is returned if *True*.
- **stop** – stop iteration at *node* if *stop* function returns *True* for *node*.
- **maxlevel** (*int*) – maximum decending in the node hierarchy.

class anytree.iterators.postorderiter.**PostOrderIter**(*node*, *filter_=None*, *stop=None*, *maxlevel=None*)

Bases: anytree.iterators.abstractiter.AbstractIter

Iterate over tree applying post-order strategy starting at *node*.

```
>>> from anytree import Node, RenderTree, AsciiStyle, PostOrderIter
>>> f = Node("f")
>>> b = Node("b", parent=f)
>>> a = Node("a", parent=b)
>>> d = Node("d", parent=b)
>>> c = Node("c", parent=d)
>>> e = Node("e", parent=d)
>>> g = Node("g", parent=f)
>>> i = Node("i", parent=g)
>>> h = Node("h", parent=i)
>>> print(RenderTree(f, style=AsciiStyle()).by_attr())
f
|-- b
|   |-- a
|   +-- d
|       |-- c
|       +-- e
+-- g
    +-- i
        +-- h
>>> [node.name for node in PostOrderIter(f)]
['a', 'c', 'e', 'd', 'b', 'h', 'i', 'g', 'f']
>>> [node.name for node in PostOrderIter(f, maxlevel=3)]
['a', 'd', 'b', 'i', 'g', 'f']
>>> [node.name for node in PostOrderIter(f, filter_=lambda n: n.name not in ('e',
↪'g'))]
['a', 'c', 'd', 'b', 'h', 'i', 'f']
>>> [node.name for node in PostOrderIter(f, stop=lambda n: n.name == 'd')]
['a', 'b', 'h', 'i', 'g', 'f']
```

Base class for all iterators.

Iterate over tree starting at *node*.

Keyword Arguments

- **filter** – function called with every *node* as argument, *node* is returned if *True*.
- **stop** – stop iteration at *node* if *stop* function returns *True* for *node*.
- **maxlevel** (*int*) – maximum decending in the node hierarchy.

class anytree.iterators.levelorderiter.**LevelOrderIter**(*node*, *filter_=None*, *stop=None*, *maxlevel=None*)

Bases: anytree.iterators.abstractiter.AbstractIter

Iterate over tree applying level-order strategy starting at *node*.

```
>>> from anytree import Node, RenderTree, AsciiStyle, LevelOrderIter
>>> f = Node("f")
>>> b = Node("b", parent=f)
>>> a = Node("a", parent=b)
>>> d = Node("d", parent=b)
>>> c = Node("c", parent=d)
>>> e = Node("e", parent=d)
>>> g = Node("g", parent=f)
>>> i = Node("i", parent=g)
>>> h = Node("h", parent=i)
>>> print(RenderTree(f, style=AsciiStyle()).by_attr())
f
|-- b
|   |-- a
|   +-- d
|       |-- c
|       +-- e
+-- g
    +-- i
        +-- h
>>> [node.name for node in LevelOrderIter(f)]
['f', 'b', 'g', 'a', 'd', 'i', 'c', 'e', 'h']
>>> [node.name for node in LevelOrderIter(f, maxlevel=3)]
['f', 'b', 'g', 'a', 'd', 'i']
>>> [node.name for node in LevelOrderIter(f, filter_=lambda n: n.name not in ('e',
↪ 'g'))]
['f', 'b', 'a', 'd', 'i', 'c', 'h']
>>> [node.name for node in LevelOrderIter(f, stop=lambda n: n.name == 'd')]
['f', 'b', 'g', 'a', 'i', 'h']
```

Base class for all iterators.

Iterate over tree starting at *node*.

Keyword Arguments

- **filter** – function called with every *node* as argument, *node* is returned if *True*.
- **stop** – stop iteration at *node* if *stop* function returns *True* for *node*.
- **maxlevel** (*int*) – maximum decending in the node hierarchy.

class anytree.iterators.levelordergroupiter.**LevelOrderGroupIter**(*node*, *filter_=None*, *stop=None*, *maxlevel=None*)

Bases: anytree.iterators.abstractiter.AbstractIter

Iterate over tree applying level-order strategy with grouping starting at *node*.

Return a tuple of nodes for each level. The first tuple contains the nodes at level 0 (always *node*). The second tuple contains the nodes at level 1 (children of *node*). The next level contains the children of the children, and so on.

```
>>> from anytree import Node, RenderTree, AsciiStyle, LevelOrderGroupIter
>>> f = Node("f")
>>> b = Node("b", parent=f)
>>> a = Node("a", parent=b)
>>> d = Node("d", parent=b)
>>> c = Node("c", parent=d)
```

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```
>>> e = Node("e", parent=d)
>>> g = Node("g", parent=f)
>>> i = Node("i", parent=g)
>>> h = Node("h", parent=i)
>>> print(RenderTree(f, style=AsciiStyle()).by_attr())
f
|-- b
|   |-- a
|   +-- d
|       |-- c
|       +-- e
+-- g
    +-- i
        +-- h
>>> [[node.name for node in children] for children in LevelOrderGroupIter(f)]
[['f'], ['b', 'g'], ['a', 'd', 'i'], ['c', 'e', 'h']]
>>> [[node.name for node in children] for children in LevelOrderGroupIter(f,␣
↪maxlevel=3)]
[['f'], ['b', 'g'], ['a', 'd', 'i']]
>>> [[node.name for node in children]
...  for children in LevelOrderGroupIter(f, filter_=lambda n: n.name not in ('e',
↪'g'))]
[['f'], ['b'], ['a', 'd', 'i'], ['c', 'h']]
>>> [[node.name for node in children]
...  for children in LevelOrderGroupIter(f, stop=lambda n: n.name == 'd')]
[['f'], ['b', 'g'], ['a', 'i'], ['h']]
```

Base class for all iterators.

Iterate over tree starting at *node*.

Keyword Arguments

- **filter** – function called with every *node* as argument, *node* is returned if *True*.
- **stop** – stop iteration at *node* if *stop* function returns *True* for *node*.
- **maxlevel** (*int*) – maximum decending in the node hierarchy.

class anytree.iterators.zigzaggroupiter.**ZigZagGroupIter**(*node*, *filter_=None*, *stop=None*, *maxlevel=None*)

Bases: anytree.iterators.abstractiter.AbstractIter

Iterate over tree applying Zig-Zag strategy with grouping starting at *node*.

Return a tuple of nodes for each level. The first tuple contains the nodes at level 0 (always *node*). The second tuple contains the nodes at level 1 (children of *node*) in reversed order. The next level contains the children of the children in forward order, and so on.

```
>>> from anytree import Node, RenderTree, AsciiStyle
>>> f = Node("f")
>>> b = Node("b", parent=f)
>>> a = Node("a", parent=b)
>>> d = Node("d", parent=b)
>>> c = Node("c", parent=d)
>>> e = Node("e", parent=d)
>>> g = Node("g", parent=f)
>>> i = Node("i", parent=g)
```

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```
>>> h = Node("h", parent=i)
>>> print(RenderTree(f, style=AsciiStyle()).by_attr())
f
|-- b
|   |-- a
|   +-- d
|       |-- c
|       +-- e
+-- g
    +-- i
        +-- h
>>> [[node.name for node in children] for children in ZigZagGroupIter(f)]
[['f'], ['g', 'b'], ['a', 'd', 'i'], ['h', 'e', 'c']]
>>> [[node.name for node in children] for children in ZigZagGroupIter(f,␣
↪maxlevel=3)]
[['f'], ['g', 'b'], ['a', 'd', 'i']]
>>> [[node.name for node in children]
...  for children in ZigZagGroupIter(f, filter_=lambda n: n.name not in ('e', 'g
↪'))]
[['f'], ['b'], ['a', 'd', 'i'], ['h', 'c']]
>>> [[node.name for node in children]
...  for children in ZigZagGroupIter(f, stop=lambda n: n.name == 'd')]
[['f'], ['g', 'b'], ['a', 'i'], ['h']]
```

Base class for all iterators.

Iterate over tree starting at *node*.

Keyword Arguments

- **filter** – function called with every *node* as argument, *node* is returned if *True*.
- **stop** – stop iteration at *node* if *stop* function returns *True* for *node*.
- **maxlevel** (*int*) – maximum decending in the node hierarchy.

3.3 Tree Rendering

Tree Rendering.

- ***RenderTree*** **using the following styles:**
  - *AsciiStyle*
  - *ContStyle*
  - *ContRoundStyle*
  - *DoubleStyle*

class anytree.render.**Row**(*pre*, *fill*, *node*)

Bases: tuple

Create new instance of Row(pre, fill, node)

fill

Alias for field number 1

node

Alias for field number 2

pre
Alias for field number 0

class anytree.render.**AbstractStyle**(*vertical*, *cont*, *end*)
Bases: object

Tree Render Style.

Parameters

- **vertical** – Sign for vertical line.
- **cont** – Chars for a continued branch.
- **end** – Chars for the last branch.

empty
Empty string as placeholder.

class anytree.render.**AsciiStyle**
Bases: *anytree.render.AbstractStyle*

Ascii style.

```
>>> from anytree import Node, RenderTree
>>> root = Node("root")
>>> s0 = Node("sub0", parent=root)
>>> s0b = Node("sub0B", parent=s0)
>>> s0a = Node("sub0A", parent=s0)
>>> s1 = Node("sub1", parent=root)
```

```
>>> print(RenderTree(root, style=AsciiStyle()))
Node('/root')
|-- Node('/root/sub0')
|   |-- Node('/root/sub0/sub0B')
|   +-- Node('/root/sub0/sub0A')
+-- Node('/root/sub1')
```

class anytree.render.**ContStyle**
Bases: *anytree.render.AbstractStyle*

Continued style, without gaps.

```
>>> from anytree import Node, RenderTree
>>> root = Node("root")
>>> s0 = Node("sub0", parent=root)
>>> s0b = Node("sub0B", parent=s0)
>>> s0a = Node("sub0A", parent=s0)
>>> s1 = Node("sub1", parent=root)
```

```
>>> print(RenderTree(root, style=ContStyle()))
Node('/root')
├── Node('/root/sub0')
│   ├── Node('/root/sub0/sub0B')
│   └── Node('/root/sub0/sub0A')
└── Node('/root/sub1')
```

class anytree.render.**ContRoundStyle**
Bases: *anytree.render.AbstractStyle*

Continued style, without gaps, round edges.

```
>>> from anytree import Node, RenderTree
>>> root = Node("root")
>>> s0 = Node("sub0", parent=root)
>>> s0b = Node("sub0B", parent=s0)
>>> s0a = Node("sub0A", parent=s0)
>>> s1 = Node("sub1", parent=root)
```

```
>>> print(RenderTree(root, style=ContRoundStyle()))
Node('/root')
├── Node('/root/sub0')
│   ├── Node('/root/sub0/sub0B')
│   ── Node('/root/sub0/sub0A')
── Node('/root/sub1')
```

class anytree.render.**DoubleStyle**

Bases: *anytree.render.AbstractStyle*

Double line style, without gaps.

```
>>> from anytree import Node, RenderTree
>>> root = Node("root")
>>> s0 = Node("sub0", parent=root)
>>> s0b = Node("sub0B", parent=s0)
>>> s0a = Node("sub0A", parent=s0)
>>> s1 = Node("sub1", parent=root)
```

```
>>> print(RenderTree(root, style=DoubleStyle))
Node('/root')
 Node('/root/sub0')
    Node('/root/sub0/sub0B')
    Node('/root/sub0/sub0A')
 Node('/root/sub1')
```

class anytree.render.**RenderTree**(*node*, *style=ContStyle()*, *childiter=<type 'list'>*)

Bases: `object`

Render tree starting at *node*.

Keyword Arguments

- **style** (`AbstractStyle`) – Render Style.
- **childiter** – Child iterator.

RenderTree is an iterator, returning a tuple with 3 items:

pre tree prefix.

fill filling for multiline entries.

node *NodeMixin* object.

It is up to the user to assemble these parts to a whole.

```
>>> from anytree import Node, RenderTree
>>> root = Node("root", lines=["c0fe", "c0de"])
>>> s0 = Node("sub0", parent=root, lines=["ha", "ba"])
>>> s0b = Node("sub0B", parent=s0, lines=["1", "2", "3"])
>>> s0a = Node("sub0A", parent=s0, lines=["a", "b"])
>>> s1 = Node("sub1", parent=root, lines=["Z"])
```

Simple one line:

```
>>> for pre, _, node in RenderTree(root):
...     print("%s%s" % (pre, node.name))
root
├── sub0
│   ├── sub0B
│   └── sub0A
└── sub1
```

Multiline:

```
>>> for pre, fill, node in RenderTree(root):
...     print("%s%s" % (pre, node.lines[0]))
...     for line in node.lines[1:]:
...         print("%s%s" % (fill, line))
c0fe
c0de
├── ha
│   ba
│   ├── 1
│   │   2
│   │   3
│   └── a
│       b
└── Z
```

The *childiter* is responsible for iterating over child nodes at the same level. An reversed order can be achived by using *reversed*.

```
>>> for row in RenderTree(root, childiter=reversed):
...     print("%s%s" % (row.pre, row.node.name))
root
├── sub1
└── sub0
    ├── sub0A
    └── sub0B
```

Or writing your own sort function:

```
>>> def mysort(items):
...     return sorted(items, key=lambda item: item.name)
>>> for row in RenderTree(root, childiter=mysort):
...     print("%s%s" % (row.pre, row.node.name))
root
├── sub0
│   ├── sub0A
│   └── sub0B
└── sub1
```

`by_attr` simplifies attribute rendering and supports multiline:

```
>>> print(RenderTree(root).by_attr())
root
├── sub0
│   ├── sub0B
│   └── sub0A
└── sub1
```

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```
>>> print(RenderTree(root).by_attr("lines"))
c0fe
c0de
├── ha
│   ba
│   ├── 1
│   │   2
│   │   3
│   └── a
│       b
└── Z
```

And can be a function:

```
>>> print(RenderTree(root).by_attr(lambda n: " ".join(n.lines)))
c0fe c0de
├── ha ba
│   ├── 1 2 3
│   └── a b
└── Z
```

by_attr(*attrname='name'*)

Return rendered tree with node attribute *attrname*.

3.4 Searching

Node Searching.

anytree.search.**findall**(*node*, *filter_=None*, *stop=None*, *maxlevel=None*, *mincount=None*, *maxcount=None*)

Search nodes matching *filter_* but stop at *maxlevel* or *stop*.

Return tuple with matching nodes.

Parameters **node** – top node, start searching.

Keyword Arguments

- **filter** – function called with every *node* as argument, *node* is returned if *True*.
- **stop** – stop iteration at *node* if *stop* function returns *True* for *node*.
- **maxlevel** (*int*) – maximum decending in the node hierarchy.
- **mincount** (*int*) – minimum number of nodes.
- **maxcount** (*int*) – maximum number of nodes.

Example tree:

```
>>> from anytree import Node, RenderTree, AsciiStyle
>>> f = Node("f")
>>> b = Node("b", parent=f)
>>> a = Node("a", parent=b)
>>> d = Node("d", parent=b)
>>> c = Node("c", parent=d)
>>> e = Node("e", parent=d)
>>> g = Node("g", parent=f)
```

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```
>>> i = Node("i", parent=g)
>>> h = Node("h", parent=i)
>>> print(RenderTree(f, style=AsciiStyle()).by_attr())
f
|-- b
|   |-- a
|   +-- d
|       |-- c
|       +-- e
+-- g
    +-- i
        +-- h
```

```
>>> findall(f, filter_=lambda node: node.name in ("a", "b"))
(Node('/f/b'), Node('/f/b/a'))
>>> findall(f, filter_=lambda node: d in node.path)
(Node('/f/b/d'), Node('/f/b/d/c'), Node('/f/b/d/e'))
```

The number of matches can be limited:

```
>>> findall(f, filter_=lambda node: d in node.path, mincount=4)
Traceback (most recent call last):
  ...
anytree.search.CountError: Expecting at least 4 elements, but found 3. ... Node('/
↪f/b/d/e'))
>>> findall(f, filter_=lambda node: d in node.path, maxcount=2)
Traceback (most recent call last):
  ...
anytree.search.CountError: Expecting 2 elements at maximum, but found 3. ... Node(
↪'/f/b/d/e'))
```

anytree.search.**findall_by_attr**(*node*, *value*, *name='name'*, *maxlevel=None*, *mincount=None*, *maxcount=None*)

Search nodes with attribute *name* having *value* but stop at *maxlevel*.

Return tuple with matching nodes.

Parameters

- **node** – top node, start searching.
- **value** – value which need to match

Keyword Arguments

- **name** (*str*) – attribute name need to match
- **maxlevel** (*int*) – maximum decending in the node hierarchy.
- **mincount** (*int*) – minimum number of nodes.
- **maxcount** (*int*) – maximum number of nodes.

Example tree:

```
>>> from anytree import Node, RenderTree, AsciiStyle
>>> f = Node("f")
>>> b = Node("b", parent=f)
>>> a = Node("a", parent=b)
>>> d = Node("d", parent=b)
```

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```
>>> c = Node("c", parent=d)
>>> e = Node("e", parent=d)
>>> g = Node("g", parent=f)
>>> i = Node("i", parent=g)
>>> h = Node("h", parent=i)
>>> print(RenderTree(f, style=AsciiStyle()).by_attr())
f
|-- b
|   |-- a
|   +-- d
|       |-- c
|       +-- e
+-- g
    +-- i
        +-- h
```

```
>>> findall_by_attr(f, "d")
(Node('/f/b/d'),)
```

`anytree.search.find`(*node*, *filter_=None*, *stop=None*, *maxlevel=None*)

Search for *single* node matching *filter_* but stop at *maxlevel* or *stop*.

Return matching node.

Parameters **node** – top node, start searching.

Keyword Arguments

- **filter** – function called with every *node* as argument, *node* is returned if *True*.
- **stop** – stop iteration at *node* if *stop* function returns *True* for *node*.
- **maxlevel** (*int*) – maximum decending in the node hierarchy.

Example tree:

```
>>> from anytree import Node, RenderTree, AsciiStyle
>>> f = Node("f")
>>> b = Node("b", parent=f)
>>> a = Node("a", parent=b)
>>> d = Node("d", parent=b)
>>> c = Node("c", parent=d)
>>> e = Node("e", parent=d)
>>> g = Node("g", parent=f)
>>> i = Node("i", parent=g)
>>> h = Node("h", parent=i)
>>> print(RenderTree(f, style=AsciiStyle()).by_attr())
f
|-- b
|   |-- a
|   +-- d
|       |-- c
|       +-- e
+-- g
    +-- i
        +-- h
```

```
>>> find(f, lambda node: node.name == "d")
Node('/f/b/d')
>>> find(f, lambda node: node.name == "z")
>>> find(f, lambda node: b in node.path)
Traceback (most recent call last):
    ...
anytree.search.CountError: Expecting 1 elements at maximum, but found 5. (Node('/
↪f/b')... Node('/f/b/d/e'))
```

anytree.search.**find_by_attr**(*node*, *value*, *name='name'*, *maxlevel=None*)

Search for *single* node with attribute *name* having *value* but stop at *maxlevel*.

Return tuple with matching nodes.

Parameters

- **node** – top node, start searching.
- **value** – value which need to match

Keyword Arguments

- **name** (*str*) – attribute name need to match
- **maxlevel** (*int*) – maximum decending in the node hierarchy.

Example tree:

```
>>> from anytree import Node, RenderTree, AsciiStyle
>>> f = Node("f")
>>> b = Node("b", parent=f)
>>> a = Node("a", parent=b)
>>> d = Node("d", parent=b)
>>> c = Node("c", parent=d, foo=4)
>>> e = Node("e", parent=d)
>>> g = Node("g", parent=f)
>>> i = Node("i", parent=g)
>>> h = Node("h", parent=i)
>>> print(RenderTree(f, style=AsciiStyle()).by_attr())
f
|-- b
|   |-- a
|   +-- d
|       |-- c
|       +-- e
+-- g
    +-- i
        +-- h
```

```
>>> find_by_attr(f, "d")
Node('/f/b/d')
>>> find_by_attr(f, name="foo", value=4)
Node('/f/b/d/c', foo=4)
>>> find_by_attr(f, name="foo", value=8)
```

exception anytree.search.**CountError**(*msg*, *result*)

Bases: exceptions.RuntimeError

Error raised on *mincount* or *maxcount* mismatch.

3.5 Node Resolution

class anytree.resolver.**Resolver**(*pathattr='name'*)

Bases: object

Resolve *NodeMixin* paths using attribute *pathattr*.

get(*node*, *path*)

Return instance at *path*.

An example module tree:

```
>>> from anytree import Node
>>> top = Node("top", parent=None)
>>> sub0 = Node("sub0", parent=top)
>>> sub0sub0 = Node("sub0sub0", parent=sub0)
>>> sub0sub1 = Node("sub0sub1", parent=sub0)
>>> sub1 = Node("sub1", parent=top)
```

A resolver using the *name* attribute:

```
>>> r = Resolver('name')
```

Relative paths:

```
>>> r.get(top, "sub0/sub0sub0")
Node('/top/sub0/sub0sub0')
>>> r.get(sub1, "..")
Node('/top')
>>> r.get(sub1, "../sub0/sub0sub1")
Node('/top/sub0/sub0sub1')
>>> r.get(sub1, ".")
Node('/top/sub1')
>>> r.get(sub1, "")
Node('/top/sub1')
>>> r.get(top, "sub2")
Traceback (most recent call last):
  ...
anytree.resolver.ChildResolverError: Node('/top') has no child sub2. Children␣
↪are: 'sub0', 'sub1'.
```

Absolute paths:

```
>>> r.get(sub0sub0, "/top")
Node('/top')
>>> r.get(sub0sub0, "/top/sub0")
Node('/top/sub0')
>>> r.get(sub0sub0, "/")
Traceback (most recent call last):
  ...
anytree.resolver.ResolverError: root node missing. root is '/top'.
>>> r.get(sub0sub0, "/bar")
Traceback (most recent call last):
  ...
anytree.resolver.ResolverError: unknown root node '/bar'. root is '/top'.
```

glob(*node*, *path*)

Return instances at *path* supporting wildcards.

Behaves identical to `get`, but accepts wildcards and returns a list of found nodes.

- * matches any characters, except '/'.
- *?* matches a single character, except '/'.

An example module tree:

```
>>> from anytree import Node
>>> top = Node("top", parent=None)
>>> sub0 = Node("sub0", parent=top)
>>> sub0sub0 = Node("sub0", parent=sub0)
>>> sub0sub1 = Node("sub1", parent=sub0)
>>> sub1 = Node("sub1", parent=top)
>>> sub1sub0 = Node("sub0", parent=sub1)
```

A resolver using the *name* attribute:

```
>>> r = Resolver('name')
```

Relative paths:

```
>>> r.glob(top, "sub0/sub?")
[Node('/top/sub0/sub0'), Node('/top/sub0/sub1')]
>>> r.glob(sub1, ".././*")
[Node('/top/sub0'), Node('/top/sub1')]
>>> r.glob(top, "*/*")
[Node('/top/sub0/sub0'), Node('/top/sub0/sub1'), Node('/top/sub1/sub0')]
>>> r.glob(top, "*/sub0")
[Node('/top/sub0/sub0'), Node('/top/sub1/sub0')]
>>> r.glob(top, "sub1/sub1")
Traceback (most recent call last):
    ...
anytree.resolver.ChildResolverError: Node('/top/sub1') has no child sub1.␣
↪Children are: 'sub0'.
```

Non-matching wildcards are no error:

```
>>> r.glob(top, "bar*")
[]
>>> r.glob(top, "sub2")
Traceback (most recent call last):
  ...
anytree.resolver.ChildResolverError: Node('/top') has no child sub2. Children␣
↪are: 'sub0', 'sub1'.
```

Absolute paths:

```
>>> r.glob(sub0sub0, "/top/*")
[Node('/top/sub0'), Node('/top/sub1')]
>>> r.glob(sub0sub0, "/")
Traceback (most recent call last):
  ...
anytree.resolver.ResolverError: root node missing. root is '/top'.
>>> r.glob(sub0sub0, "/bar")
Traceback (most recent call last):
  ...
anytree.resolver.ResolverError: unknown root node '/bar'. root is '/top'.
```

static is_wildcard(*path*)
Return *True* is a wildcard.

exception anytree.resolver.**ResolverError**(*node*, *child*, *msg*)
Bases: exceptions.RuntimeError

Resolve Error at *node* handling *child*.

exception anytree.resolver.**ChildResolverError**(*node*, *child*, *pathattr*)
Bases: *anytree.resolver.ResolverError*

Child Resolve Error at *node* handling *child*.

3.6 Tree Walking

class anytree.walker.**Walker**
Bases: object

Walk from one node to another.

walk(*start*, *end*)
Walk from *start* node to *end* node.

Returns *upwards* is a list of nodes to go upward to. *common* top node. *downwards* is a list of nodes to go downward to.

Return type (upwards, common, downwards)

Raises *WalkError* – on no common root node.

```
>>> from anytree import Node, RenderTree, AsciiStyle
>>> f = Node("f")
>>> b = Node("b", parent=f)
>>> a = Node("a", parent=b)
>>> d = Node("d", parent=b)
>>> c = Node("c", parent=d)
>>> e = Node("e", parent=d)
>>> g = Node("g", parent=f)
>>> i = Node("i", parent=g)
>>> h = Node("h", parent=i)
>>> print(RenderTree(f, style=AsciiStyle()))
Node('/f')
|-- Node('/f/b')
|   |-- Node('/f/b/a')
|   +-- Node('/f/b/d')
|       |-- Node('/f/b/d/c')
|       +-- Node('/f/b/d/e')
+-- Node('/f/g')
    +-- Node('/f/g/i')
        +-- Node('/f/g/i/h')
```

Create a walker:

```
>>> w = Walker()
```

This class is made for walking:

```
>>> w.walk(f, f)
((), Node('/f'), ())
>>> w.walk(f, b)
((), Node('/f'), (Node('/f/b'),))
>>> w.walk(b, f)
((Node('/f/b'),), Node('/f'), ())
>>> w.walk(h, e)
((Node('/f/g/i/h'), Node('/f/g/i'), Node('/f/g')), Node('/f'), (Node('/f/b'),␣
↪Node('/f/b/d'), Node('/f/b/d/e')))
>>> w.walk(d, e)
((), Node('/f/b/d'), (Node('/f/b/d/e'),))
```

For a proper walking the nodes need to be part of the same tree:

```
>>> w.walk(Node("a"), Node("b"))
Traceback (most recent call last):
  ...
anytree.walker.WalkError: Node('/a') and Node('/b') are not part of the same␣
↪tree.
```

exception anytree.walker.**WalkError**

Bases: exceptions.RuntimeError

Walk Error.

3.7 Utilities

Utilities.

anytree.util.**commonancestors**(**nodes*)

Determine common ancestors of *nodes*.

```
>>> from anytree import Node
>>> udo = Node("Udo")
>>> marc = Node("Marc", parent=udo)
>>> lian = Node("Lian", parent=marc)
>>> dan = Node("Dan", parent=udo)
>>> jet = Node("Jet", parent=dan)
>>> jan = Node("Jan", parent=dan)
>>> joe = Node("Joe", parent=dan)
```

```
>>> commonancestors(jet, joe)
(Node('/Udo'), Node('/Udo/Dan'))
>>> commonancestors(jet, marc)
(Node('/Udo'),)
>>> commonancestors(jet)
(Node('/Udo'), Node('/Udo/Dan'))
>>> commonancestors()
()
```

anytree.util.**leftsibling**(*node*)

Return Left Sibling of *node*.

```
>>> from anytree import Node
>>> dan = Node("Dan")
```

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```
>>> jet = Node("Jet", parent=dan)
>>> jan = Node("Jan", parent=dan)
>>> joe = Node("Joe", parent=dan)
>>> leftsibling(dan)
>>> leftsibling(jet)
>>> leftsibling(jan)
Node('/Dan/Jet')
>>> leftsibling(joe)
Node('/Dan/Jan')
```

anytree.util.**rightsibling**(*node*)

Return Right Sibling of *node*.

```
>>> from anytree import Node
>>> dan = Node("Dan")
>>> jet = Node("Jet", parent=dan)
>>> jan = Node("Jan", parent=dan)
>>> joe = Node("Joe", parent=dan)
>>> rightsibling(dan)
>>> rightsibling(jet)
Node('/Dan/Jan')
>>> rightsibling(jan)
Node('/Dan/Joe')
>>> rightsibling(joe)
```

CHAPTER 4

Importer

One fundamental idea behind *anytree* is the common tree node data structure, which can be imported from different formats and exported to different formats.

Available importers:

4.1 Dictionary Importer

class anytree.importer.dictimporter.**DictImporter**(*nodecls=<class 'anytree.node.anynode.AnyNode'>*)

Bases: object

Import Tree from dictionary.

Every dictionary is converted to an instance of *nodecls*. The dictionaries listed in the children attribute are converted likewise and added as children.

Keyword Arguments **nodecls** – class used for nodes.

```
>>> from anytree.importer import DictImporter
>>> from anytree import RenderTree
>>> importer = DictImporter()
>>> data = {
...     'a': 'root',
...     'children': [{'a': 'sub0',
...                   'children': [{'a': 'sub0A', 'b': 'foo'}, {'a': 'sub0B'}]},
...                  {'a': 'sub1'}]}
>>> root = importer.import_(data)
>>> print(RenderTree(root))
AnyNode(a='root')
├── AnyNode(a='sub0')
│   ├── AnyNode(a='sub0A', b='foo')
│   └── AnyNode(a='sub0B')
└── AnyNode(a='sub1')
```

import_(*data*)
Import tree from *data*.

4.2 JSON Importer

class anytree.importer.jsonimporter.**JsonImporter**(*dictimporter=None*, ***kwargs*)
Bases: object

Import Tree from JSON.

The JSON is read and converted to a dictionary via *dictimporter*.

Keyword Arguments

- **dictimporter** – Dictionary Importer used (see *DictImporter*).
- **kwargs** – All other arguments are passed to json.load/json.loads. See documentation for reference.

```
>>> from anytree.importer import JsonImporter
>>> from anytree import RenderTree
>>> importer = JsonImporter()
>>> data = '''
... {
...   "a": "root",
...   "children": [
...     {
...       "a": "sub0",
...       "children": [
...         {
...           "a": "sub0A",
...           "b": "foo"
...         },
...         {
...           "a": "sub0B"
...         }
...       ]
...     },
...     {
...       "a": "sub1"
...     }
...   ]
... }'''
>>> root = importer.import_(data)
>>> print(RenderTree(root))
AnyNode(a='root')
├── AnyNode(a='sub0')
│   ├── AnyNode(a='sub0A', b='foo')
│   └── AnyNode(a='sub0B')
└── AnyNode(a='sub1')
```

import_(*data*)
Read JSON from *data*.

read(*filehandle*)
Read JSON from *filehandle*.

Importer missing? File a request here: Issues.

CHAPTER 5

Exporter

One fundamental idea behind *anytree* is the common tree node data structure, which can be imported from different formats and exported to different formats.

Available exporters:

5.1 Dictionary Exporter

class anytree.exporter.dictexporter.**DictExporter**(*dictcls=<type 'dict'>*, *attriter=None*, *childiter=<type 'list'>*)

Bases: object

Tree to dictionary exporter.

Every node is converted to a dictionary with all instance attributes as key-value pairs. Child nodes are exported to the children attribute. A list of dictionaries.

Keyword Arguments

- **dictcls** – class used as dictionary. Dictionary displays by default.
- **attriter** – attribute iterator for sorting and/or filtering.
- **childiter** – child iterator for sorting and/or filtering.

```
>>> from pprint import pprint  # just for nice printing
>>> from anytree import AnyNode
>>> from anytree.exporter import DictExporter
>>> root = AnyNode(a="root")
>>> s0 = AnyNode(a="sub0", parent=root)
>>> s0a = AnyNode(a="sub0A", b="foo", parent=s0)
>>> s0b = AnyNode(a="sub0B", parent=s0)
>>> s1 = AnyNode(a="sub1", parent=root)
```

```
>>> exporter = DictExporter()
>>> pprint(exporter.export(root))  # order within dictionary might vary!
{'a': 'root',
 'children': [{'a': 'sub0',
               'children': [{'a': 'sub0A', 'b': 'foo'}, {'a': 'sub0B'}]},
              {'a': 'sub1'}]}
```

Pythons dictionary *dict* does not preserve order. `collections.OrderedDict` does. In this case attributes can be ordered via *attriter*.

```
>>> from collections import OrderedDict
>>> exporter = DictExporter(dictcls=OrderedDict, attriter=sorted)
>>> pprint(exporter.export(root))
OrderedDict([('a', 'root'),
             ('children',
              [OrderedDict([('a', 'sub0'),
                            ('children',
                             [OrderedDict([('a', 'sub0A'), ('b', 'foo')]),
                              OrderedDict([('a', 'sub0B')])])]),
               OrderedDict([('a', 'sub1')])])])
```

The attribute iterator *attriter* may be used for filtering too. For example, just dump attributes named *a*:

```
>>> exporter = DictExporter(attriter=lambda attrs: [(k, v) for k, v in attrs if k␣
↪== "a"])
>>> pprint(exporter.export(root))
{'a': 'root',
 'children': [{'a': 'sub0', 'children': [{'a': 'sub0A'}, {'a': 'sub0B'}]},
              {'a': 'sub1'}]}
```

The child iterator *childiter* can be used for sorting and filtering likewise:

```
>>> exporter = DictExporter(childiter=lambda children: [child for child in␣
↪children if "0" in child.a])
>>> pprint(exporter.export(root))
{'a': 'root',
 'children': [{'a': 'sub0',
               'children': [{'a': 'sub0A', 'b': 'foo'}, {'a': 'sub0B'}]}]}
```

export(*node*)

Export tree starting at *node*.

5.2 JSON Exporter

class `anytree.exporter.jsonexporter.`**JsonExporter**(*dictexporter=None*, ***kwargs*)

Bases: `object`

Tree to JSON exporter.

The tree is converted to a dictionary via *dictexporter* and exported to JSON.

Keyword Arguments

- **dictexporter** – Dictionary Exporter used (see `DictExporter`).
- **kwargs** – All other arguments are passed to `json.dump`/`json.dumps`. See documentation for reference.

```
>>> from anytree import AnyNode
>>> from anytree.exporter import JsonExporter
>>> root = AnyNode(a="root")
>>> s0 = AnyNode(a="sub0", parent=root)
>>> s0a = AnyNode(a="sub0A", b="foo", parent=s0)
>>> s0b = AnyNode(a="sub0B", parent=s0)
>>> s1 = AnyNode(a="sub1", parent=root)
```

```
>>> exporter = JsonExporter(indent=2, sort_keys=True)
>>> print(exporter.export(root))
{
  "a": "root",
  "children": [
    {
      "a": "sub0",
      "children": [
        {
          "a": "sub0A",
          "b": "foo"
        },
        {
          "a": "sub0B"
        }
      ]
    },
    {
      "a": "sub1"
    }
  ]
}
```

export(*node*)

Return JSON for tree starting at *node*.

write(*node*, *filehandle*)

Write JSON to *filehandle* starting at *node*.

5.3 Dot Exporter

For any details about the *dot* language, see graphviz

class anytree.exporter.dotexporter.**DotExporter**(*node*, *graph='digraph'*, *name='tree'*, *options=None*, *indent=4*, *nodenamefunc=None*, *nodeattrfunc=None*, *edgeattrfunc=None*, *edgetypefunc=None*)

Bases: object

Dot Language Exporter.

Parameters **node** (Node) – start node.

Keyword Arguments

- **graph** – DOT graph type.
- **name** – DOT graph name.

- **options** – list of options added to the graph.
- **indent** (*int*) – number of spaces for indent.
- **nodenamefunc** – Function to extract node name from *node* object. The function shall accept one *node* object as argument and return the name of it.
- **nodeattrfunc** – Function to decorate a node with attributes. The function shall accept one *node* object as argument and return the attributes.
- **edgeattrfunc** – Function to decorate a edge with attributes. The function shall accept two *node* objects as argument. The first the node and the second the child and return the attributes.
- **edgetypefunc** – Function to which gives the edge type. The function shall accept two *node* objects as argument. The first the node and the second the child and return the edge (i.e. '->').

```
>>> from anytree import Node
>>> root = Node("root")
>>> s0 = Node("sub0", parent=root, edge=2)
>>> s0b = Node("sub0B", parent=s0, foo=4, edge=109)
>>> s0a = Node("sub0A", parent=s0, edge="")
>>> s1 = Node("sub1", parent=root, edge="")
>>> s1a = Node("sub1A", parent=s1, edge=7)
>>> s1b = Node("sub1B", parent=s1, edge=8)
>>> s1c = Node("sub1C", parent=s1, edge=22)
>>> s1ca = Node("sub1Ca", parent=s1c, edge=42)
```

A directed graph:

```
>>> from anytree.exporter import DotExporter
>>> for line in DotExporter(root):
...     print(line)
digraph tree {
    "root";
    "sub0";
    "sub0B";
    "sub0A";
    "sub1";
    "sub1A";
    "sub1B";
    "sub1C";
    "sub1Ca";
    "root" -> "sub0";
    "root" -> "sub1";
    "sub0" -> "sub0B";
    "sub0" -> "sub0A";
    "sub1" -> "sub1A";
    "sub1" -> "sub1B";
    "sub1" -> "sub1C";
    "sub1C" -> "sub1Ca";
}
```

An undirected graph:

```
>>> def nodenamefunc(node):
...     return '%s:%s' % (node.name, node.depth)
>>> def edgeattrfunc(node, child):
```

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```
...     return 'label="%s:%s"' % (node.name, child.name)
>>> def edgetypefunc(node, child):
...     return '--'
        >>> from anytree.exporter import DotExporter
>>> for line in DotExporter(root, graph="graph",
...                             nodenamefunc=nodenamefunc,
...                             nodeattrfunc=lambda node: "shape=box",
...                             edgeattrfunc=edgeattrfunc,
...                             edgetypefunc=edgetypefunc):
...     print(line)
graph tree {
    "root:0" [shape=box];
    "sub0:1" [shape=box];
    "sub0B:2" [shape=box];
    "sub0A:2" [shape=box];
    "sub1:1" [shape=box];
    "sub1A:2" [shape=box];
    "sub1B:2" [shape=box];
    "sub1C:2" [shape=box];
    "sub1Ca:3" [shape=box];
    "root:0" -- "sub0:1" [label="root:sub0"];
    "root:0" -- "sub1:1" [label="root:sub1"];
    "sub0:1" -- "sub0B:2" [label="sub0:sub0B"];
    "sub0:1" -- "sub0A:2" [label="sub0:sub0A"];
    "sub1:1" -- "sub1A:2" [label="sub1:sub1A"];
    "sub1:1" -- "sub1B:2" [label="sub1:sub1B"];
    "sub1:1" -- "sub1C:2" [label="sub1:sub1C"];
    "sub1C:2" -- "sub1Ca:3" [label="sub1C:sub1Ca"];
}
```

to_dotfile(*filename*)

Write graph to *filename*.

```
>>> from anytree import Node
>>> root = Node("root")
>>> s0 = Node("sub0", parent=root)
>>> s0b = Node("sub0B", parent=s0)
>>> s0a = Node("sub0A", parent=s0)
>>> s1 = Node("sub1", parent=root)
>>> s1a = Node("sub1A", parent=s1)
>>> s1b = Node("sub1B", parent=s1)
>>> s1c = Node("sub1C", parent=s1)
>>> s1ca = Node("sub1Ca", parent=s1c)
```

```
>>> from anytree.exporter import DotExporter
>>> DotExporter(root).to_dotfile("tree.dot")
```

The generated file should be handed over to the *dot* tool from the http://www.graphviz.org/ package:

```
$ dot tree.dot -T png -o tree.png
```

to_picture(*filename*)

Write graph to a temporary file and invoke *dot*.

The output file type is automatically detected from the file suffix.

'graphviz' needs to be installed, before usage of this method.

static esc(*str*)
Escape Strings.

Exporter missing? File a request here: Issues.

CHAPTER 6

Tricks

6.1 Read-only Tree

Application: A read-only tree data structure, which denies modifications.

The *Node._pre_attach* and *Node._pre_detach* hookups can be used for blocking tree modifications. If they raise an *Exception*, the tree is not modified.

```
>>> from anytree import NodeMixin, RenderTree
```

The exception:

```
>>> class ReadOnlyError(RuntimeError):
...     pass
```

6.1.1 Permanent

The read-only attribute needs to be set after attaching to parent:

```
>>> class ReadOnlyNode(NodeMixin):
...
...     def __init__(self, foo, parent=None):
...         super(ReadOnlyNode, self).__init__()
...         self.foo = foo
...         self.__readonly = False
...         self.parent = parent
...         self.__readonly = True
...
...     def _pre_attach(self, parent):
...         if self.__readonly:
...             raise ReadOnlyError()
...
```

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```
...     def _pre_detach(self, parent):
...         raise ReadOnlyError()
```

An example tree:

```
>>> a = ReadOnlyNode("a")
>>> a0 = ReadOnlyNode("a0", parent=a)
>>> a1 = ReadOnlyNode("a1", parent=a)
>>> a1a = ReadOnlyNode("a1a", parent=a1)
>>> a2 = ReadOnlyNode("a2", parent=a)
>>> print(RenderTree(a).by_attr("foo"))
a
├── a0
├── a1
│   └── a1a
└── a2
```

Modifications raise an *ReadOnlyError*

```
>>> a0.parent = a2
Traceback (most recent call last):
    ...
ReadOnlyError
>>> a.children = [a1]
Traceback (most recent call last):
    ...
ReadOnlyError
```

The tree structure is untouched:

```
>>> print(RenderTree(a).by_attr("foo"))
a
├── a0
├── a1
│   └── a1a
└── a2
```

6.1.2 Temporary

To select the read-only mode temporarily, the root node should provide an attribute for all child nodes, set *after* construction.

```
>>> class ReadOnlyNode(NodeMixin):
...     def __init__(self, foo, parent=None):
...         super(ReadOnlyNode, self).__init__()
...         self.readonly = False
...         self.foo = foo
...         self.parent = parent
...     def _pre_attach(self, parent):
...         if self.root.readonly:
...             raise ReadOnlyError()
...     def _pre_detach(self, parent):
...         if self.root.readonly:
...             raise ReadOnlyError()
```

An example tree:

```
>>> a = ReadOnlyNode("a")
>>> a0 = ReadOnlyNode("a0", parent=a)
>>> a1 = ReadOnlyNode("a1", parent=a)
>>> a1a = ReadOnlyNode("a1a", parent=a1)
>>> a2 = ReadOnlyNode("a2", parent=a)
>>> print(RenderTree(a).by_attr("foo"))
a
├── a0
├── a1
│   └── a1a
└── a2
```

Switch to read-only mode:

```
>>> a.readonly = True
```

```
>>> a0.parent = a2
Traceback (most recent call last):
    ...
ReadOnlyError
>>> a.children = [a1]
Traceback (most recent call last):
    ...
ReadOnlyError
```

Disable read-only mode:

```
>>> a.readonly = False
```

Modifications are allowd now:

```
>>> a0.parent = a2
>>> print(RenderTree(a).by_attr("foo"))
a
├── a1
│   └── a1a
└── a2
    └── a0
```

6.2 YAML Import/Export

YAML (YAML Ain't Markup Language) is a human-readable data serialization language.

PYYAML implements importer and exporter in python. *Please install it, before continuing*

Note: anytree package does not depend on any external packages. It does **NOT** include PYYAML.

Warning: It is not safe to call yaml.load with any data received from an untrusted source! yaml.load is as powerful as pickle.load and so may call any Python function. The yaml.safe_load function limits the load functionality to built-in types.

6.2.1 Export

The `DictExporter` converts any tree to a dictionary, which can be handled by *yaml.dump*.

```
>>> import yaml
>>> from anytree import AnyNode
>>> from anytree.exporter import DictExporter
```

Example tree:

```
>>> root = AnyNode(a="root")
>>> s0 = AnyNode(a="sub0", parent=root)
>>> s0a = AnyNode(a="sub0A", b="foo", parent=s0)
>>> s0b = AnyNode(a="sub0B", parent=s0)
>>> s1 = AnyNode(a="sub1", parent=root)
```

Export to dictionary and convert to YAML:

```
>>> dct = DictExporter().export(root)
>>> print(yaml.dump(dct, default_flow_style=False))
a: root
children:
- a: sub0
  children:
  - a: sub0A
    b: foo
  - a: sub0B
- a: sub1
```

`DictExporter` controls the content. *yaml.dump* controls the YAML related stuff.

To dump to a file, use an file object as second argument:

```
>>> with open("/path/to/file", "w") as file:
...     yaml.dump(data, file)
```

6.2.2 Import

The *yaml.load* function reads YAML data — a dictionary, which `DictImporter` converts to a tree.

```
>>> import yaml
>>> from anytree.importer import DictImporter
>>> from pprint import pprint  # just for nice printing
>>> from anytree import RenderTree  # just for nice printing
```

Example data:

```
>>> data = """
... a: root
... children:
... - a: sub0
...   children:
...   - a: sub0A
...     b: foo
...   - a: sub0B
... - a: sub1
... """
```

Import to dictionary and convert to tree:

```
>>> dct = yaml.load(data)
>>> pprint(dct)
{'a': 'root',
 'children': [{'a': 'sub0',
               'children': [{'a': 'sub0A', 'b': 'foo'}, {'a': 'sub0B'}]},
              {'a': 'sub1'}]}
>>> root = DictImporter().import_(dct)
>>> print(RenderTree(root))
AnyNode(a='root')
├── AnyNode(a='sub0')
│   ├── AnyNode(a='sub0A', b='foo')
│   └── AnyNode(a='sub0B')
└── AnyNode(a='sub1')
```

CHAPTER 7

Getting started

Usage is simple.

Construction

```
>>> from anytree import Node, RenderTree
>>> udo = Node("Udo")
>>> marc = Node("Marc", parent=udo)
>>> lian = Node("Lian", parent=marc)
>>> dan = Node("Dan", parent=udo)
>>> jet = Node("Jet", parent=dan)
>>> jan = Node("Jan", parent=dan)
>>> joe = Node("Joe", parent=dan)
```

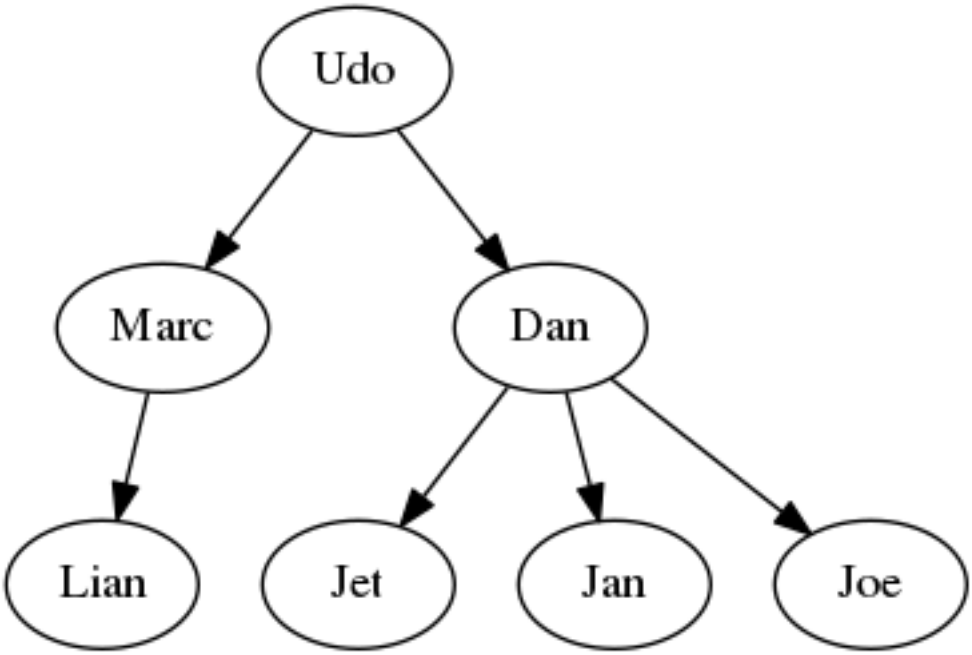
Node

```
>>> print(udo)
Node('/Udo')
>>> print(joe)
Node('/Udo/Dan/Joe')
```

Tree

```
>>> for pre, fill, node in RenderTree(udo):
...     print("%s%s" % (pre, node.name))
Udo
├── Marc
│   └── Lian
└── Dan
    ├── Jet
    ├── Jan
    └── Joe
```

```
>>> from anytree.exporter import DotExporter
>>> # graphviz needs to be installed for the next line!
>>> DotExporter(udo).to_picture("udo.png")
```



Manipulation

A second tree:

```
>>> mary = Node("Mary")
>>> urs = Node("Urs", parent=mary)
>>> chris = Node("Chris", parent=mary)
>>> marta = Node("Marta", parent=mary)
>>> print(RenderTree(mary))
Node('/Mary')
├── Node('/Mary/Urs')
├── Node('/Mary/Chris')
└── Node('/Mary/Marta')
```

Append:

```
>>> udo.parent = mary
>>> print(RenderTree(mary))
Node('/Mary')
├── Node('/Mary/Urs')
├── Node('/Mary/Chris')
├── Node('/Mary/Marta')
└── Node('/Mary/Udo')
    ├── Node('/Mary/Udo/Marc')
    │   └── Node('/Mary/Udo/Marc/Lian')
    └── Node('/Mary/Udo/Dan')
        ├── Node('/Mary/Udo/Dan/Jet')
        ├── Node('/Mary/Udo/Dan/Jan')
        └── Node('/Mary/Udo/Dan/Joe')
```

Subtree rendering:

```
>>> print(RenderTree(marc))
Node('/Mary/Udo/Marc')
└── Node('/Mary/Udo/Marc/Lian')
```

Cut:

```
>>> dan.parent = None
>>> print(RenderTree(dan))
Node('/Dan')
├── Node('/Dan/Jet')
├── Node('/Dan/Jan')
└── Node('/Dan/Joe')
```

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