Python Tree Data

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Contents

1 Installation **3**

2 Introduction **5**
- 2.1 Overview . . . 5
- 2.2 Basics . . . 6
- 2.3 Detach/Attach Protocol . . . 7
- 2.4 Custom Separator . . . 8

3 API **9**
- 3.1 Node Classes . . . 9
- 3.2 Tree Iteration . . . 14
- 3.3 Tree Rendering . . . 19
- 3.4 Node Resolution . . . 22
- 3.5 Tree Walking . . . 25

4 Importer **27**
- 4.1 Dictionary Importer . . . 27
- 4.2 JSON Importer . . . 28

5 Exporter **29**
- 5.1 Dictionary Exporter . . . 29
- 5.2 JSON Exporter . . . 30
- 5.3 Dot Exporter . . . 31

6 Tricks **35**
- 6.1 Read-only Tree . . . 35

7 Getting started **39**

Python Module Index **43**

Simple, lightweight and extensible Tree data structure.

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.

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

class anytree.node.**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.

```
>>> 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):
...         super(MyClass, self).__init__()
...         self.name = name
...         self.length = length
...         self.width = width
...         self.parent = 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
```

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')
>>> 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.

```
>>> 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'))
>>> 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.TreeError: Cannot add node Node('/n/a') multiple times as child.
```

path

Path of this *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.

```
>>> 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.

```
>>> 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
(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.

```
>>> 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.

```
>>> 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'))
```

is_leaf
Node has no children (External 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.

```
>>> 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*.

```
>>> 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*.

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

class anytree.node.**AnyNode**(*parent=None*, ***kwargs*)
Bases: *anytree.node.NodeMixin*, object

A generic tree node with any *kwargs*.

```
>>> 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')
|    - 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**(*name*, *parent=None*, ***kwargs*)

Bases: *anytree.node.NodeMixin*, object

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

```
>>> 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')
|    - 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')
```

name

Name.

exception anytree.node.**TreeError**

Bases: exceptions.RuntimeError

Tree Error.

exception anytree.node.**LoopError**

Bases: *anytree.node.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)
>>> 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)
>>> 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.**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 pre, _, node in RenderTree(root, childiter=reversed):
...     print("%s%s" % (pre, 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 pre, _, node in RenderTree(root, childiter=mysort):
...     print("%s%s" % (pre, 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
>>> print(RenderTree(root).by_attr("lines"))
c0fe
c0de
- ha
|   ba
|   - 1
|   |   2
|   |   3
|   - a
|       b
- Z
```

by_attr(*attrname='name'*)
Return rendered tree with node attribute *attrname*.

3.4 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*.

3.5 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.

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'>*)

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: anytree.exporter.dotexporter._Render

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):
...     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"];
}
```

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()
...
```

```
...     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
```

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)
```

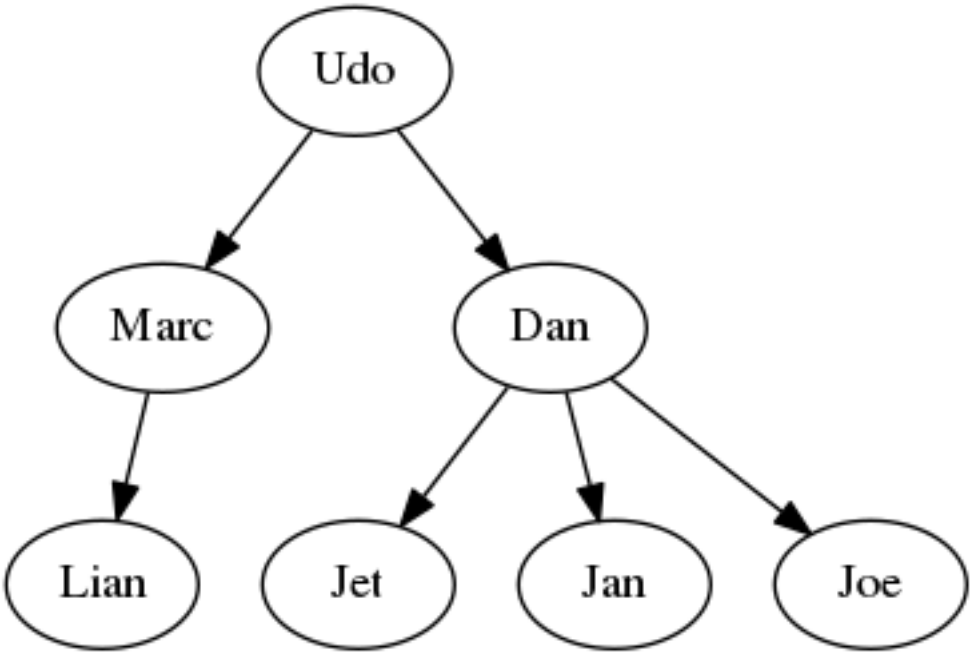
Node

```
>>> 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')
```

Python Module Index

a

anytree.exporter.dictexporter, 29
anytree.exporter.dotexporter, 31
anytree.exporter.jsonexporter, 30
anytree.importer.dictimporter, 27
anytree.importer.jsonimporter, 28
anytree.iterators, 14
anytree.iterators.levelordergroupiter, 17
anytree.iterators.levelorderiter, 16
anytree.iterators.postorderiter, 15
anytree.iterators.preorderiter, 15
anytree.iterators.zigzaggroupiter, 18
anytree.node, 9
anytree.render, 19
anytree.resolver, 22
anytree.walker, 25

Index

A

AbstractStyle (class in anytree.render), 19
ancestors (anytree.node.NodeMixin attribute), 11
anchestors (anytree.node.NodeMixin attribute), 11
AnyNode (class in anytree.node), 13
anytree.exporter.dictexporter (module), 29
anytree.exporter.dotexporter (module), 31
anytree.exporter.jsonexporter (module), 30
anytree.importer.dictimporter (module), 27
anytree.importer.jsonimporter (module), 28
anytree.iterators (module), 14
anytree.iterators.levelordergroupiter (module), 17
anytree.iterators.levelorderiter (module), 16
anytree.iterators.postorderiter (module), 15
anytree.iterators.preorderiter (module), 15
anytree.iterators.zigzaggroupiter (module), 18
anytree.node (module), 9
anytree.render (module), 19
anytree.resolver (module), 22
anytree.walker (module), 25
AsciiStyle (class in anytree.render), 19

B

by_attr() (anytree.render.RenderTree method), 22

C

children (anytree.node.NodeMixin attribute), 10
ChildResolverError, 24
ContRoundStyle (class in anytree.render), 20
ContStyle (class in anytree.render), 20

D

depth (anytree.node.NodeMixin attribute), 13
descendants (anytree.node.NodeMixin attribute), 11
DictExporter (class in anytree.exporter.dictexporter), 29
DictImporter (class in anytree.importer.dictimporter), 27
DotExporter (class in anytree.exporter.dotexporter), 31
DoubleStyle (class in anytree.render), 20

E

empty (anytree.render.AbstractStyle attribute), 19
export() (anytree.exporter.dictexporter.DictExporter method), 30
export() (anytree.exporter.jsonexporter.JsonExporter method), 31

G

get() (anytree.resolver.Resolver method), 22
glob() (anytree.resolver.Resolver method), 23

H

height (anytree.node.NodeMixin attribute), 13

I

import_() (anytree.importer.dictimporter.DictImporter method), 27
import_() (anytree.importer.jsonimporter.JsonImporter method), 28
is_leaf (anytree.node.NodeMixin attribute), 12
is_root (anytree.node.NodeMixin attribute), 12
is_wildcard() (anytree.resolver.Resolver static method), 24

J

JsonExporter (class in anytree.exporter.jsonexporter), 30
JsonImporter (class in anytree.importer.jsonimporter), 28

L

LevelOrderGroupIter (class in anytree.iterators.levelordergroupiter), 17
LevelOrderIter (class in anytree.iterators.levelorderiter), 16
LoopError, 14

N

name (anytree.node.Node attribute), 14
Node (class in anytree.node), 14
NodeMixin (class in anytree.node), 9

P

parent (anytree.node.NodeMixin attribute), 10
path (anytree.node.NodeMixin attribute), 11
PostOrderIter (class in anytree.iterators.postorderiter), 15
PreOrderIter (class in anytree.iterators.preorderiter), 15

R

read() (anytree.importer.jsonimporter.JsonImporter method), 28
RenderTree (class in anytree.render), 21
Resolver (class in anytree.resolver), 22
ResolverError, 24
root (anytree.node.NodeMixin attribute), 12

S

separator (anytree.node.NodeMixin attribute), 9
siblings (anytree.node.NodeMixin attribute), 12

T

TreeError, 14

W

walk() (anytree.walker.Walker method), 25
Walker (class in anytree.walker), 25
WalkError, 26
write() (anytree.exporter.jsonexporter.JsonExporter method), 31

Z

ZigZagGroupIter (class in anytree.iterators.zigzaggroupiter), 18