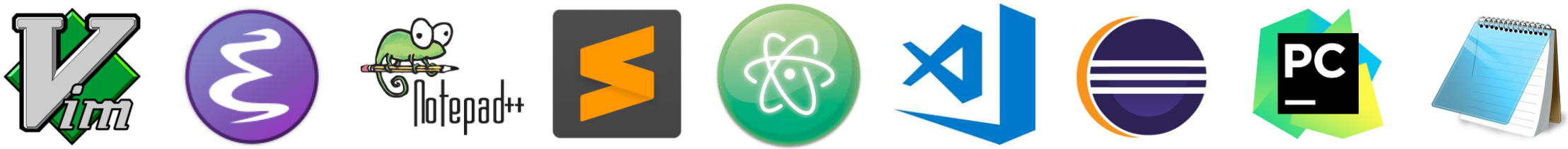
AST-based structural code editing for Python

Felix Kohlgrüber / 2018/07/10

Code Editors



… and so many more

Code Editor == Text Editor?

Text Editors

- General tool

```
def greet(s):
    print(f"Hello {s}")

if __name__ == '__main__':
    greet("World")
```

```
Lorem ipsum dolor sit amet, consectetur
adipisici elit, sed eiusmod tempor
incidunt ut labore et dolore magna
aliqua. Ut enim ad minim veniam, quis
nostrud exercitation ullamco laboris
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consequat.
```
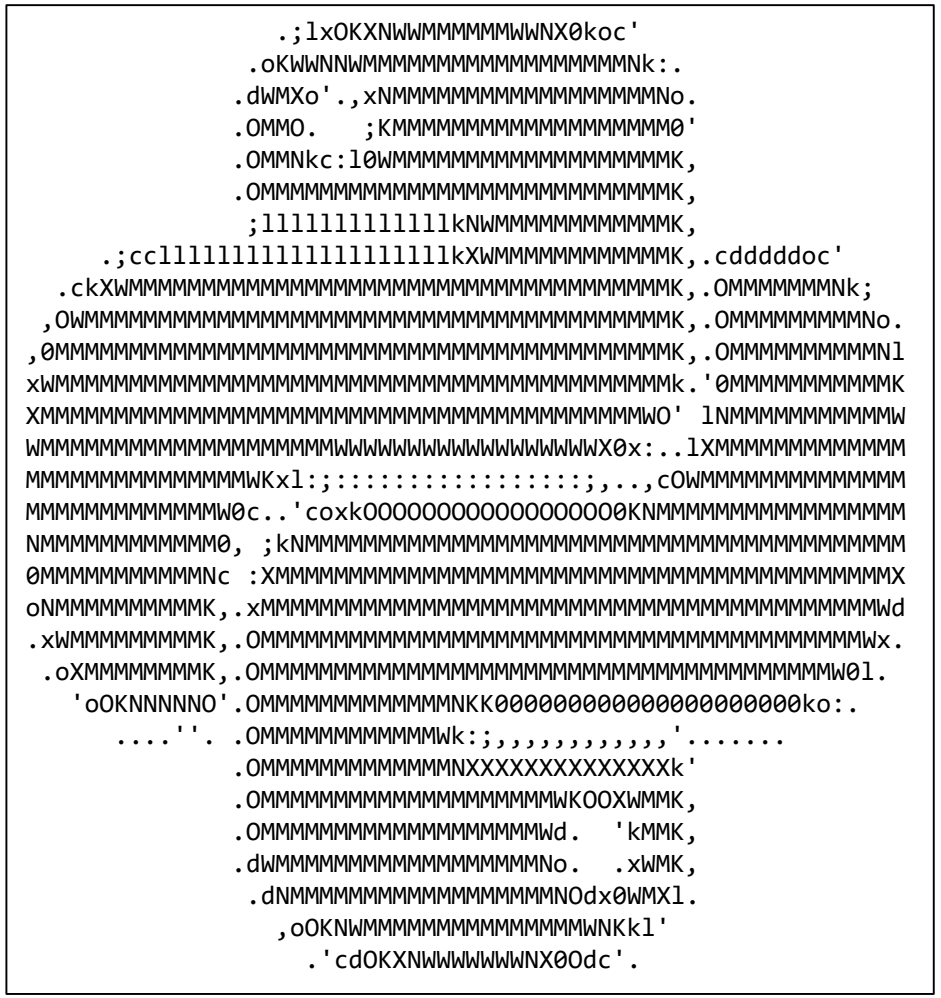




REMEMBER, WITH GREAT POWER
COMES GREAT RESPONSIBILITY
quickmeme.com

Problem: Syntax Errors

```
def greet(s):
    return f"Hello {s}"

if __name__ == '__main__':
    print greet("World")
```

```
def half_diag(a, b):
    retrun ((sqrt(a[i]**2 + b[i]**2)/2 for i in range(len(a)))
```

```
function multiply(a, b) {
  return a * b;
}

if __name__ == '__main__’:
    print(multiply(42, 20))
```

Problem: Tabs vs. Spaces

```
if __name__ == '__main__':
    a = 1000
    print(f"a = {a}")
```

```
C:\Users\felix\Desktop>python test.py
  File "test.py", line 3
    print(f"a = {a}")
                    ^
IndentationError: unindent does not match any outer
indentation level
```

Problem: Style Guide Violations

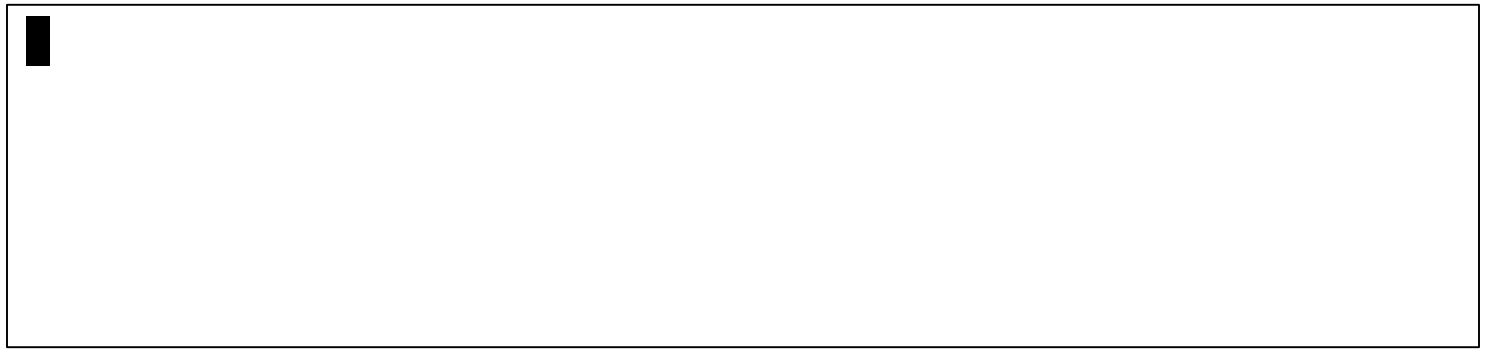
```
def calculate(a   ,b) :
    sum=a+  b
    return(sum/ 2)

if __name__ == '__main__':
    print (calculate(1,3),)
```

```
def calculate(a, b):
    sum = a + b
    return sum / 2

if __name__ == '__main__':
    print(calculate(1, 3), )
```

```
# Python 2
In [1]: def calculate(a   ,b) :
   ...:     sum=a+   b
   ...:     return(sum/ 2)
   ...:
   ...: if __name__ == '__main__':
   ...:     print (calculate(1,3),)
   ...:
(2,)
```

```
# Python 3
In [1]: def calculate(a   ,b) :
   ...:     sum=a+   b
   ...:     return(sum/ 2)
   ...:
   ...: if __name__ == '__main__':
   ...:     print (calculate(1,3),)
   ...:
2.0
```

Problem: Discoverability



Do we need all that power?

Structure Editors

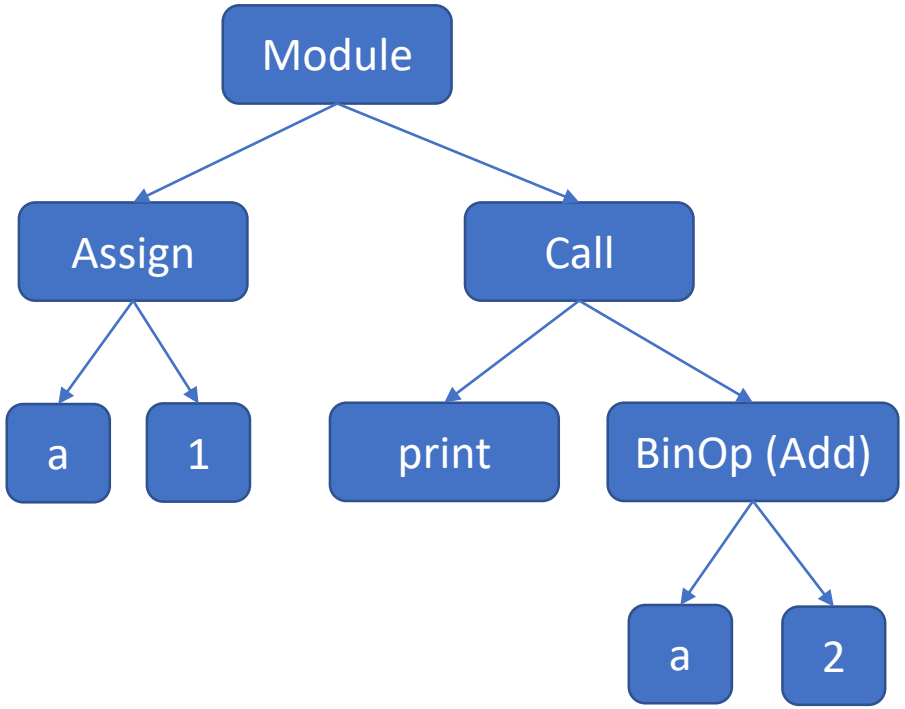
- *"A **structure editor**, also **structured editor** or **projectional editor**, is any document editor that is cognizant of the document's underlying structure." (Wikipedia)*
- Edit parse tree / abstract syntax tree (AST) instead of sequence of characters

Abstract syntax trees

- Tree structure representing source code
- Example:

```
import ast

code = """
a = 1
print(a+2)
"""

a = ast.parse(code)
print(ast.dump(a))
```

```
# Simplified AST
Module(
   body=[
      Assign(targets=[Name(id='a')],
             value=Num(n=1)),
      Call(
        func=Name(id='print'),
        args=[
          BinOp(left=Name(id='a'),
                op=Add(),
                right=Num(n=2))
        ],
      )
   ]
)
```



Structure Editors

- *"A **structure editor**, also **structured editor** or **projectional editor**, is any document editor that is cognizant of the document's underlying structure." (Wikipedia)*
- Edit parse tree / abstract syntax tree (AST) instead of sequence of characters
- Active research topic since ~1985
- Example:

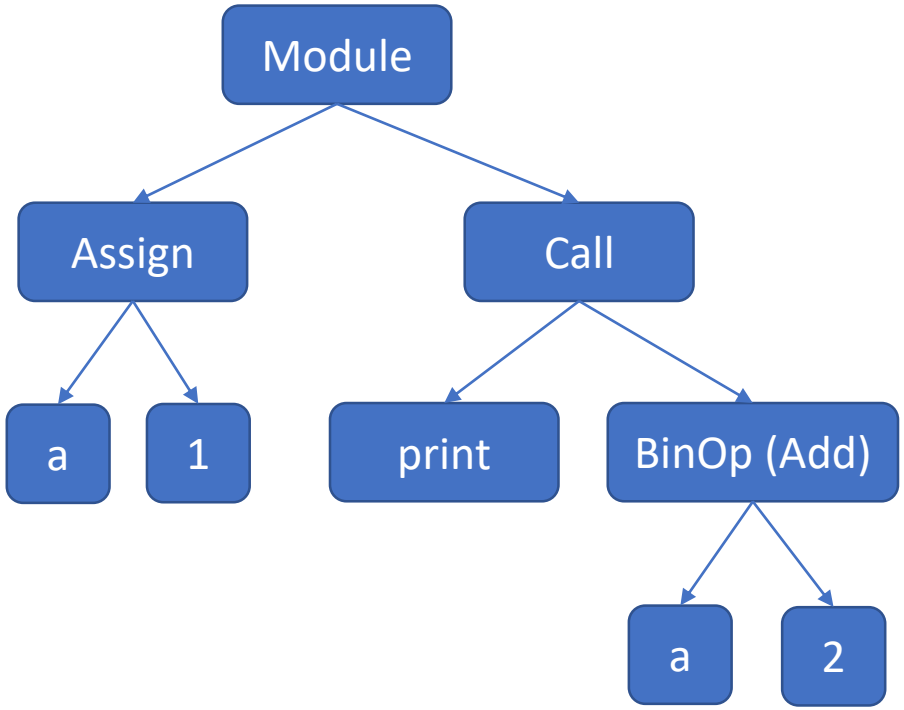
vrite

- Structured editor for Python
- Web-based (javascript, vue.js)
- Status: notevenclosetoalpha

DEMO

vrite – Navigation

- AST-nodes instead of character-by-character




```
a = 1
print(a+2)
```

vrite – Semantic commands

„Wrap with function call“

„Create function“

„Swap operands“

„Insert import statement“

„Move argument to the right“

…

- High-level interactions
- Availability depends on context

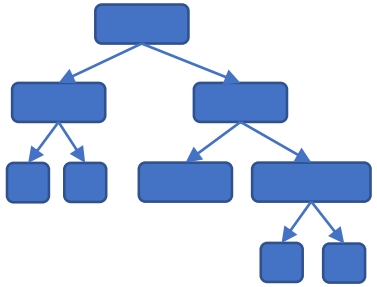
vrite – Deactivate code

- Alternative to „commenting out“-hack

```
x = my_func(a, b, input_sorted=True)
print(x * 5 / pi)
```

```
x = my_func(a, b, input_sorted=True)
print(x * 5 / pi)
```

vrite – Flexible representation



?

- Pep8/Black-formatted text
- Depending on available width
- User-configurable amount of indentation (in px)
- Parametric fonts

```
def fn(first_argument, second_arg):
    pass
```

```
def fn(
    first_argument,
    second_arg
):
    pass
```

```
def my_function(a, b):
    """This is the description of my Function"""
    return 2 * a + b
```

```
def my_function(a, b):
    """This is the description of my Function"""
    return 2 * a + b
```

vrite – Flexible representation (cont.)

- Use color to disambiguate tokens
- Use syntax that‘s easy to read/understand by humans
- *Possible: Braceless Javascript/Java/C++ (!!)*
- Use non-text elements

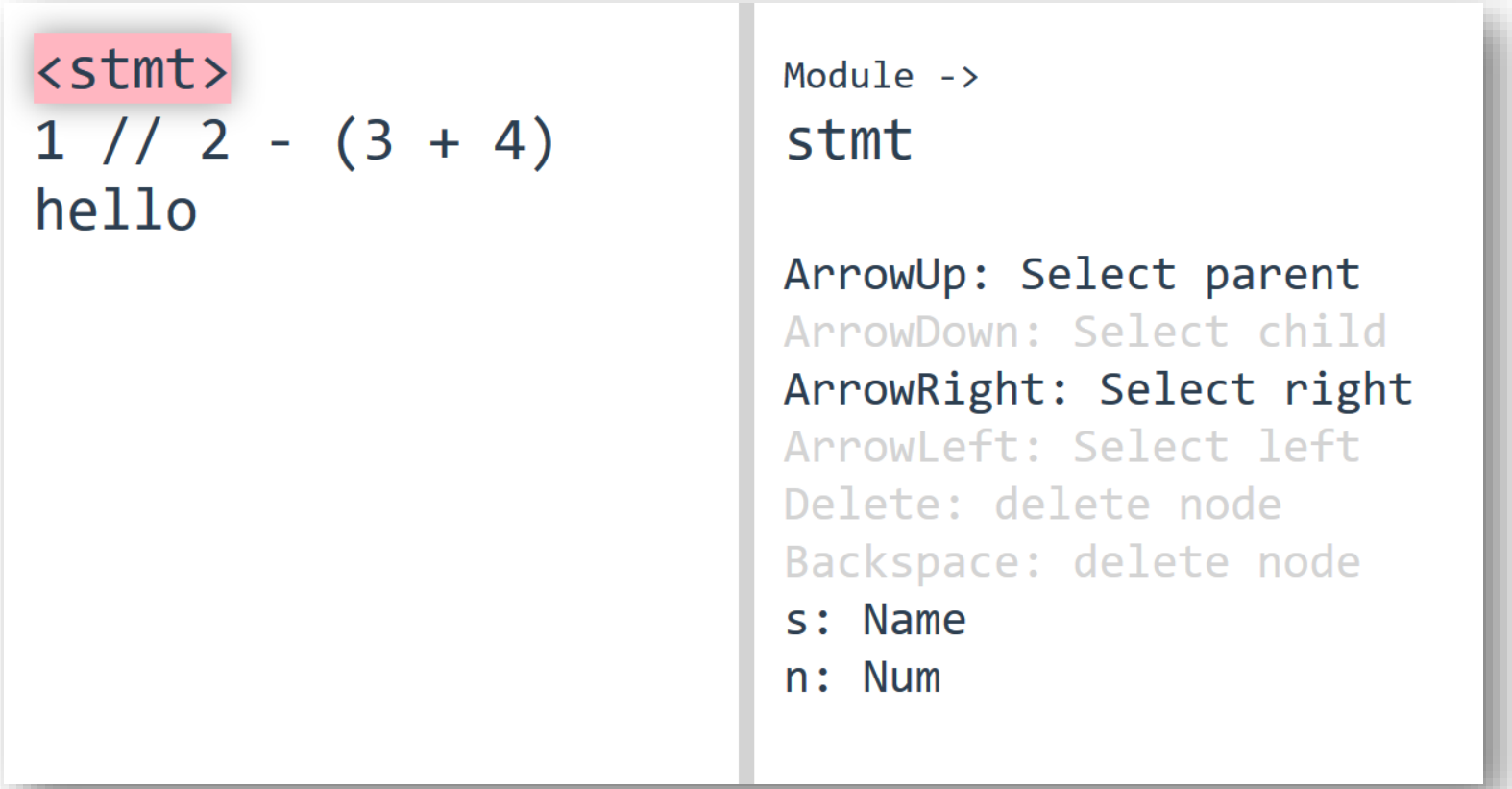
```
a = "1000"
b = 1000
c = "say \"hello\"\nsecond line"
d = map(lambda x: x+2, range(10))
```

```
a = 1000
b = 1000
c = say "hello"
    second line
c = say "hello"⏎second line
d = map(|x| x+2, ..10)
```

```
if a:
    if b:
        return 42
    else:
        return 23
else:
    if b:
        return 19
    else:
        return 0
```

return		b	not b
	a	42	23
	not a	19	0

vrite – Discoverability



Summary

```
File "<stdin>", line 1
    async = 123
          ^
SyntaxError: invalid syntax
```

```
def calculate(a   ,b) :
    sum=a+  b
    return(sum/ 2)

if __name__ == '__main__':
    print (calculate(1,3),)
```

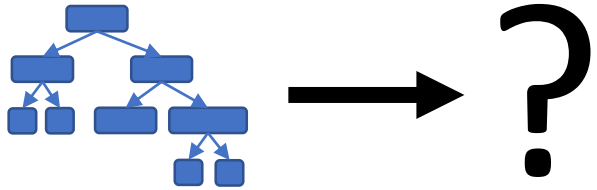
„Wrap with function call“

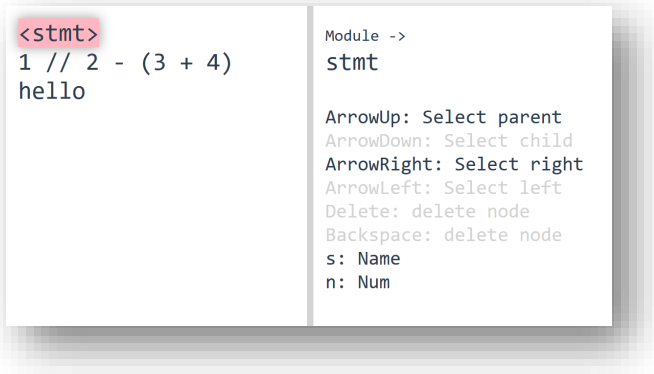
„Create function“

„Swap operands“

„Insert import statement“

„Move argument to the right“





Thank you!

github.com/fkohlgrueber/vrite

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