Introduction to Metaprogramming (Tutorial)

CS453 Automated Software Testing

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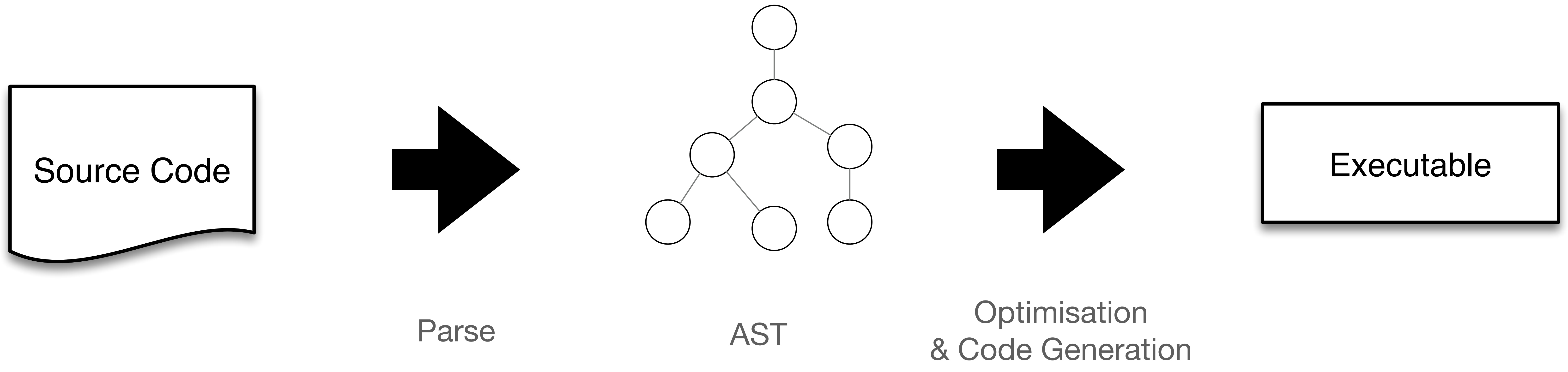
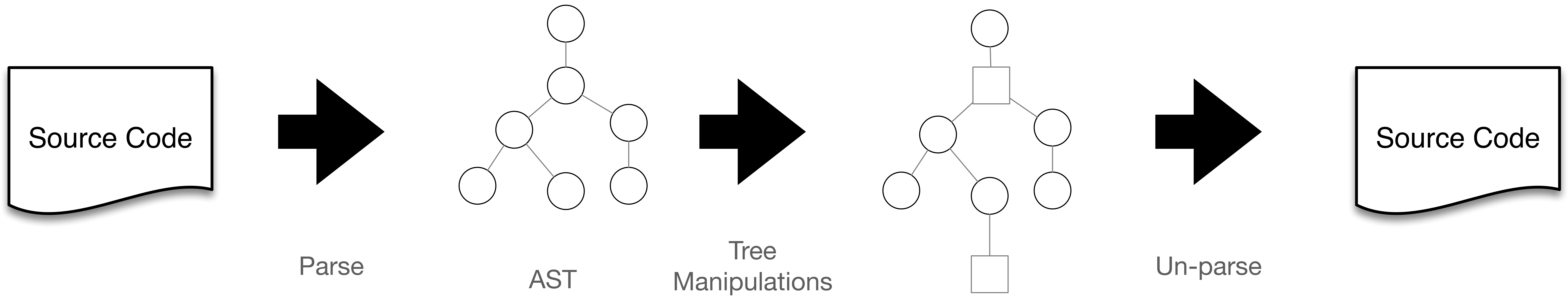
Metaprogramming

- Programming technique in which computer programs have the ability to take other programs as data: a program that can read, generate, analyze, or transform other programs (from Wikipedia)
    - A program may even modify itself!
- Von Neumann Architecture: a stored-program computer means 1) a separation of CPU and memory and 2) same mechanism being used to fetch both instructions and data. From this, we can derive two principles, code-as-data and data-as-code, opening our way to meta programming.

Manipulating AST in Python



Compilers



Metaprogramming

Tutorial Example 1

Programmatically modify from foo to bar

```python
def foo(x):
  if x > 0:
    print('positive')
  elif x == 0:
    print('zero!')
  else:
    print('negative')

def change_function_name():
  # what can we do here so that this program runs?

if __name__ == '__main__':
  change_function_name()
  bar(3) # DO NOT CHANGE
```

Tutorial Example 2

Programmatically add a function bar and write the source code

```python
def foo(x):
  if x > 0:
    print('positive')
  elif x == 0:
    print('zero!')
  else:
    print('negative')
```

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```python
def bar():
    print('Yeah!')


def foo(x):
    if x > 0:
        print('positive')
    elif x == 0:
        print('zero!')
    else:
        print('negative')
```