Pipeline Architecture

CSSE6400

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February 28, 2022

Question

Can you name a *pipeline archiecture*?

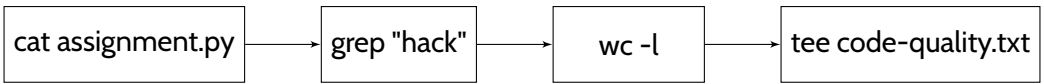
Question

Can you name a *pipeline archiecture*?

Answer

How about *bash*?

```
>> cat assignment.py | grep "hack" | wc -l \
   | tee code-quality.txt
```


cat assignment.py
grep "hack"
wc -l
tee code-quality.txt


Filter
Pipe
Filter
Pipe
Filter

Filters

Modular software components

Filters

Modular software components

Pipes

The flow of data between filters

Producers

Source of data.

Producers

Source of data.

Transformers

Transform data.

Producers

Source of data.

Transformers

Transform data.

Testers

Filter data.

Producers

Source of data.

Transformers

Transform data.

Testers

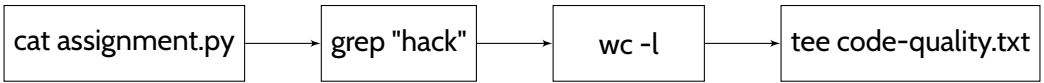
Filter data.

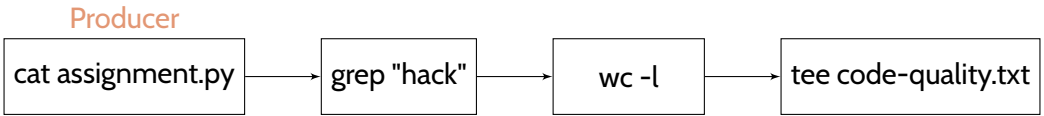
Consumers

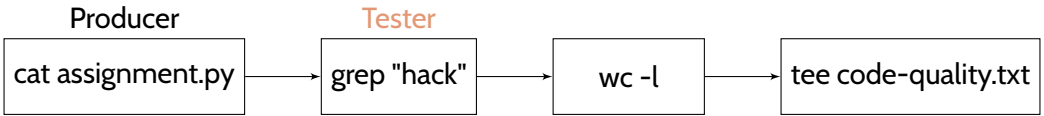
Target for results.

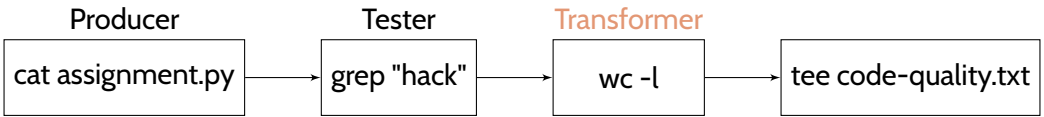
Exercise

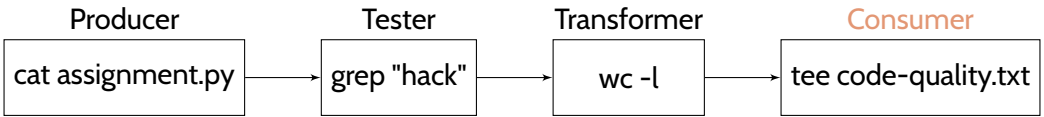
Label the bash pipeline.


cat assignment.py
grep "hack"
wc -l
tee code-quality.txt


Producer
cat assignment.py
grep "hack"
wc -l
tee code-quality.txt


Producer
Tester
cat assignment.py
grep "hack"
wc -l
tee code-quality.txt


Producer
cat assignment.py
Tester
grep "hack"
Transformer
wc -l
tee code-quality.txt


Producer
cat assignment.py
Tester
grep "hack"
Transformer
wc -l
Consumer
tee code-quality.txt

Question

Does this seem familiar?

Poll

Who has done *functional programming*?

```
let sum = reduce
            (λ total value → total + value)
            (map (λ seq → size seq) xs)
            0
```

```
1 let sum = reduce + (map size xs) 0
```

Definition 1. *map*

```
map : (τ1 → τ2) → τ1Seq → τ2Seq
map f xs
```

Definition 2. *reduce*

```
1 reduce : (τ1 → τ1 → τ1) → τ1Seq → τ1 → τ1Seq
2 reduce f xs initial
```

Question

What's the advantage of the map reduce pattern?

Question

What's the advantage of the map reduce pattern?

Answer

Parallelism [1]

Question

Using pipeline terminology, what filters do the *map* and *reduce* operators correspond to?

References

[1] Jeffrey Dean and Sanjay Ghemawat.
Mapreduce: Simplified data processing on large clusters.
In *OSDI'04: Sixth Symposium on Operating System Design and Implementation*, pages 137–150, San Francisco, CA, 2004.