

solving problems with computers

digitalisierung und programmierung · prof. dr. nicolas meseth

- 1 what happens in the middle?
- 2 the boxes in this project
- 3 boxes all the way down
- 4 two questions inside every box

part 1

what happens in the middle?

you order.
a tray appears.
what happened
in between?



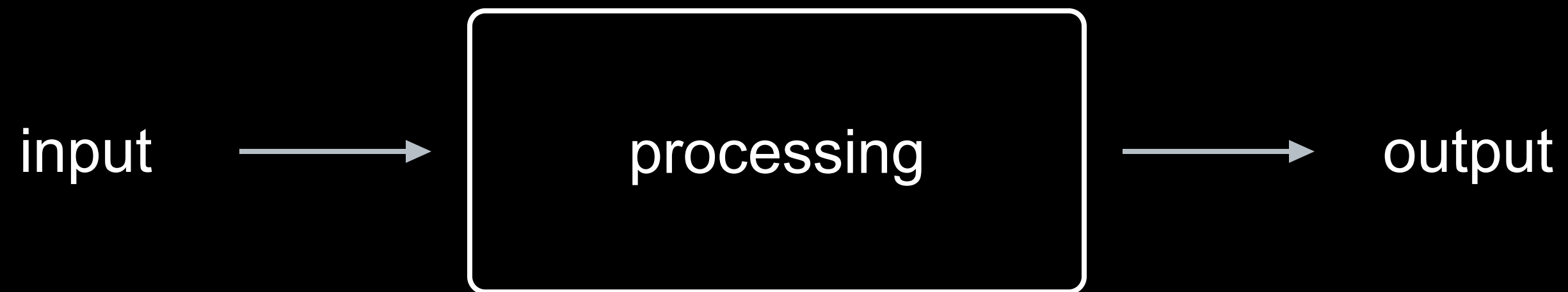
every computable piece has this shape



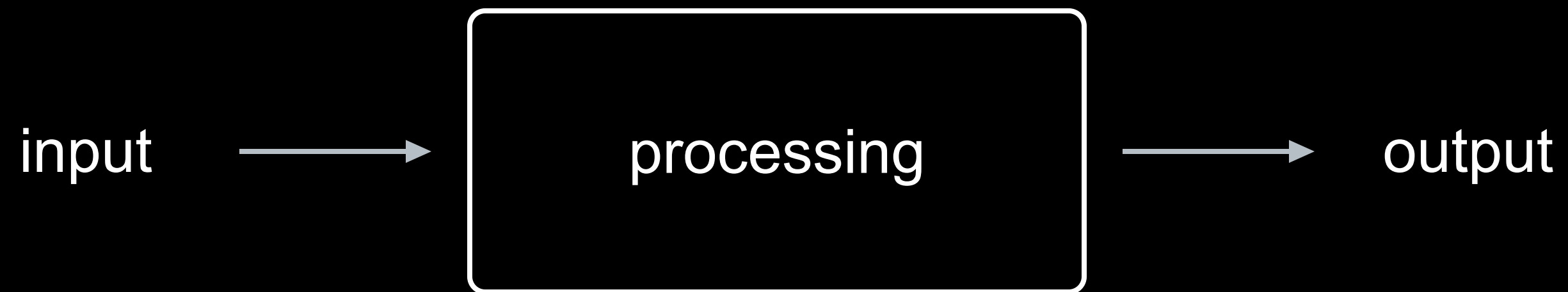
every computable piece has this shape



every computable piece has this shape



every computable piece has this shape

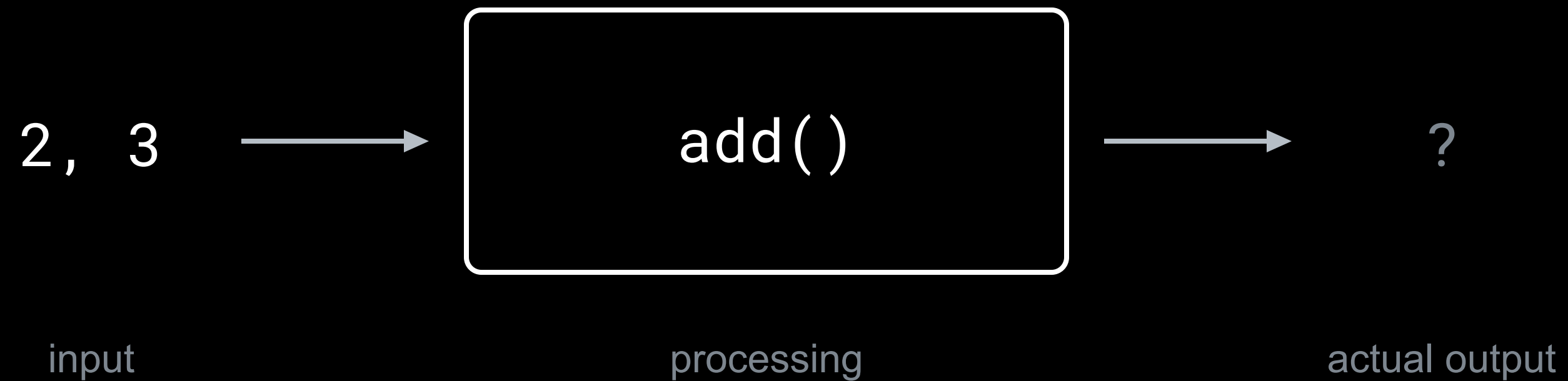


input · processing · output

IPO

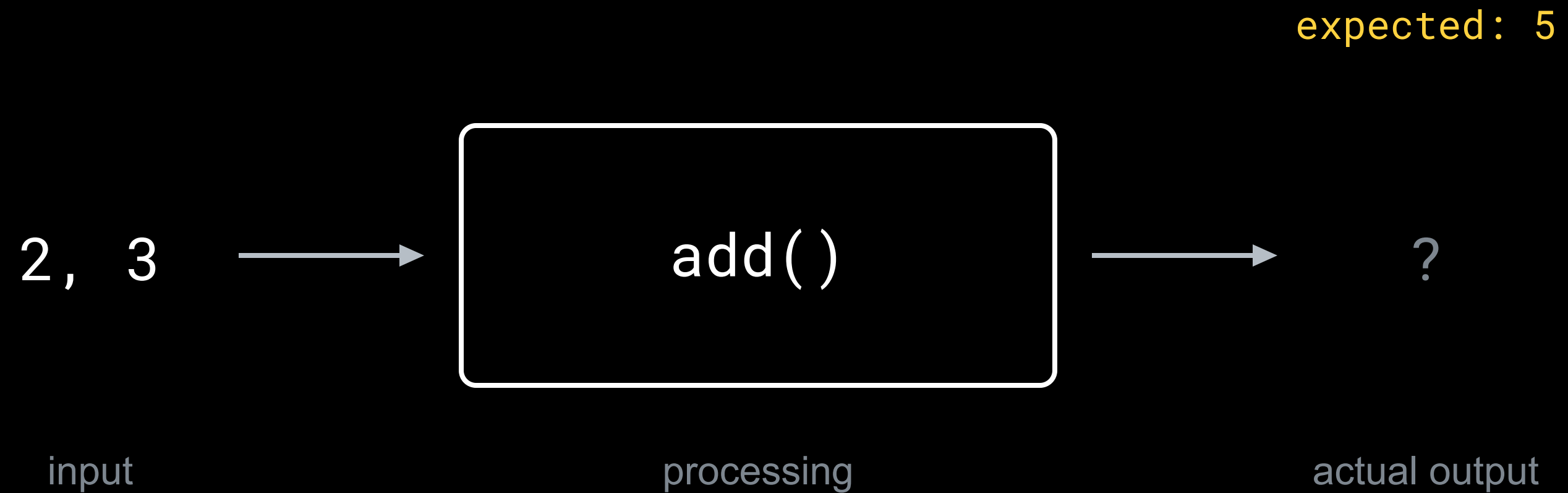
what happens in the middle?

a box with clear edges brings its own test



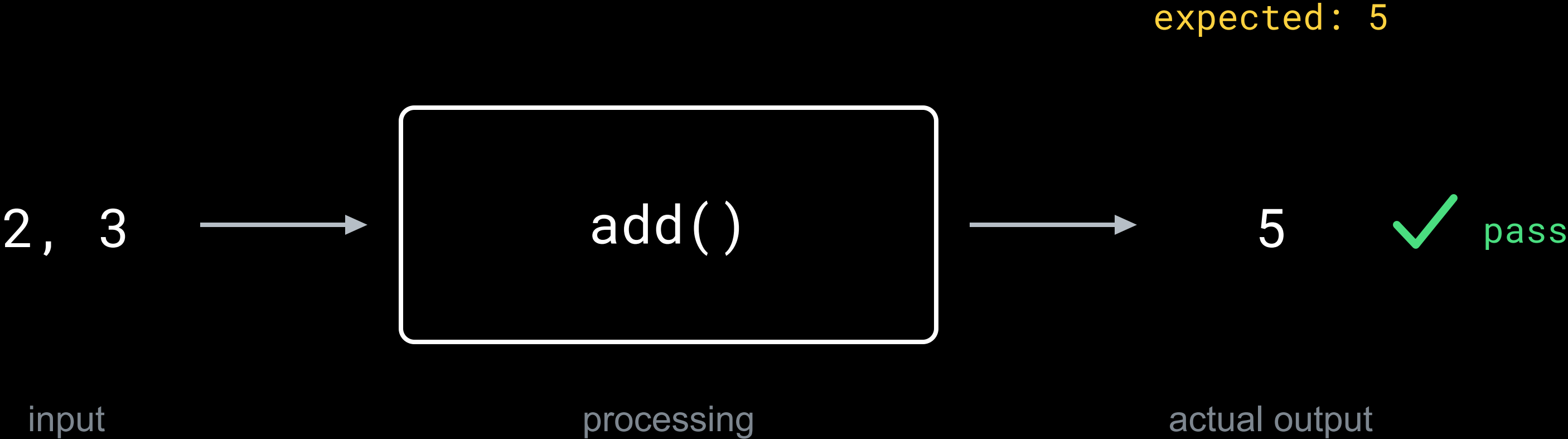
if you know the input and expected output, you have a test.

a box with clear edges brings its own test



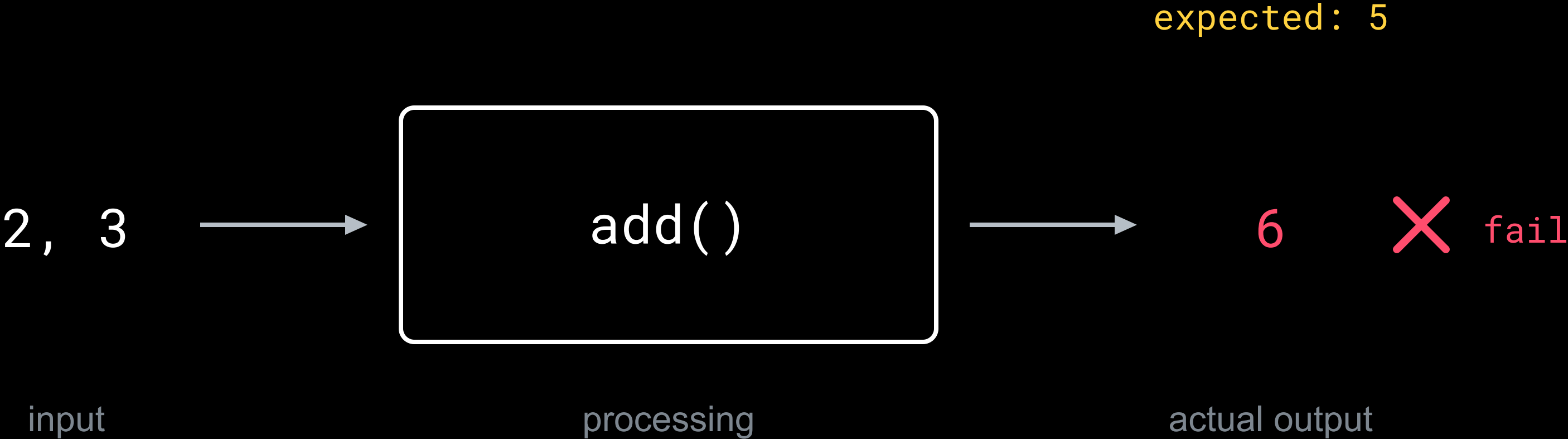
if you know the input and expected output, you have a test.

a box with clear edges brings its own test



if you know the input and expected output, you have a test.

a box with clear edges brings its own test

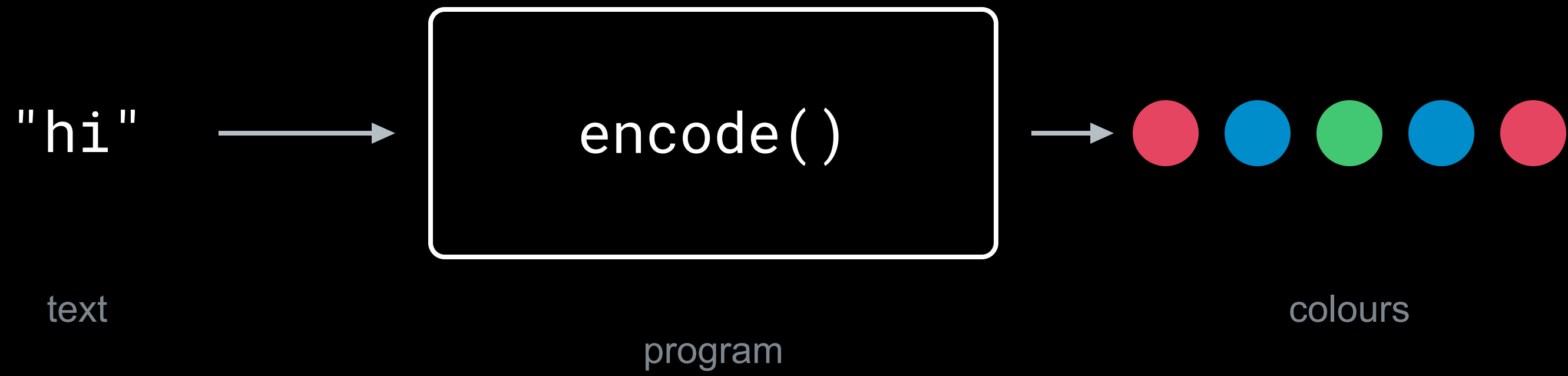


if you know the input and expected output, you have a test.

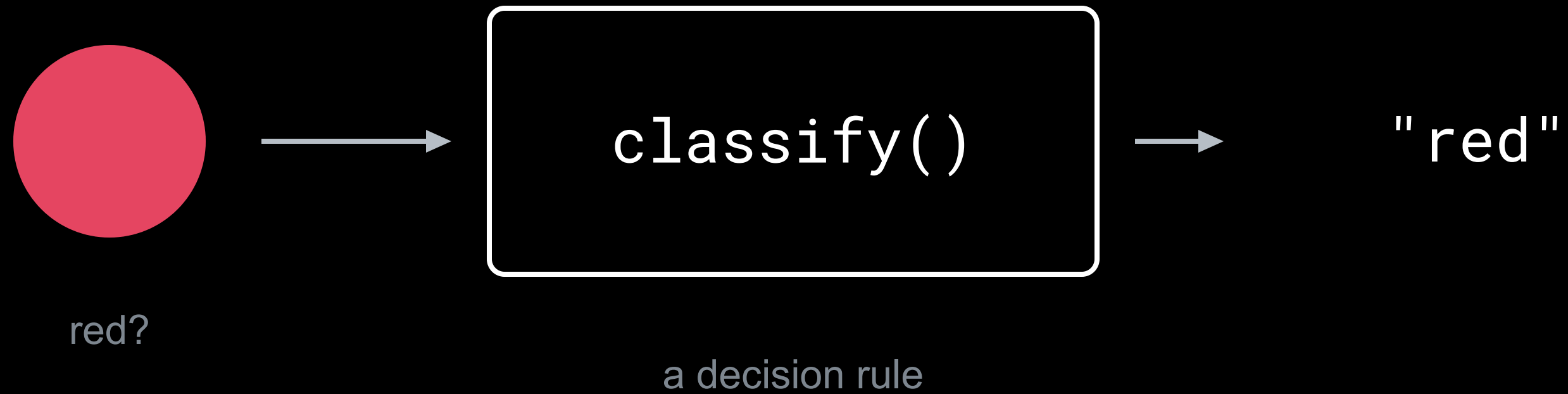
part 2

the boxes in this project

the sender is a box

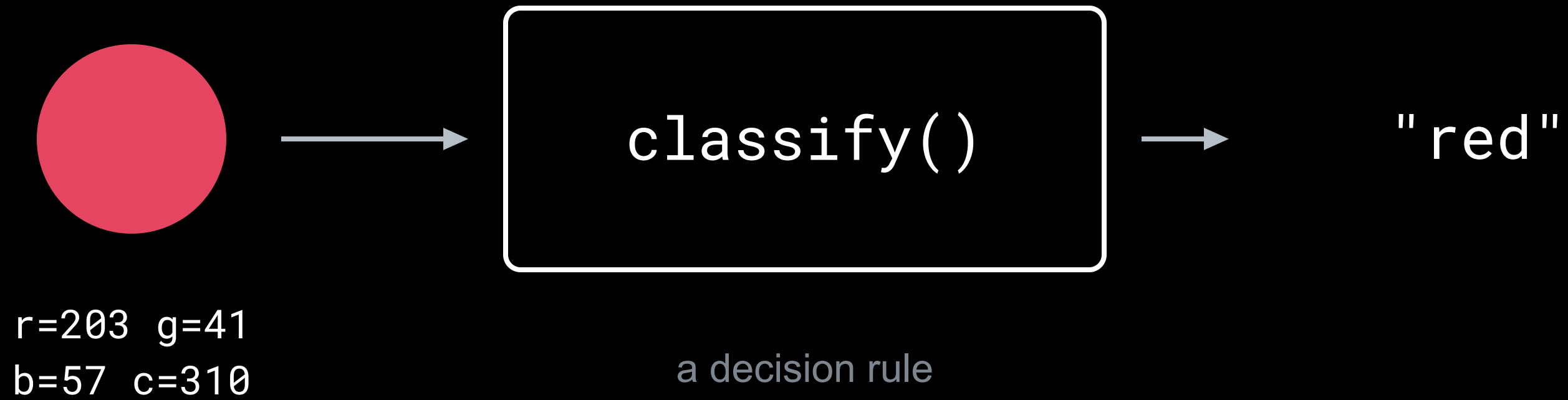


what enters the receiver?



your eyes see red. the box sees four numbers.

what enters the receiver?



your eyes see red. the box sees four numbers.

try it: what does the sensor see?

sensor case

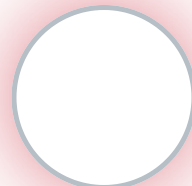
clear red

weak red

mixed light

darkness

1 input



R		203
G		41
B		57
C		310

(203, 41, 57, 310) → red

2 processing

```
classify(r, g, b, c)  
  
if c < min light → off  
if lead < min lead → uncertain  
else → strongest channel
```

min light		80
min lead		30

3 output

actual

red

expected

red

green

blue

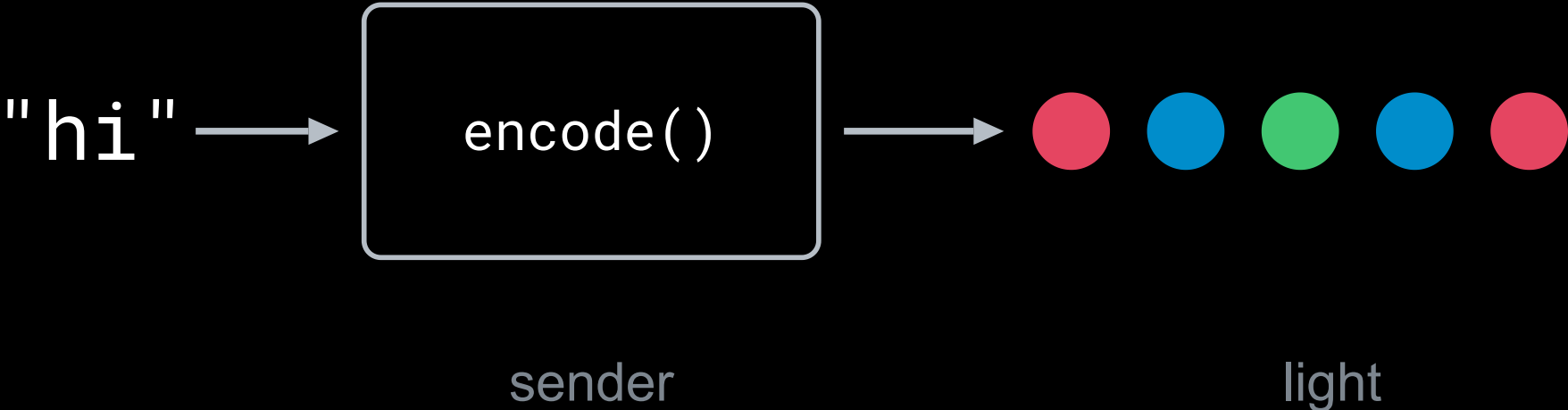
off

uncertain

✓ pass

change the input or the rule. the test follows.

boxes connect when their edges agree



boxes connect when their edges agree



boxes connect when their edges agree



an agreement at every boundary.

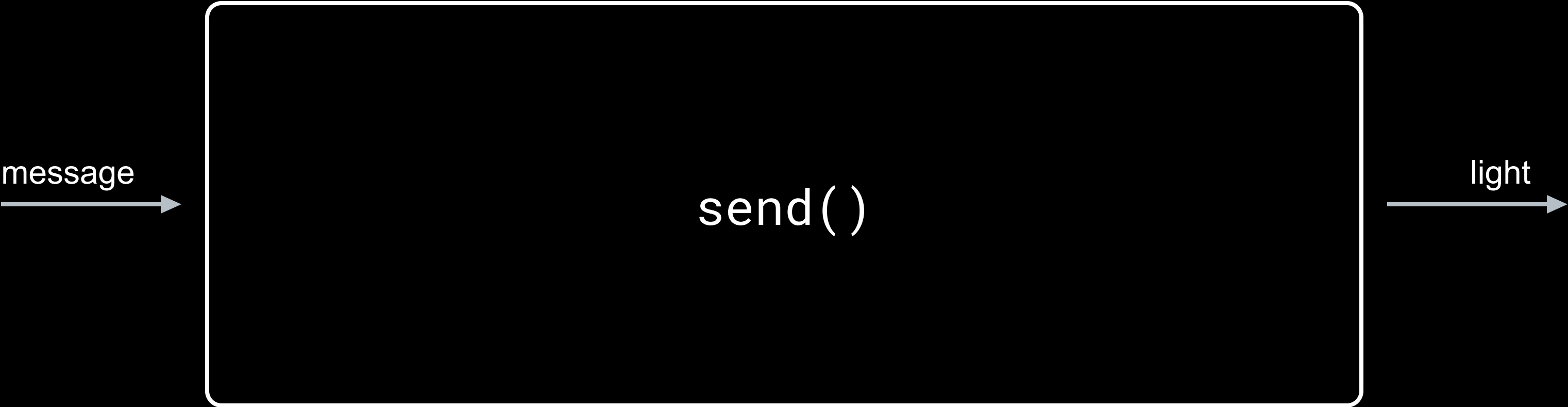
to find the fault,
follow the data.

test one boundary at a time.

part 3

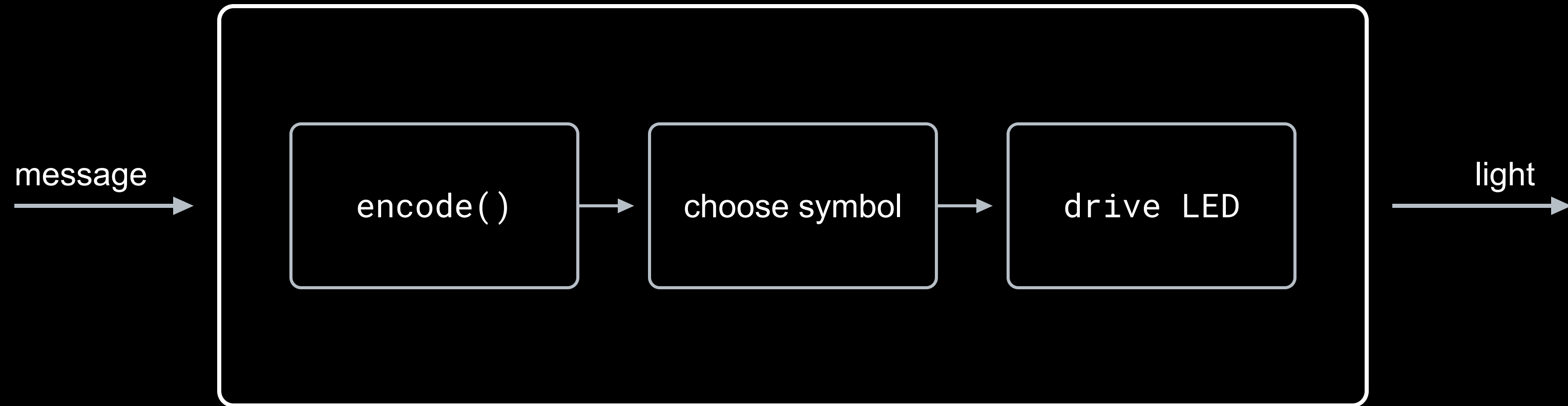
boxes all the way down

one box from the outside



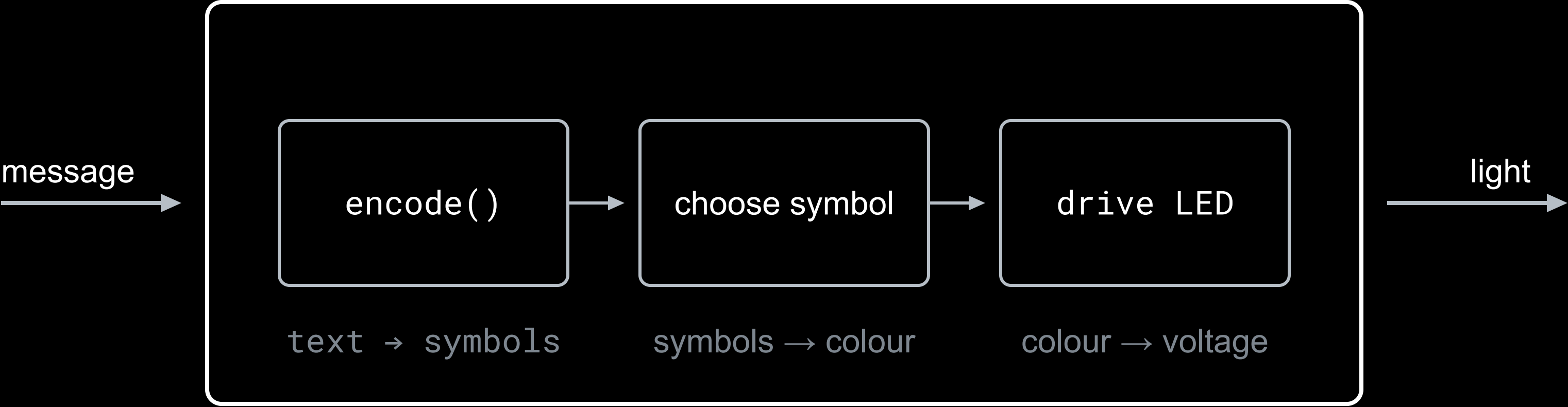
open a box only as far as your question requires.

one box from the outside



open a box only as far as your question requires.

one box from the outside

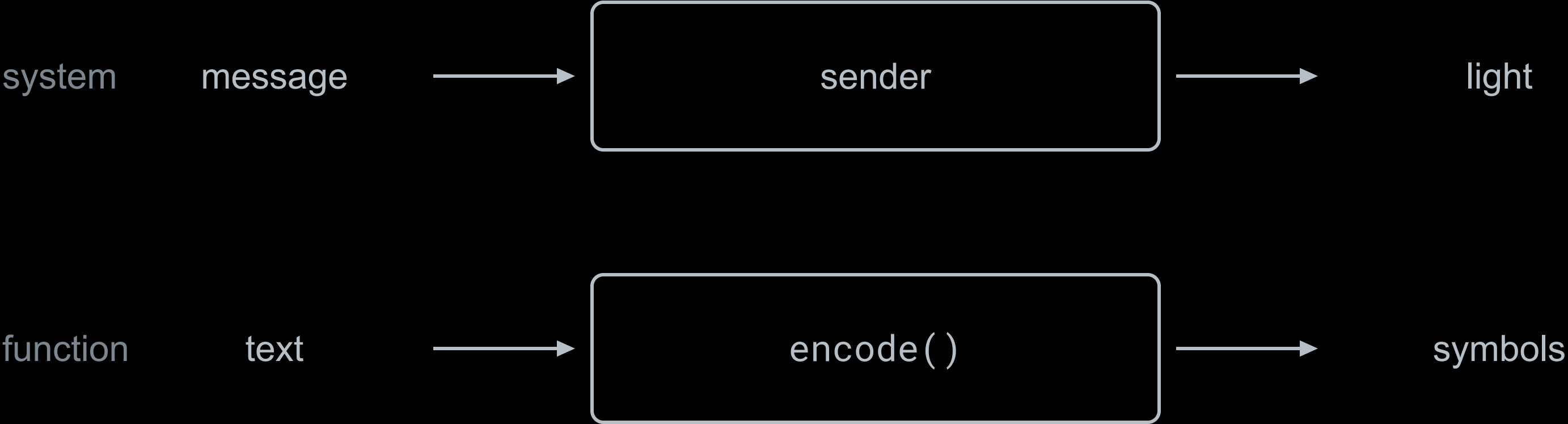


open a box only as far as your question requires.

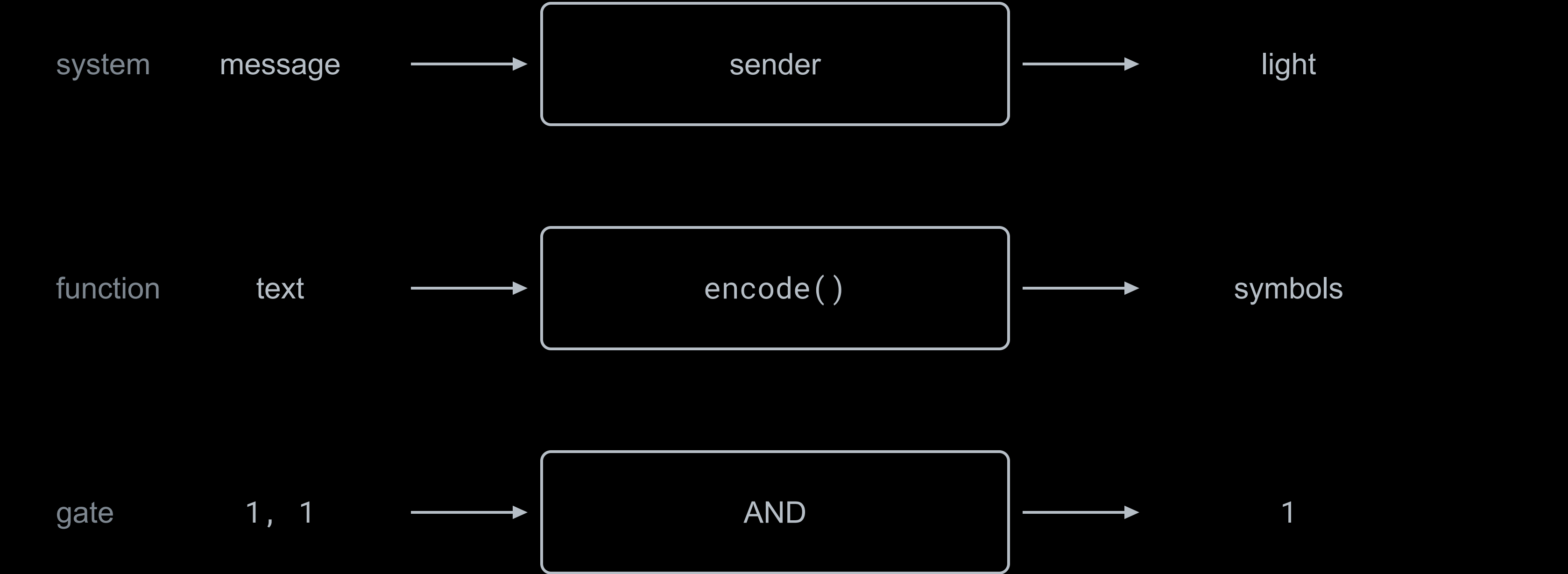
the shape survives every level



the shape survives every level



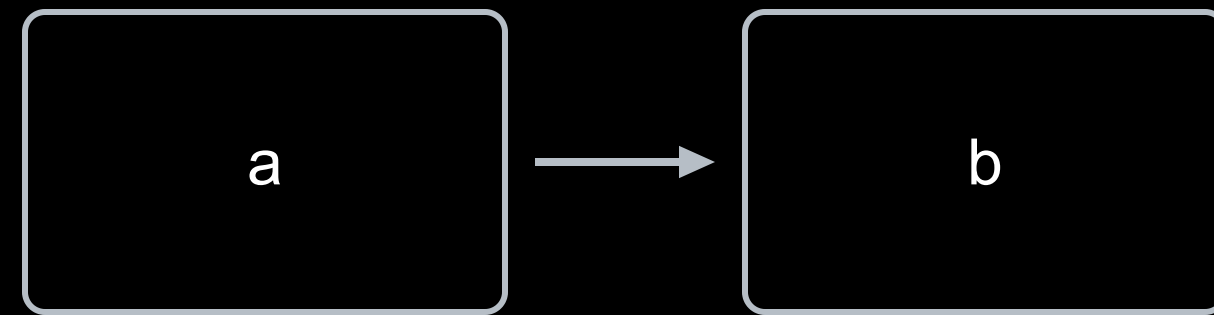
the shape survives every level



two relationships, two questions

boxes in a row

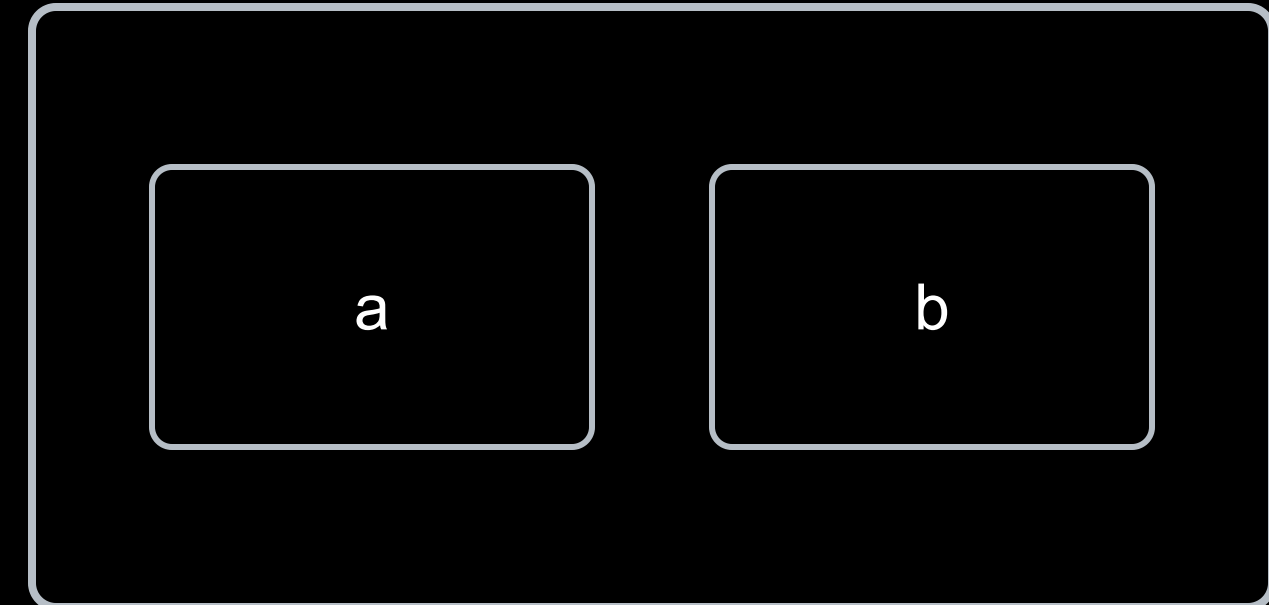
where do the data go next?



data flow

boxes inside boxes

what smaller work happens inside?



hierarchy

both are ways of cutting a problem, as in **cutting problems**: into steps in a row, or into smaller work inside.

the right level is the one
you can test.

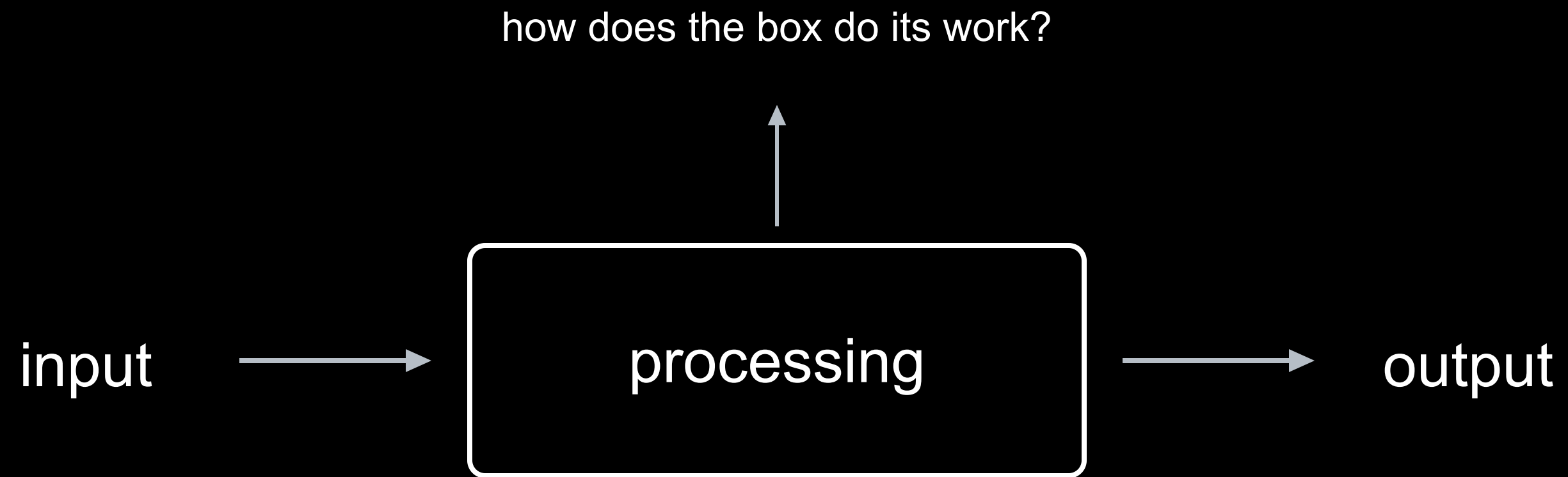
part 4

two questions inside every box

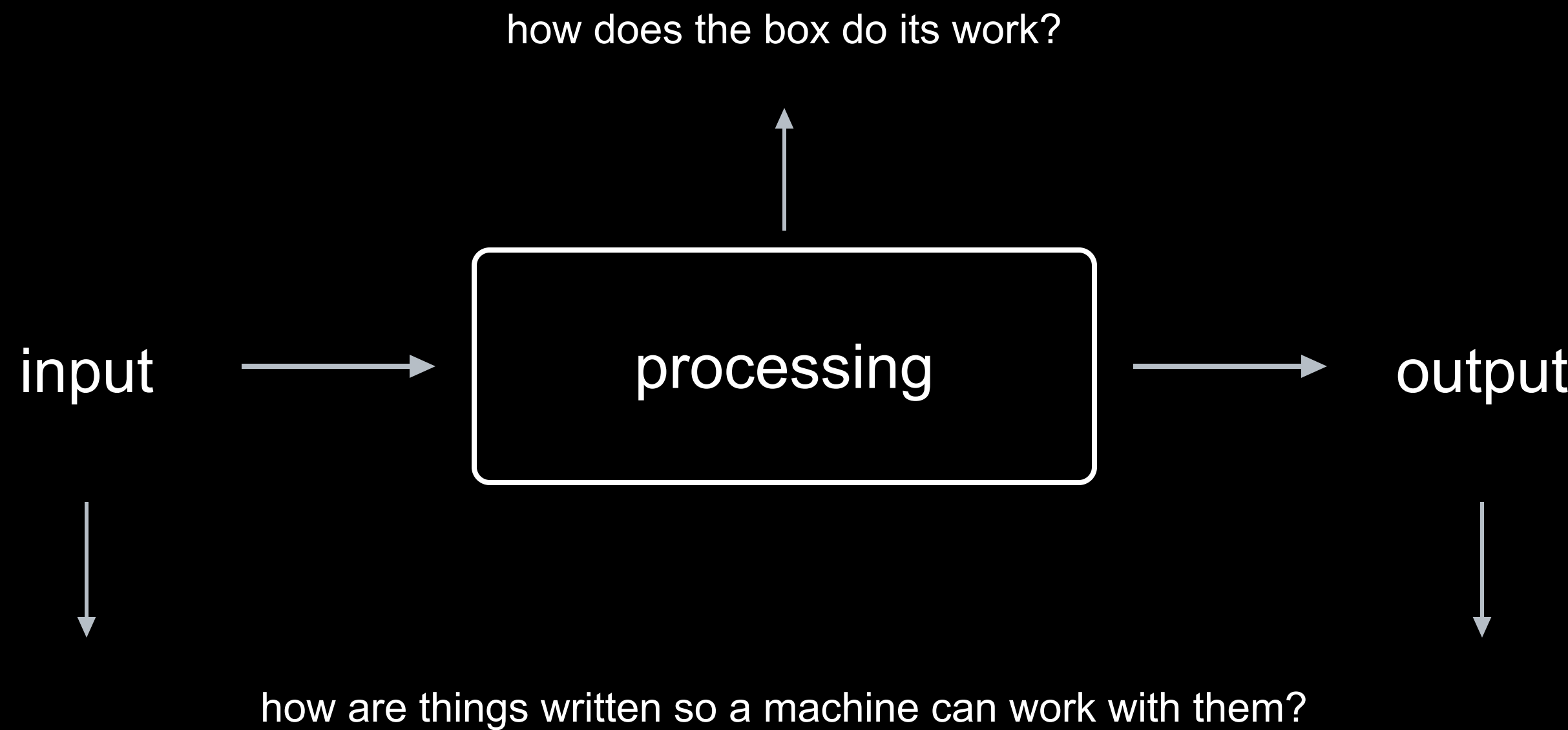
every box leaves two questions



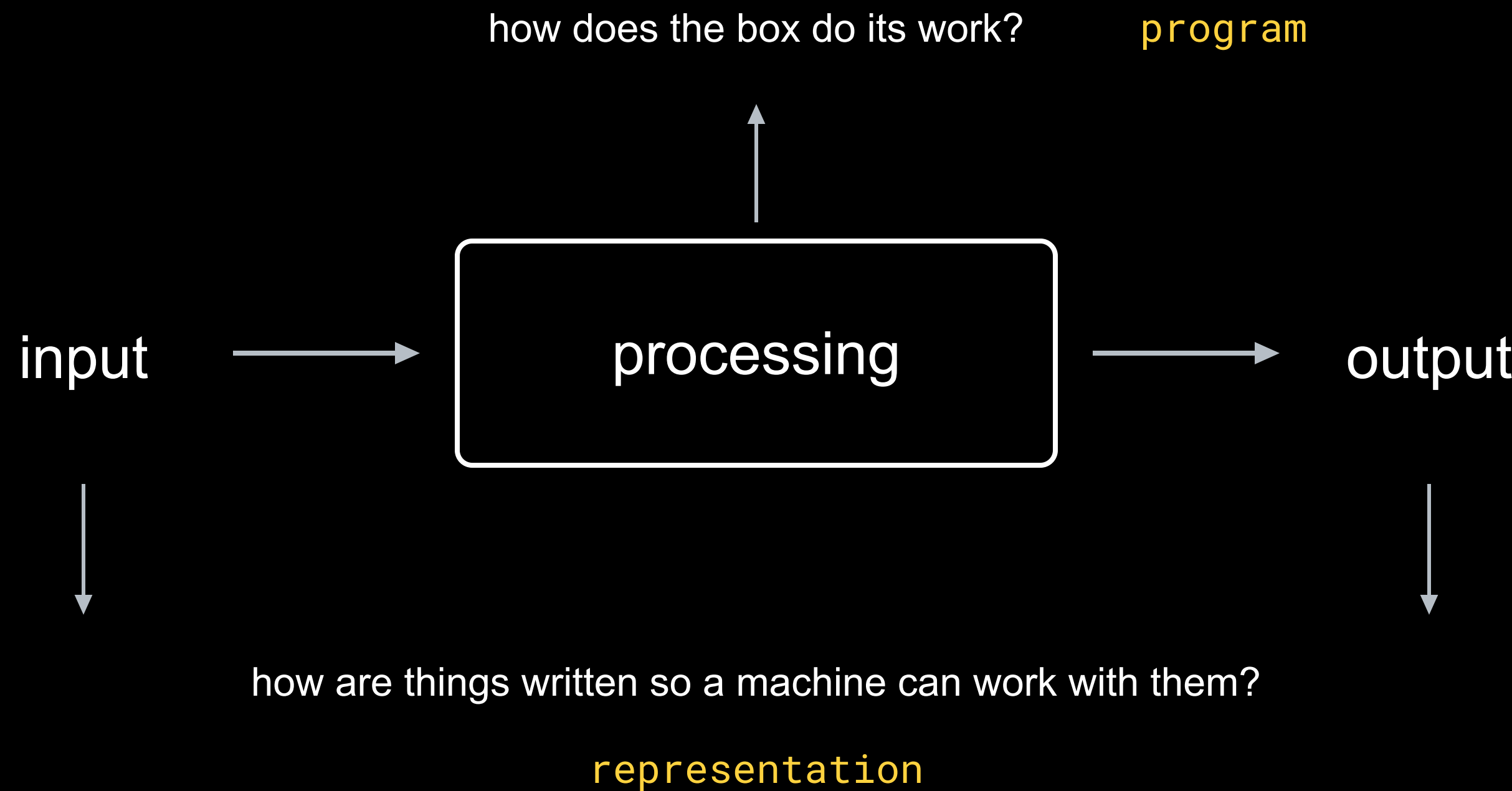
every box leaves two questions



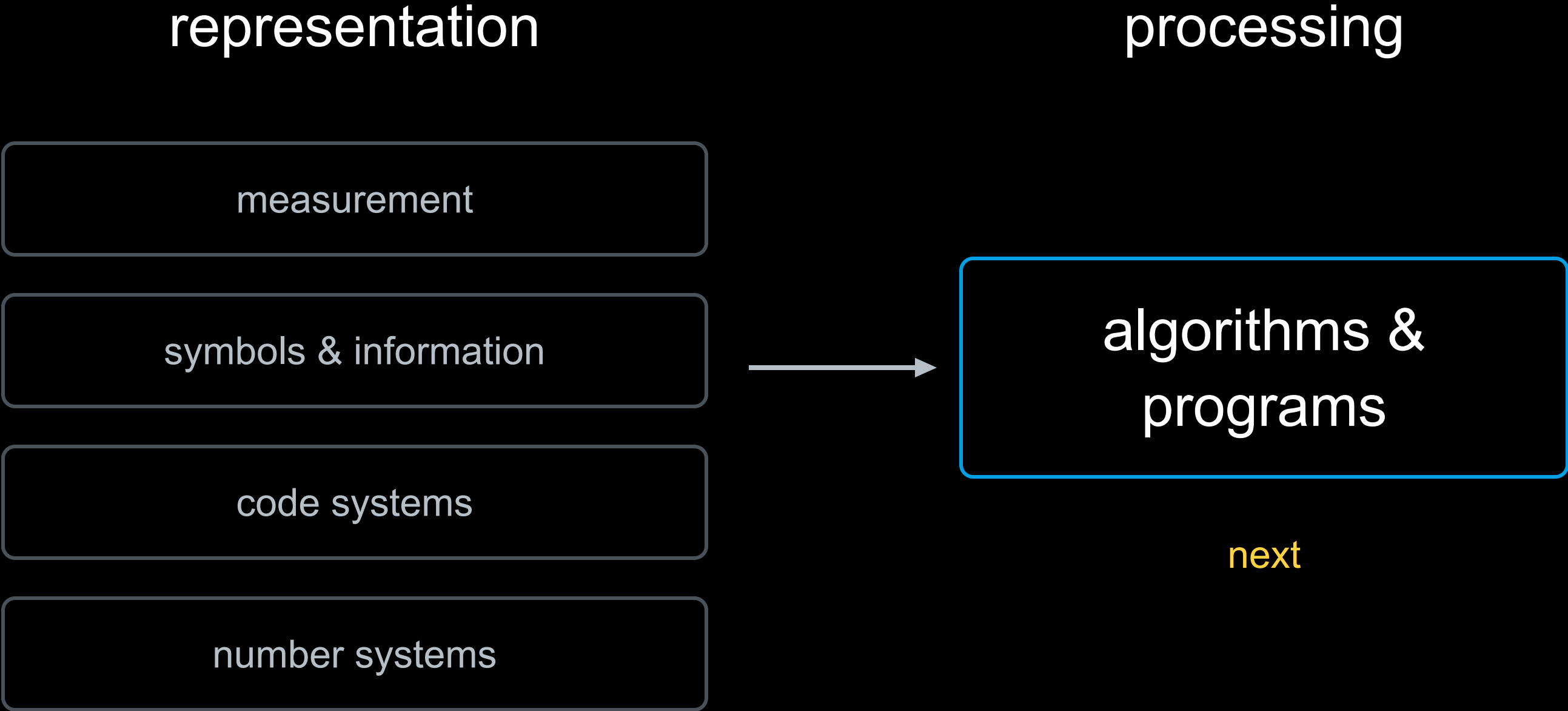
every box leaves two questions



every box leaves two questions



the map of the module



the box stays. the question moves.

an AI agent is a box, too



you do not need trust when you have a test.

an AI agent is a box, too



clear example

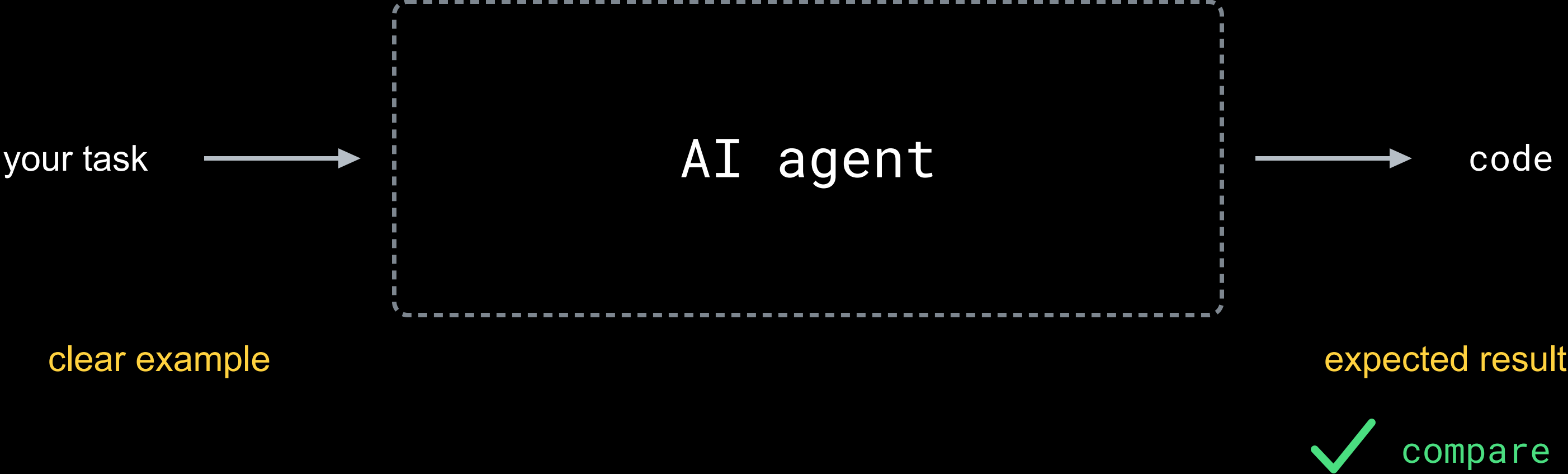
you do not need trust when you have a test.

an AI agent is a box, too



you do not need trust when you have a test.

an AI agent is a box, too



you do not need trust when you have a test.

behind the counter:
inside the box
is a program.

