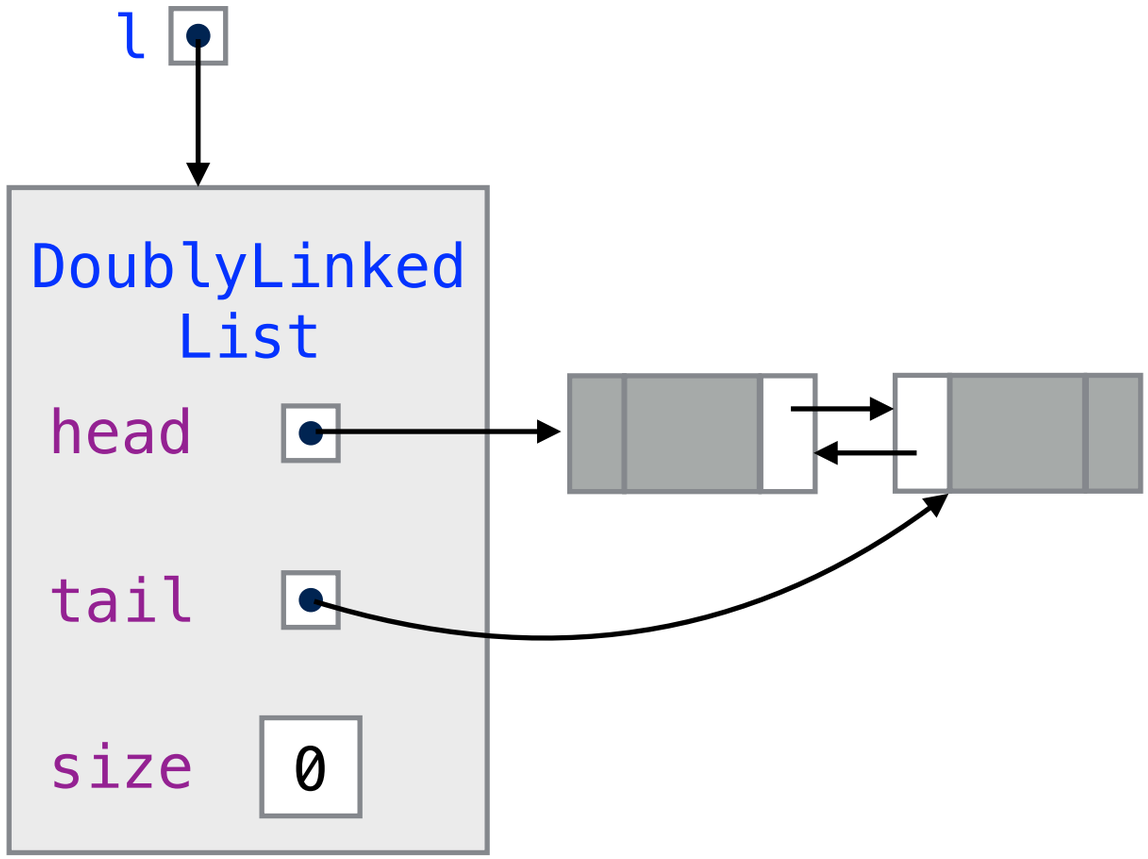
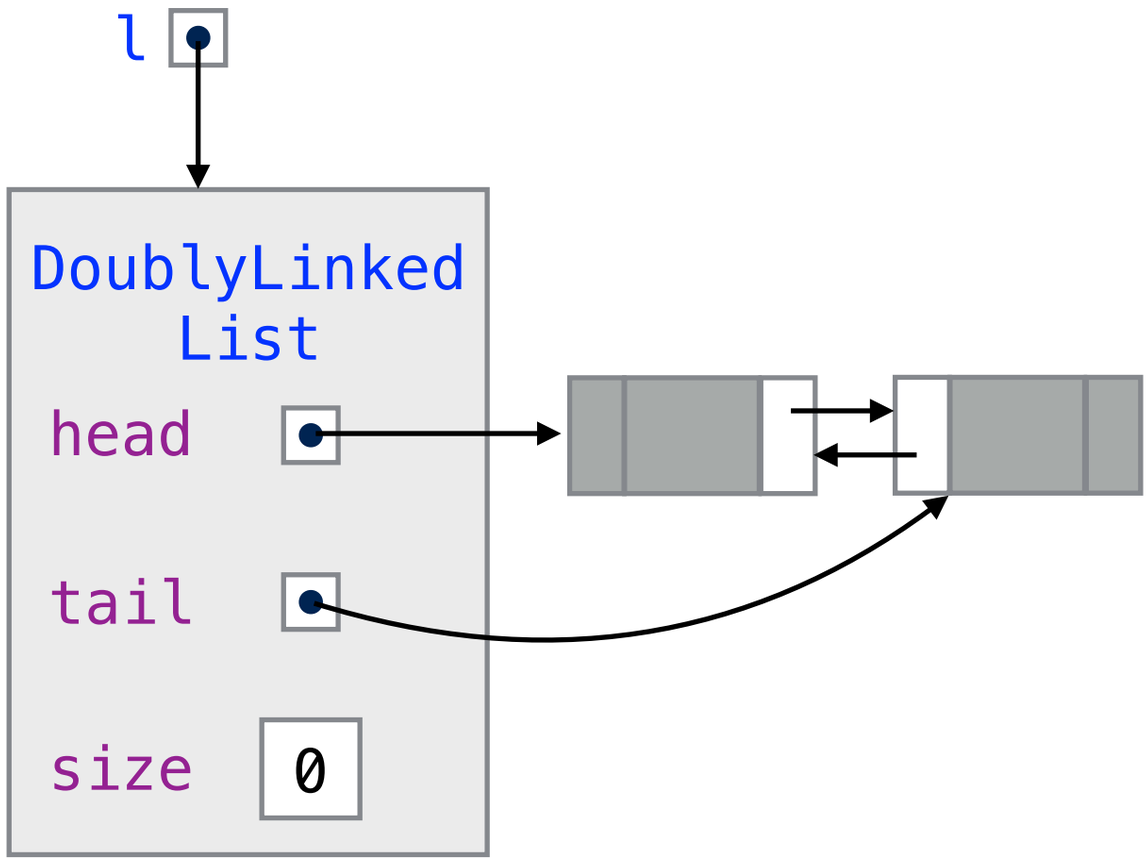
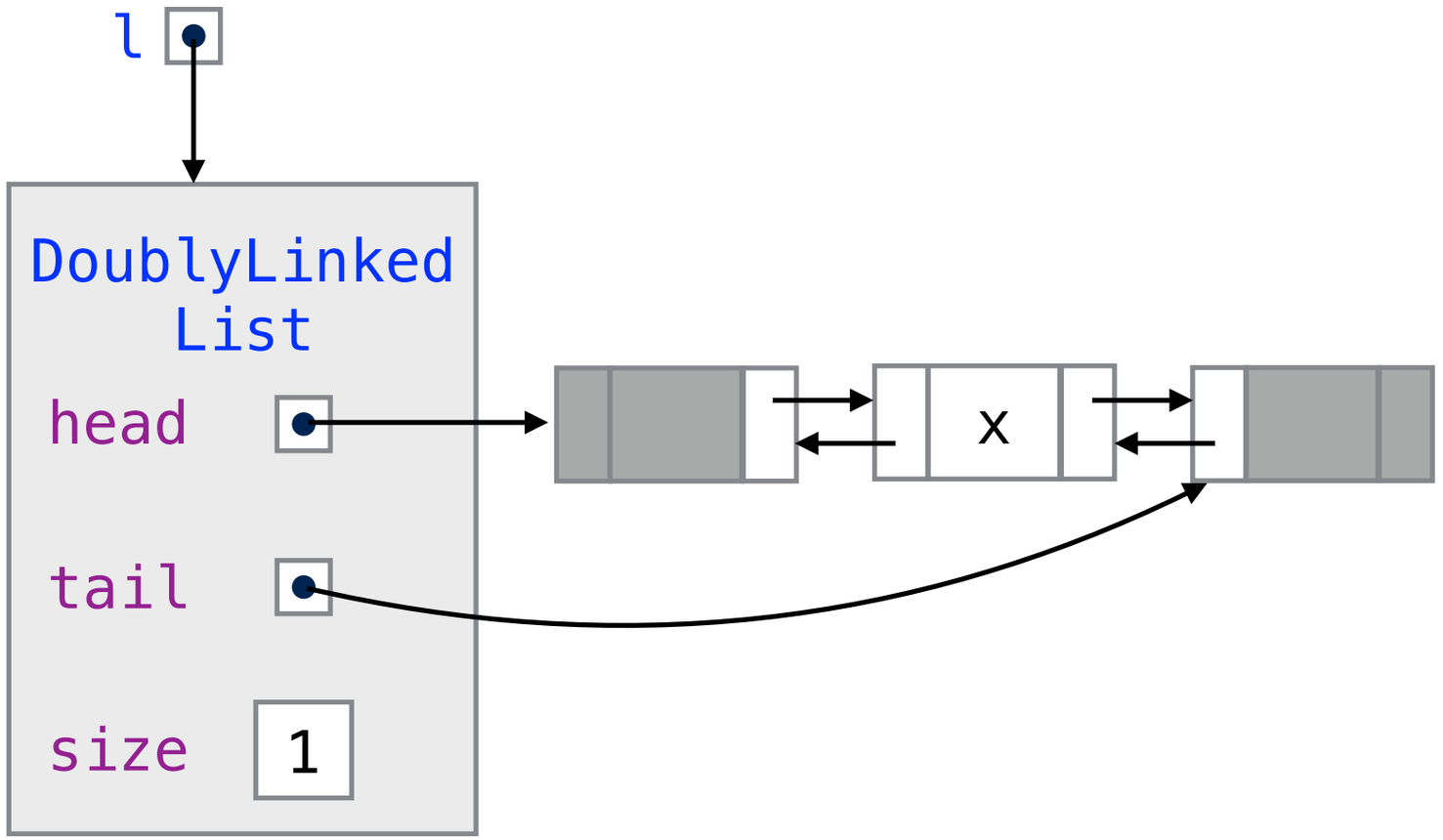
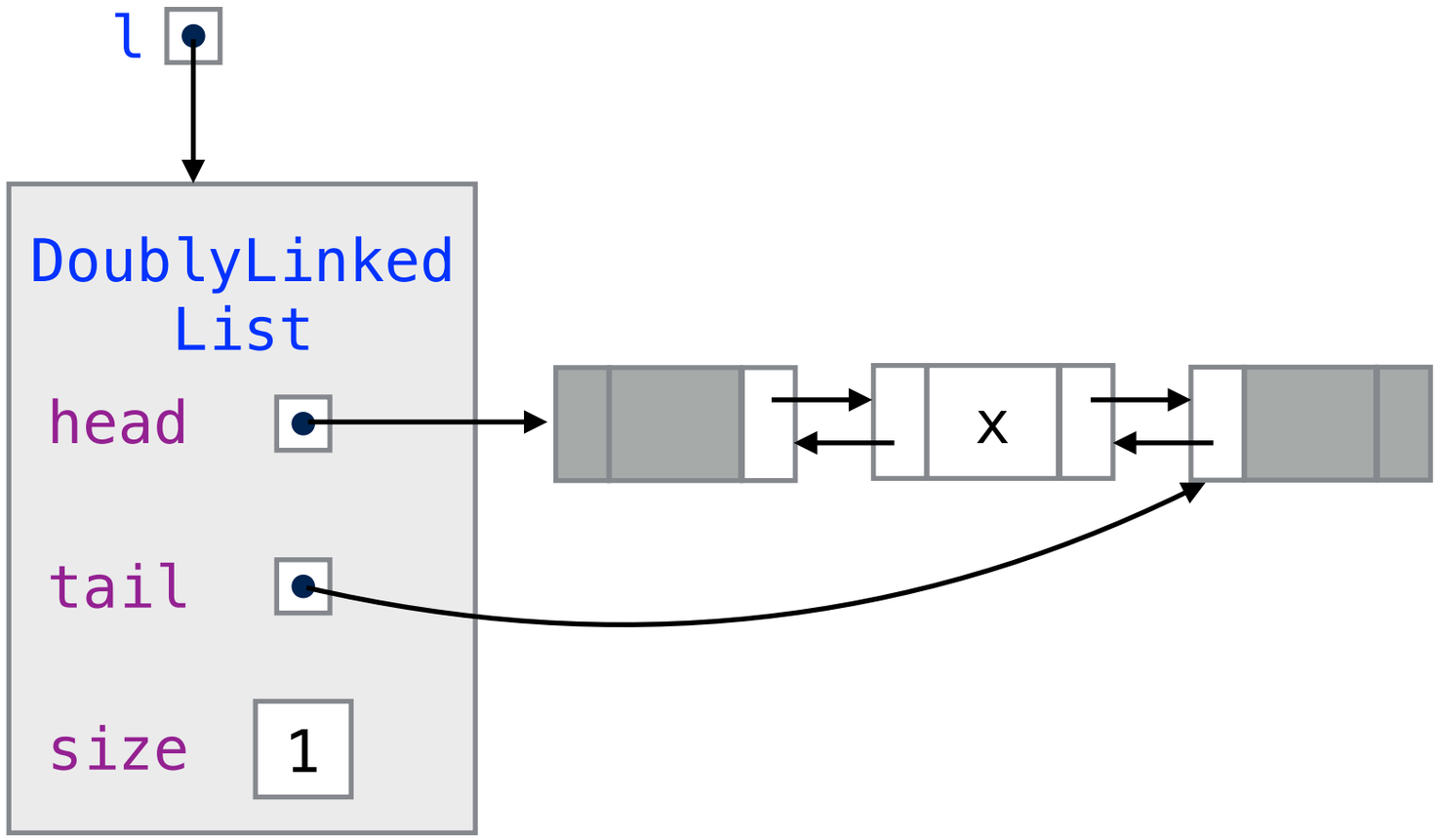
`List<E>`: Doubly-Linked Implementation


l
DoublyLinked List
head
tail
size
0

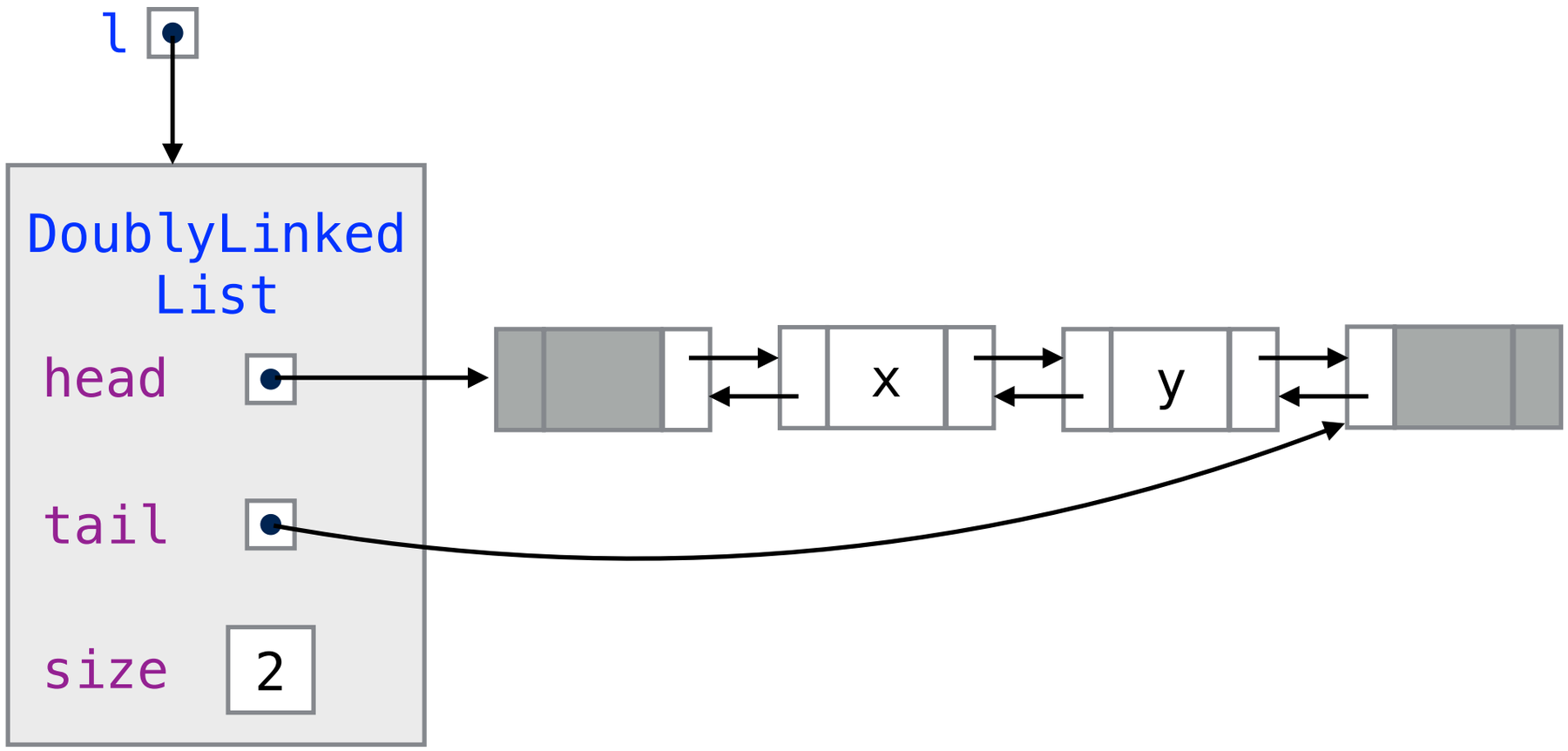


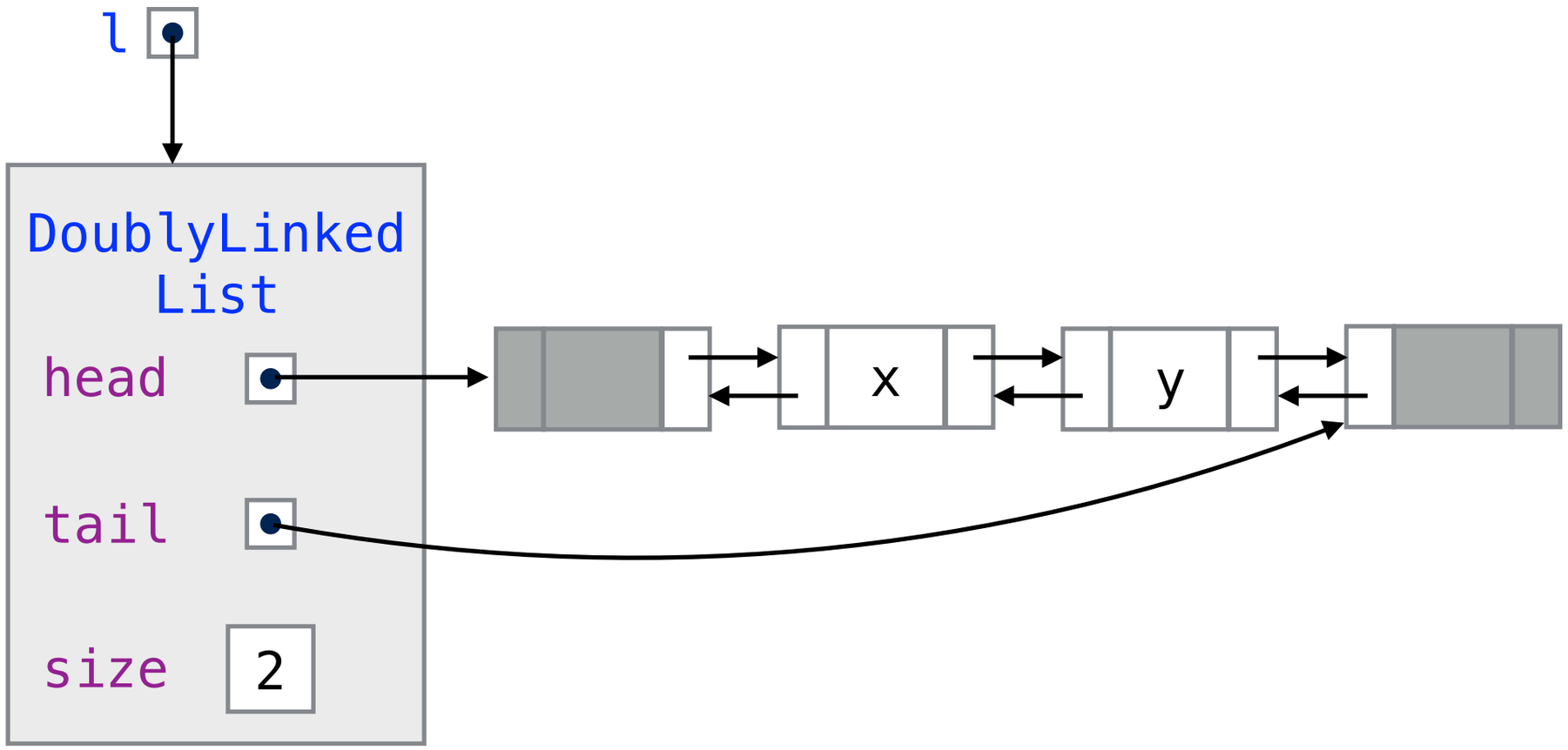
l.add(“x”)


l
DoublyLinked List
head
tail
size
1
x

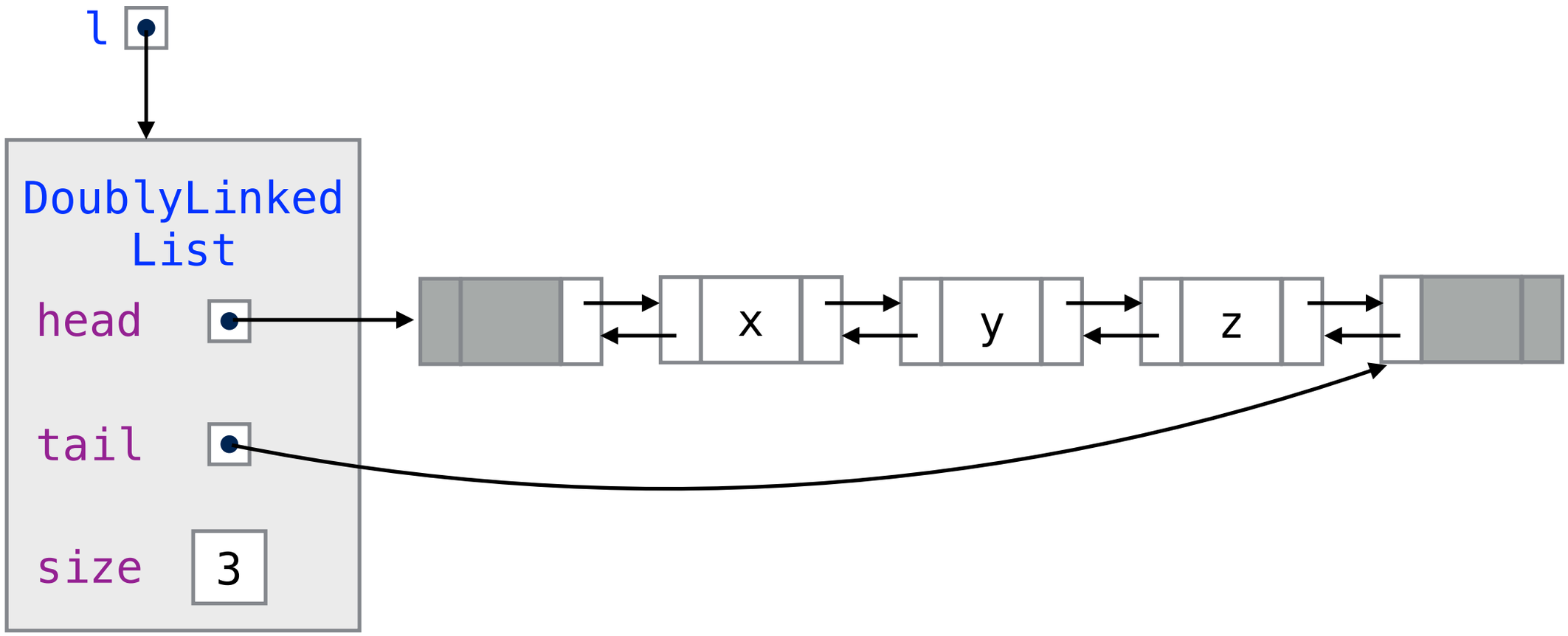



```
l.add("y")
```


l
DoublyLinked List
head
tail
size
2
x
y

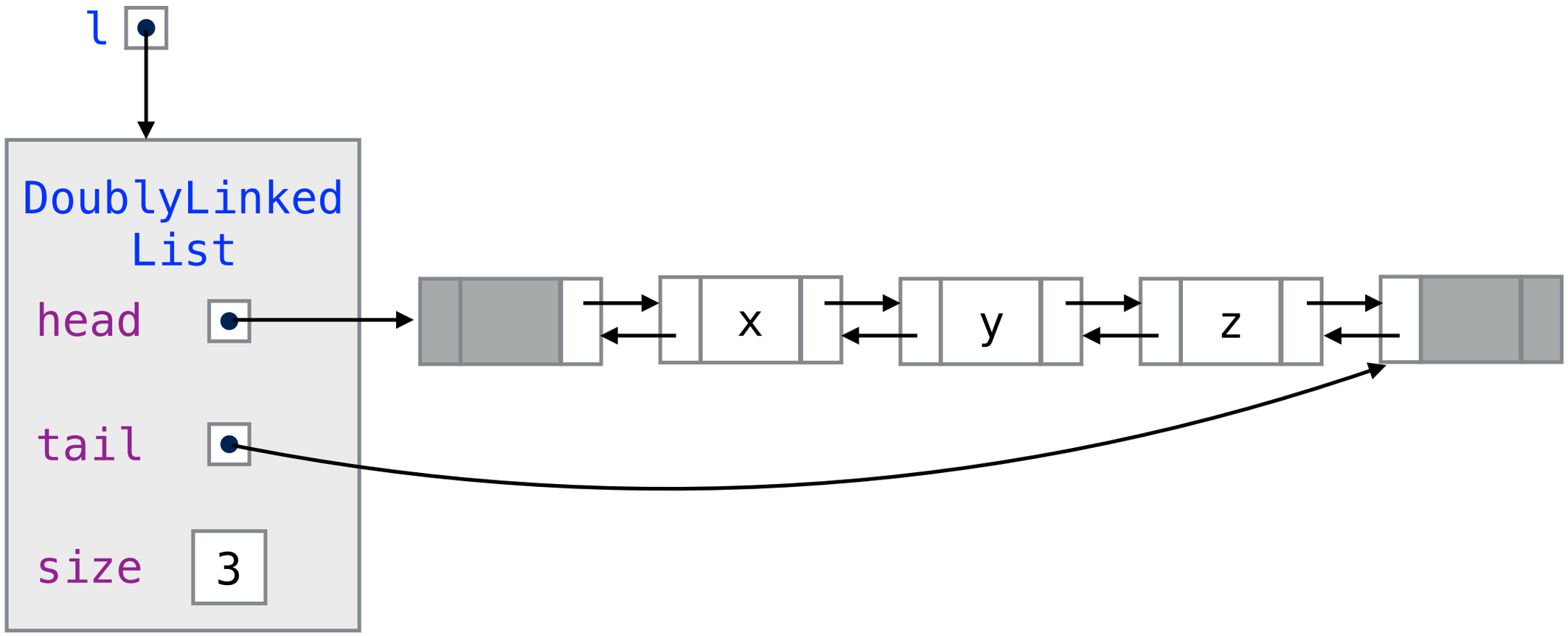


l.add(“z”)

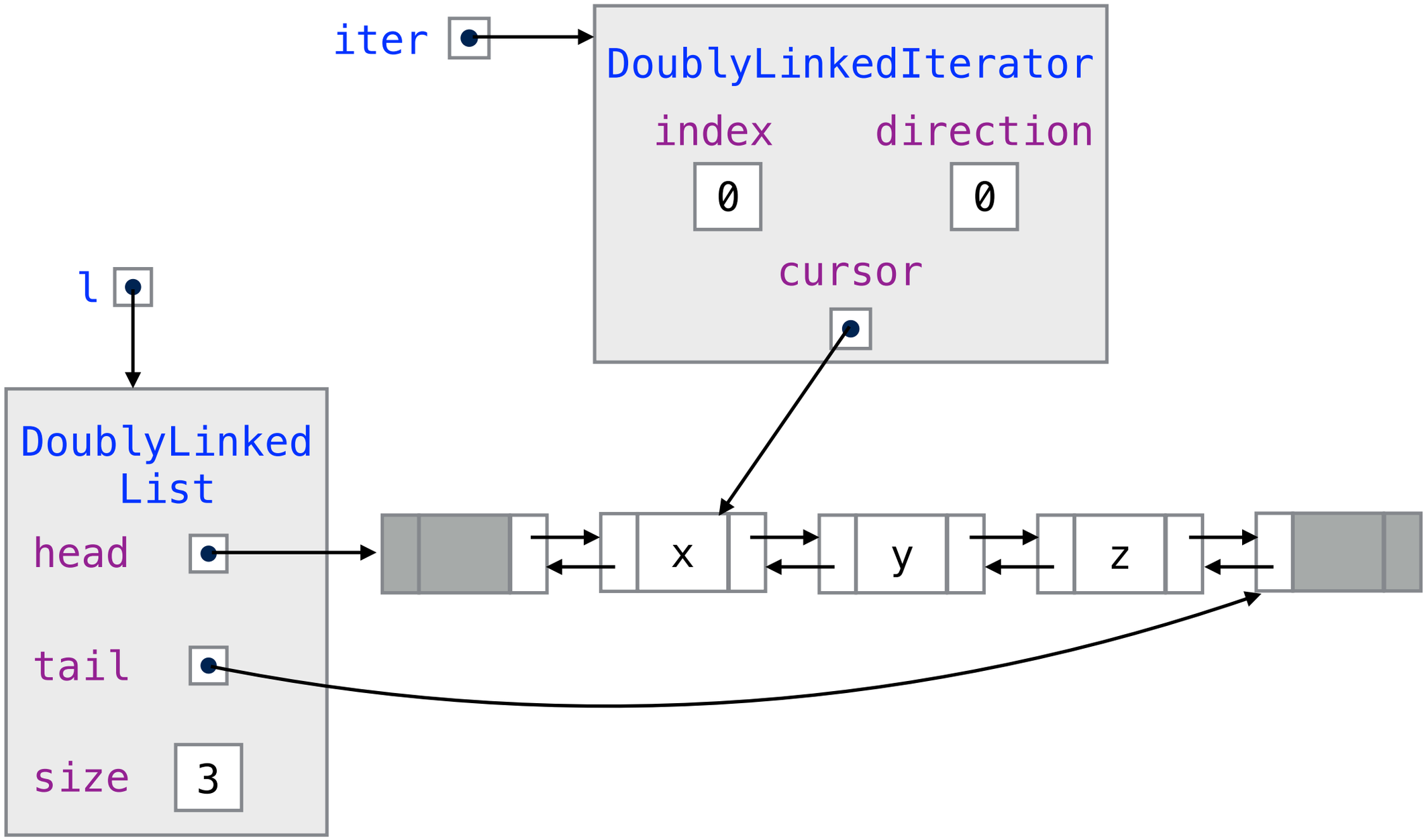

l
DoublyLinked List
head
tail
size
3
x
y
z

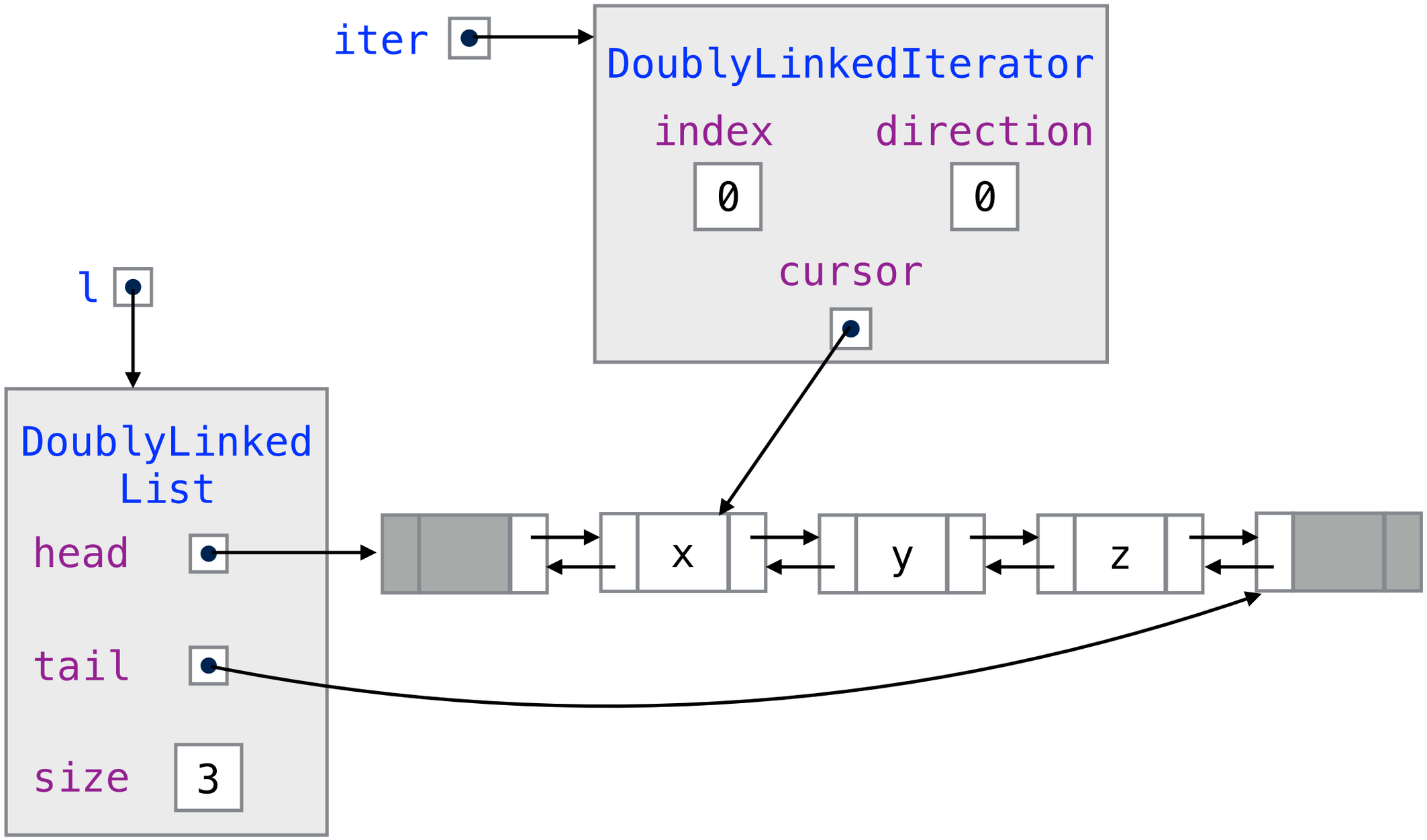
Iterators:

`next()` and `previous()`

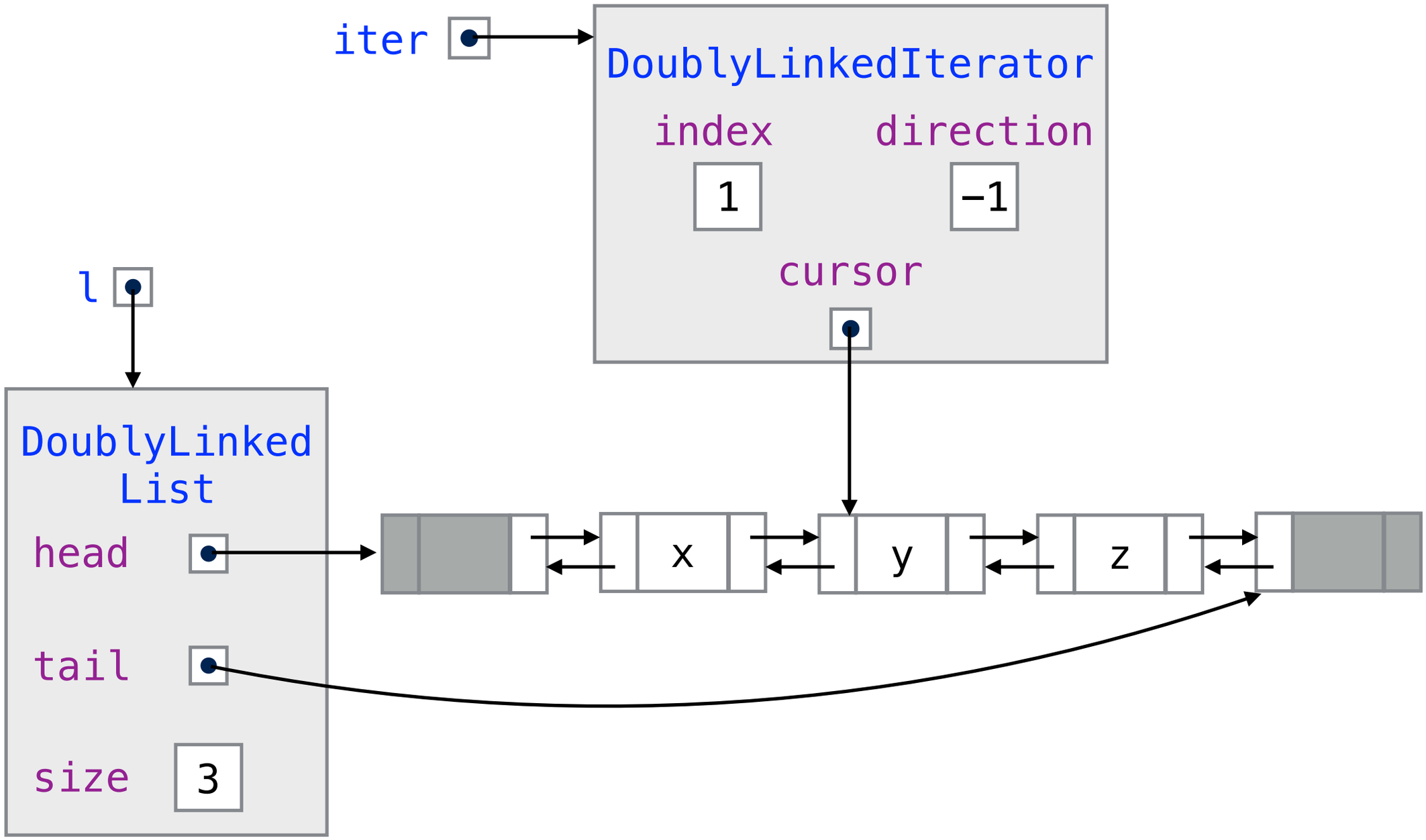


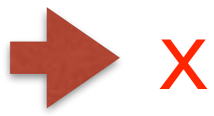

```
ListIterator<String> iter = l.listIterator()
```

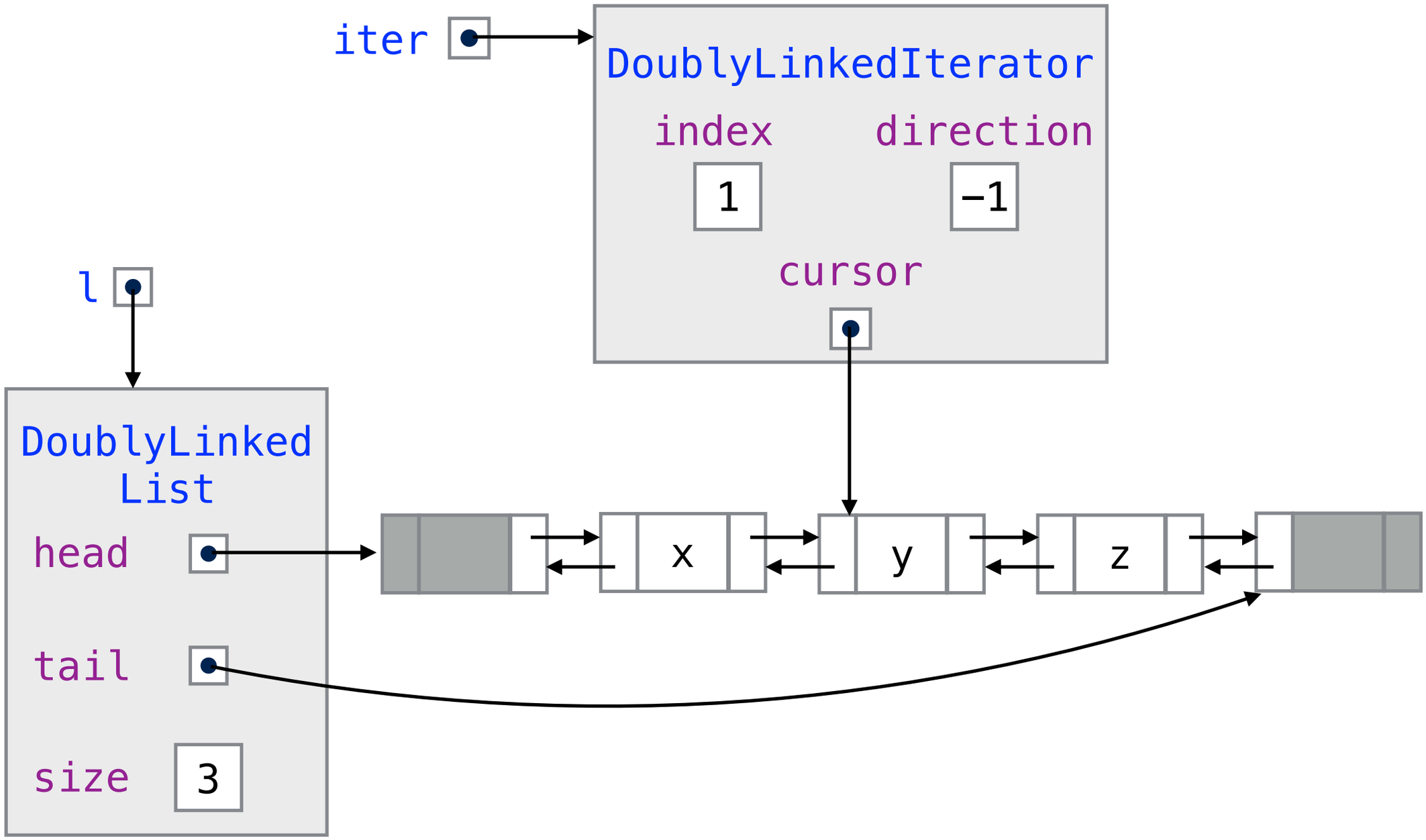

iter
DoublyLinkedIterator
index
direction
0
0
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z

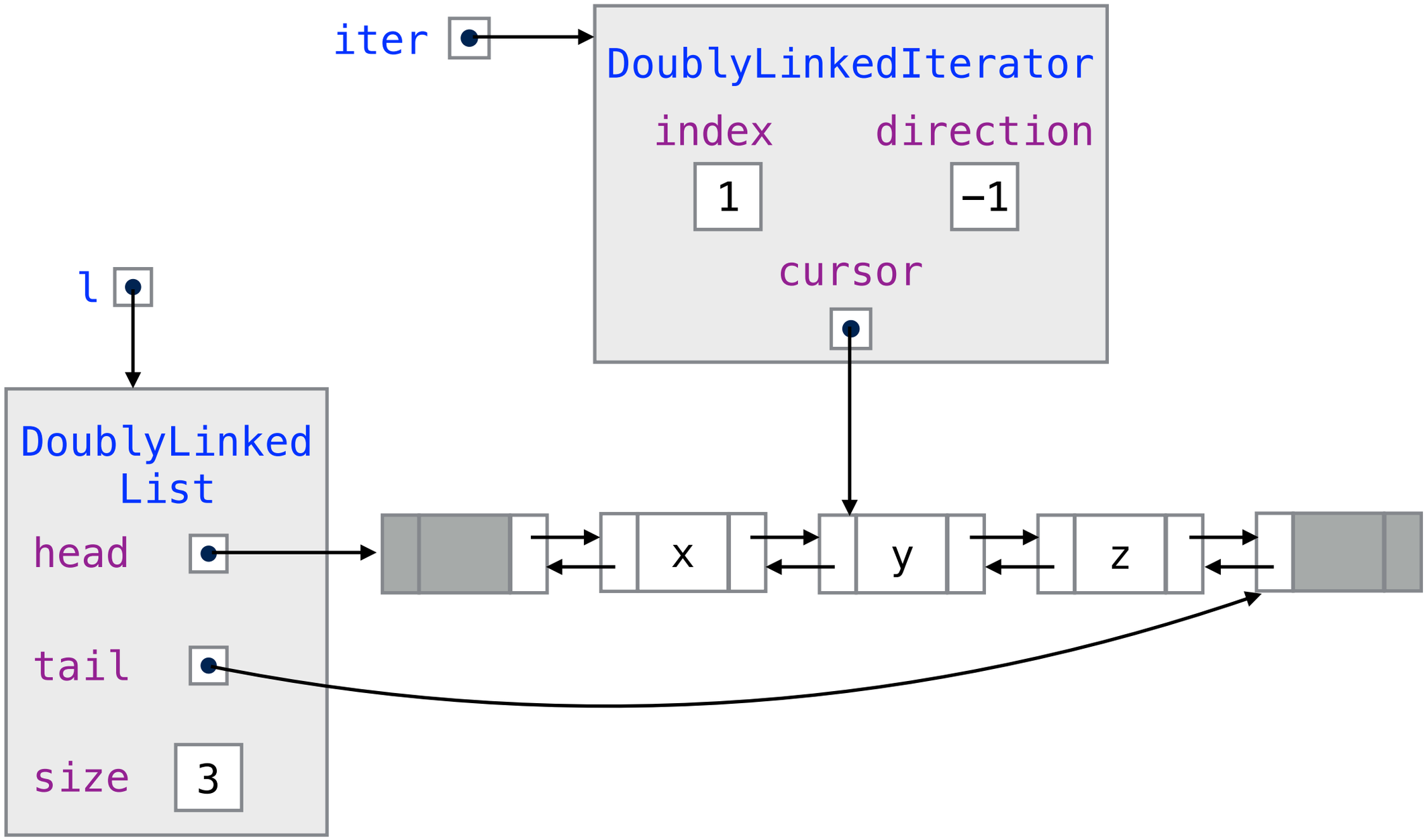

iter
DoublyLinkedIterator
index
direction
0
0
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z

iter.next()

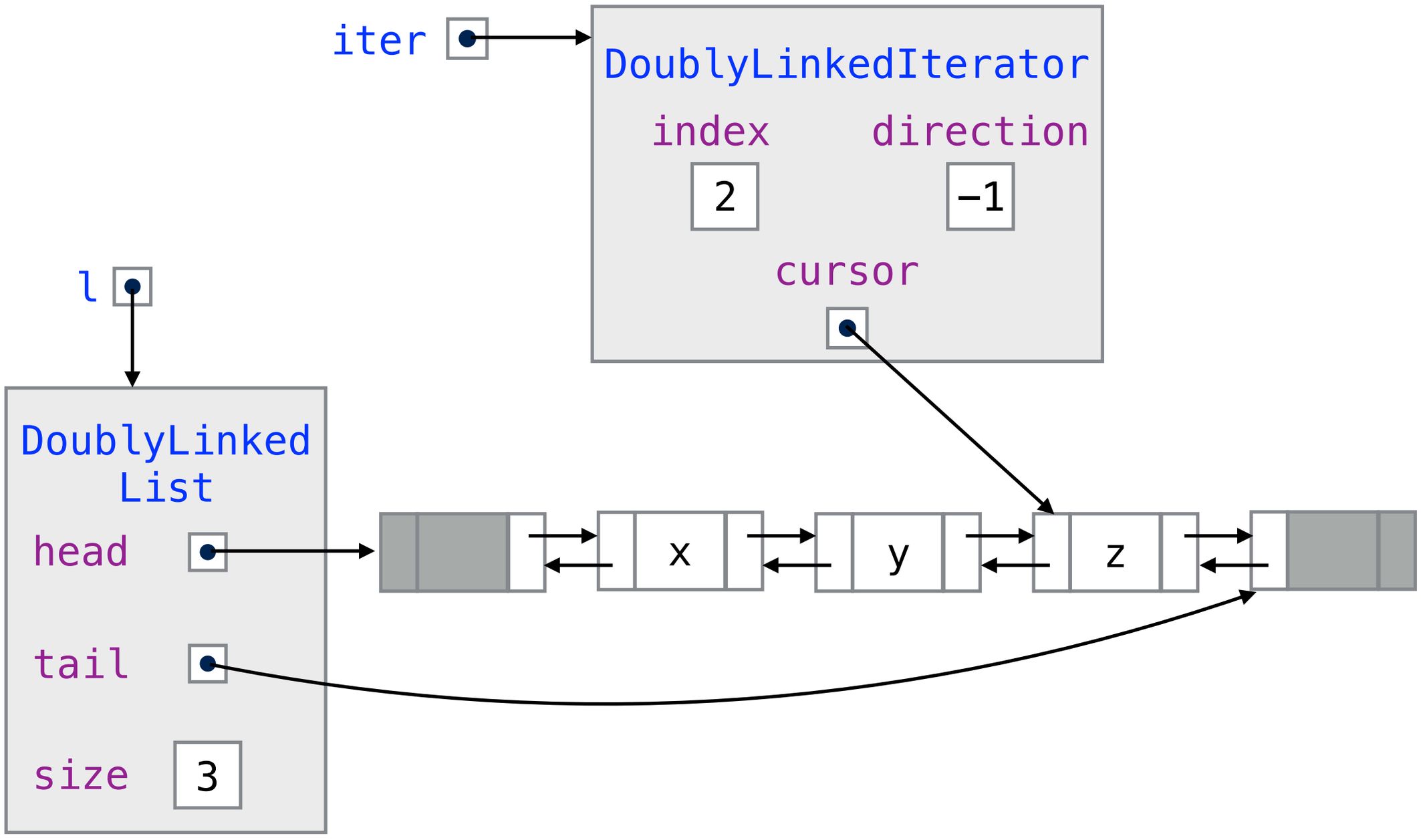

iter
DoublyLinkedIterator
index
direction
1
-1
cursor
l
DoublyLinked List
head
tail
size
3
x
y
z


x

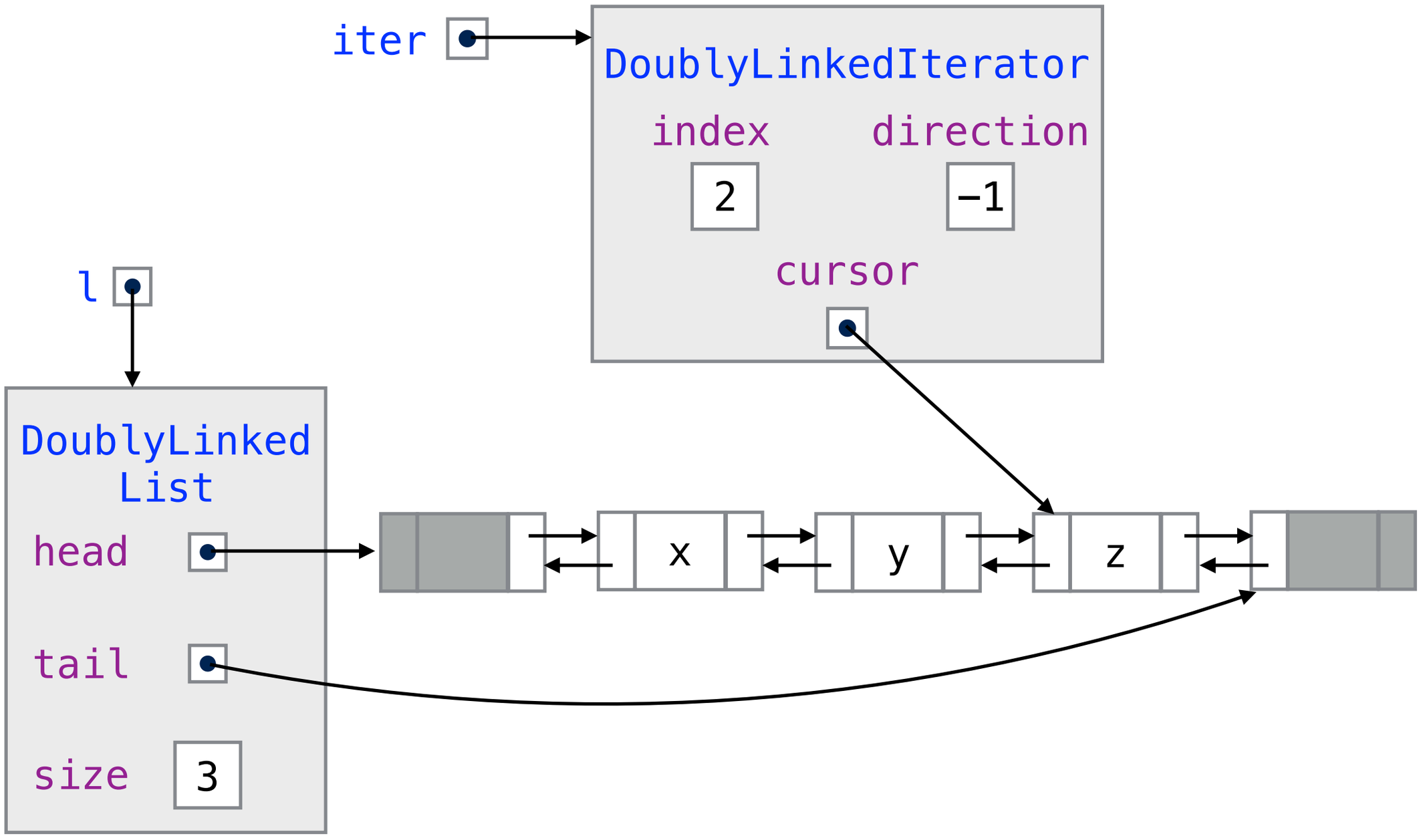

iter
DoublyLinkedIterator
index
direction
1
-1
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z

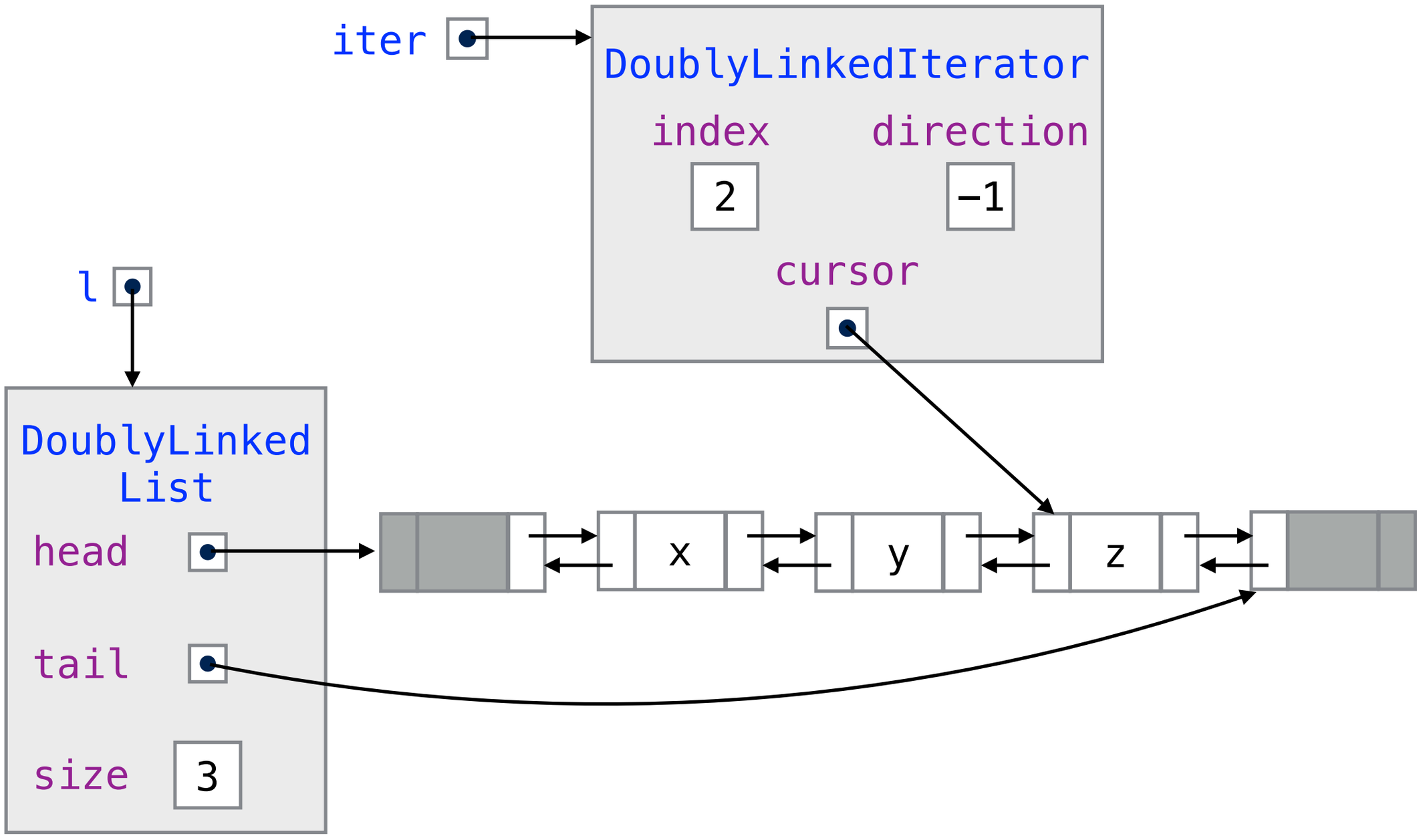

iter
DoublyLinkedIterator
index
direction
1
-1
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z

iter.next()

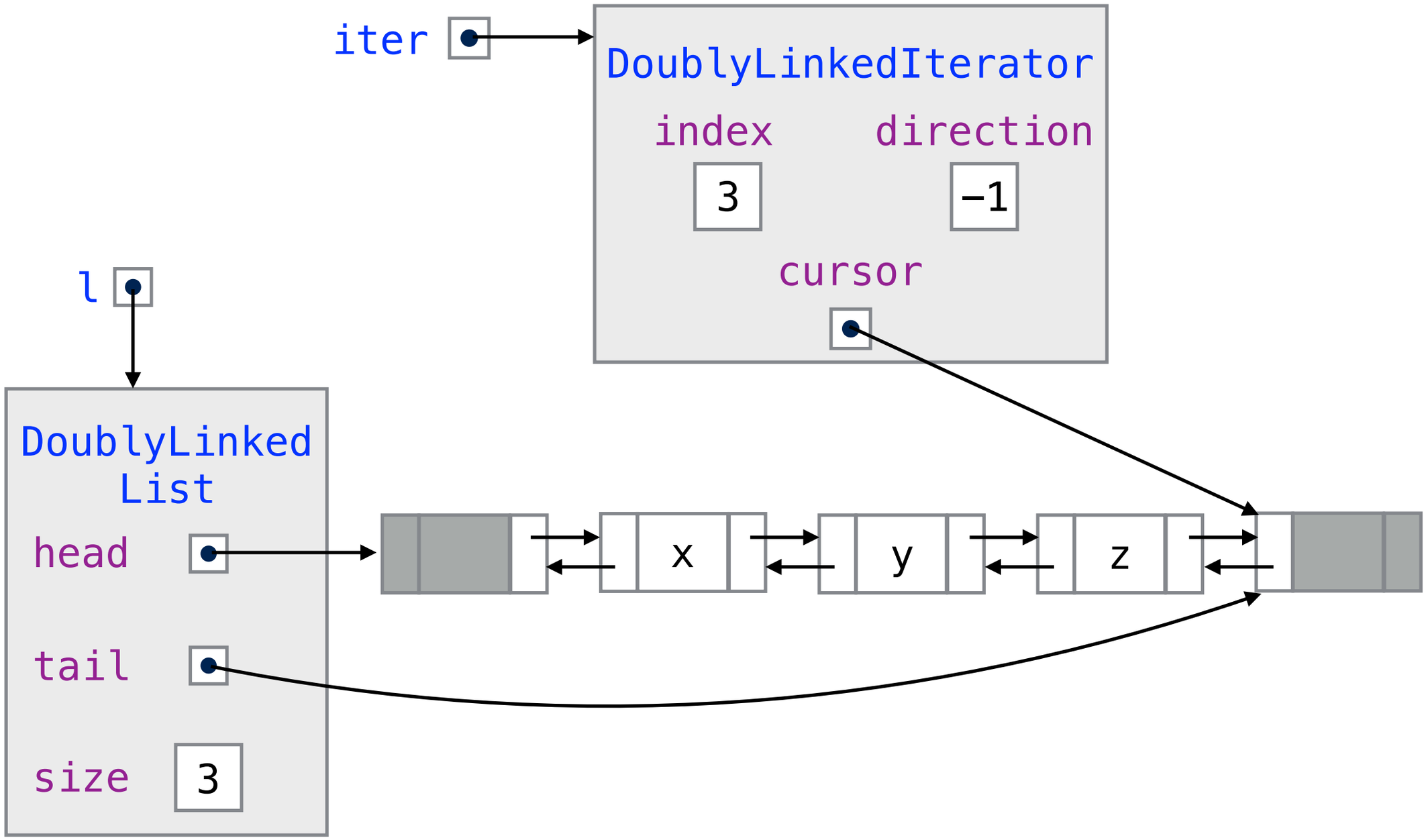

iter
DoublyLinkedIterator
index
direction
2
-1
cursor
l
DoublyLinked List
head
tail
size
3
x
y
z

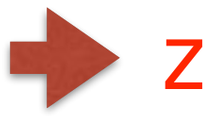
y

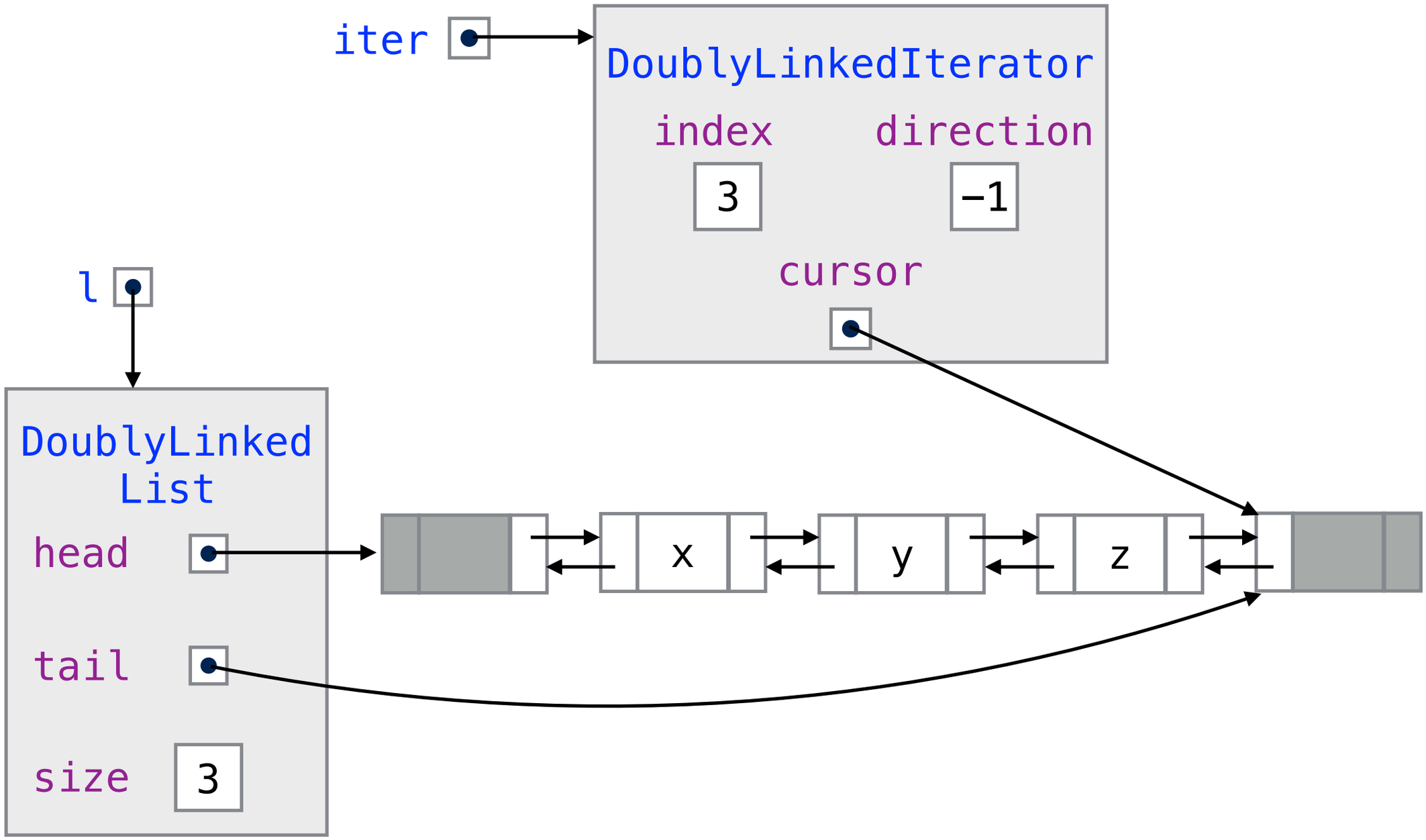

iter
DoublyLinkedIterator
index
direction
2
-1
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z

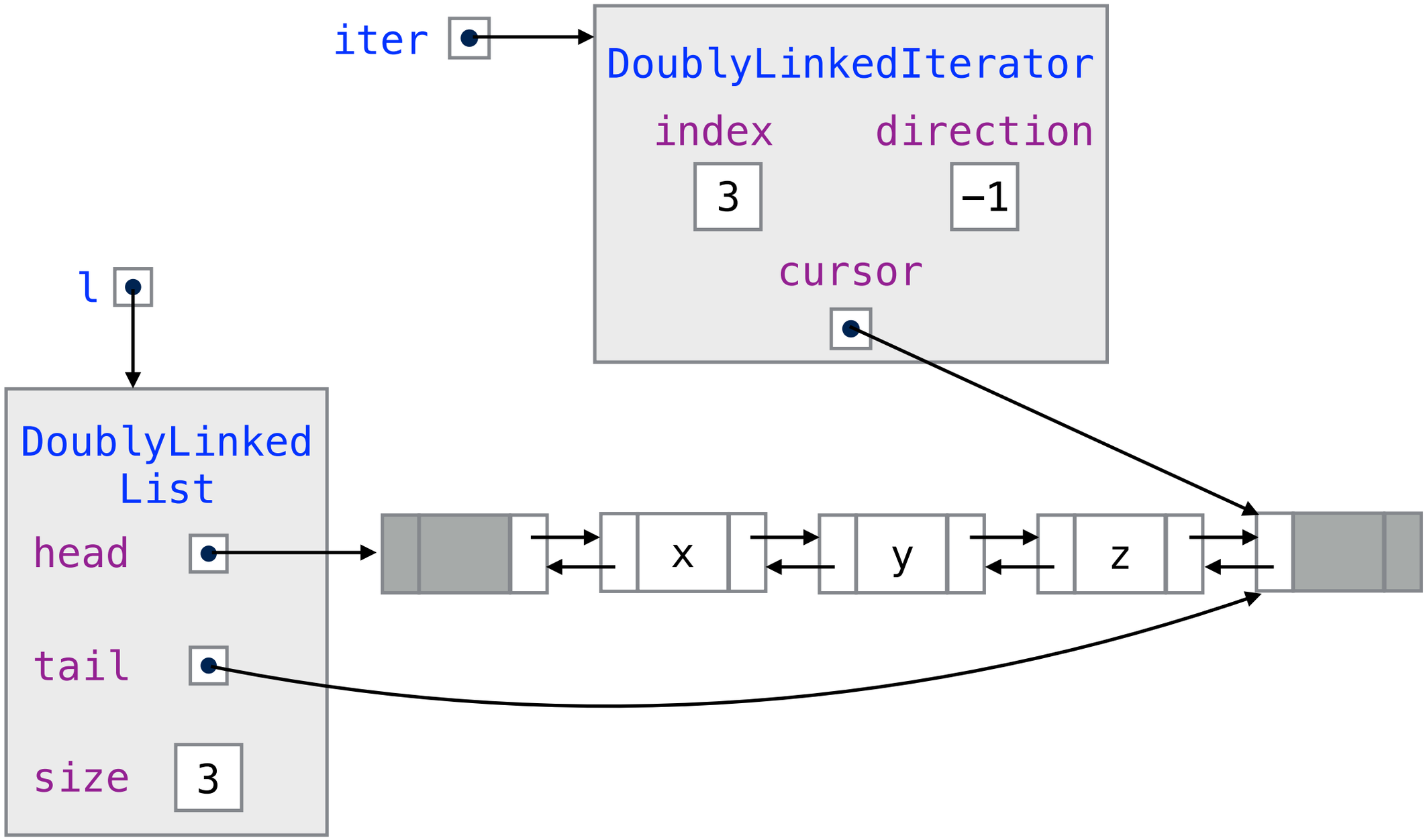

iter
DoublyLinkedIterator
index
direction
2
-1
cursor
l
DoublyLinked List
head
tail
size
3
x
y
z

iter.next()

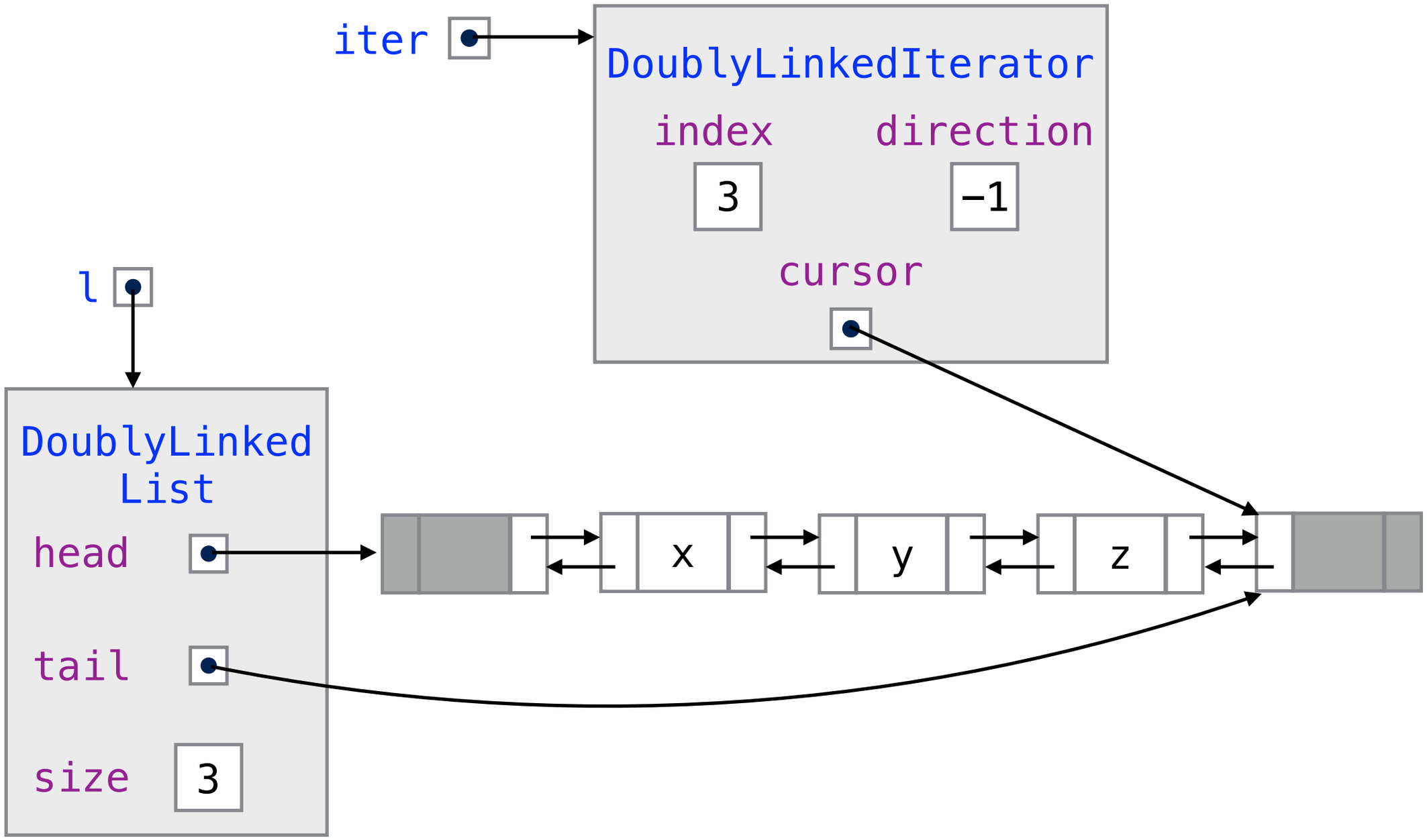

iter
DoublyLinkedIterator
index
direction
3
-1
cursor
l
DoublyLinked List
head
tail
size
3
x
y
z


z

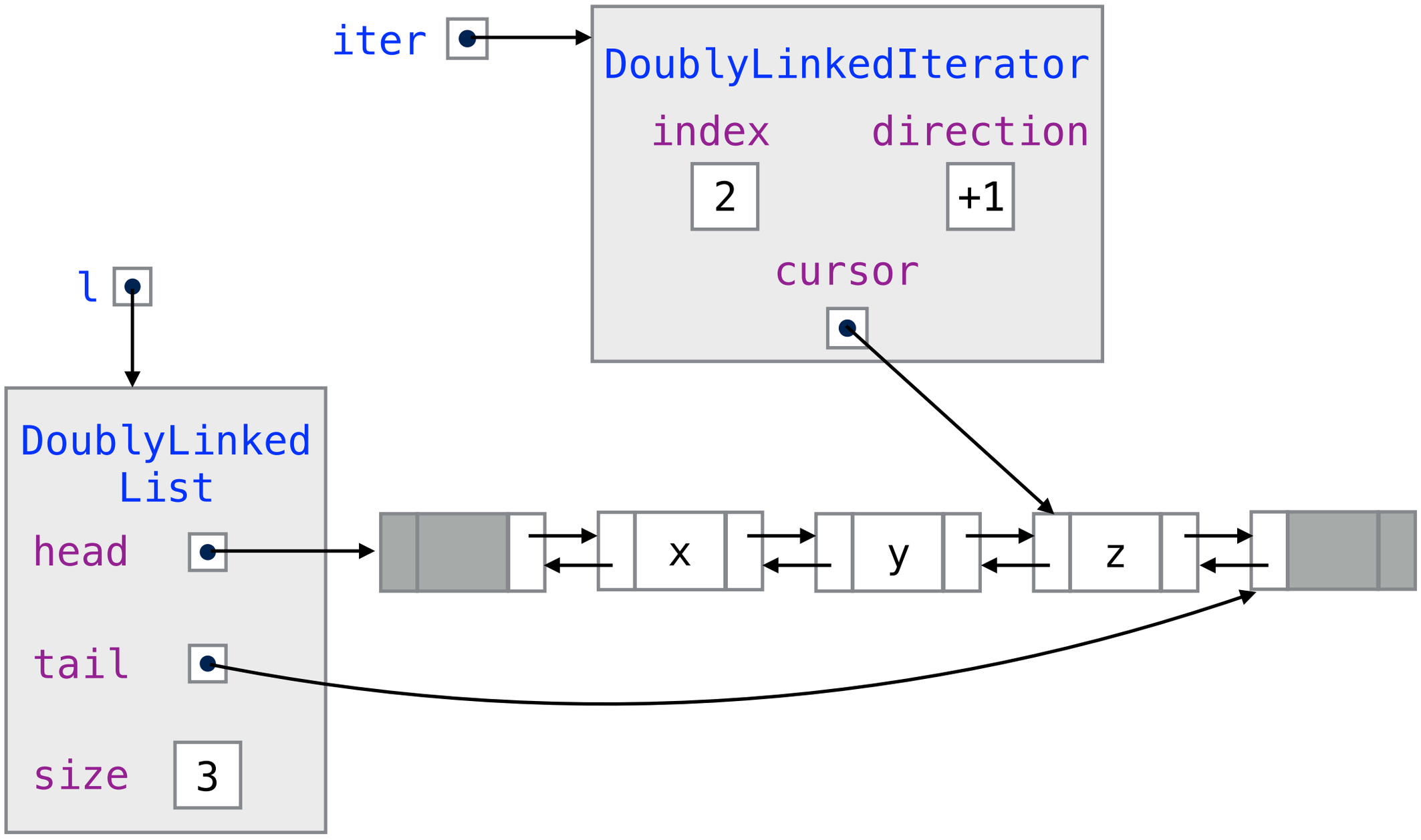

iter
DoublyLinkedIterator
index
direction
3
-1
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z

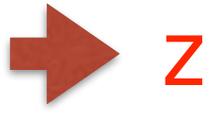


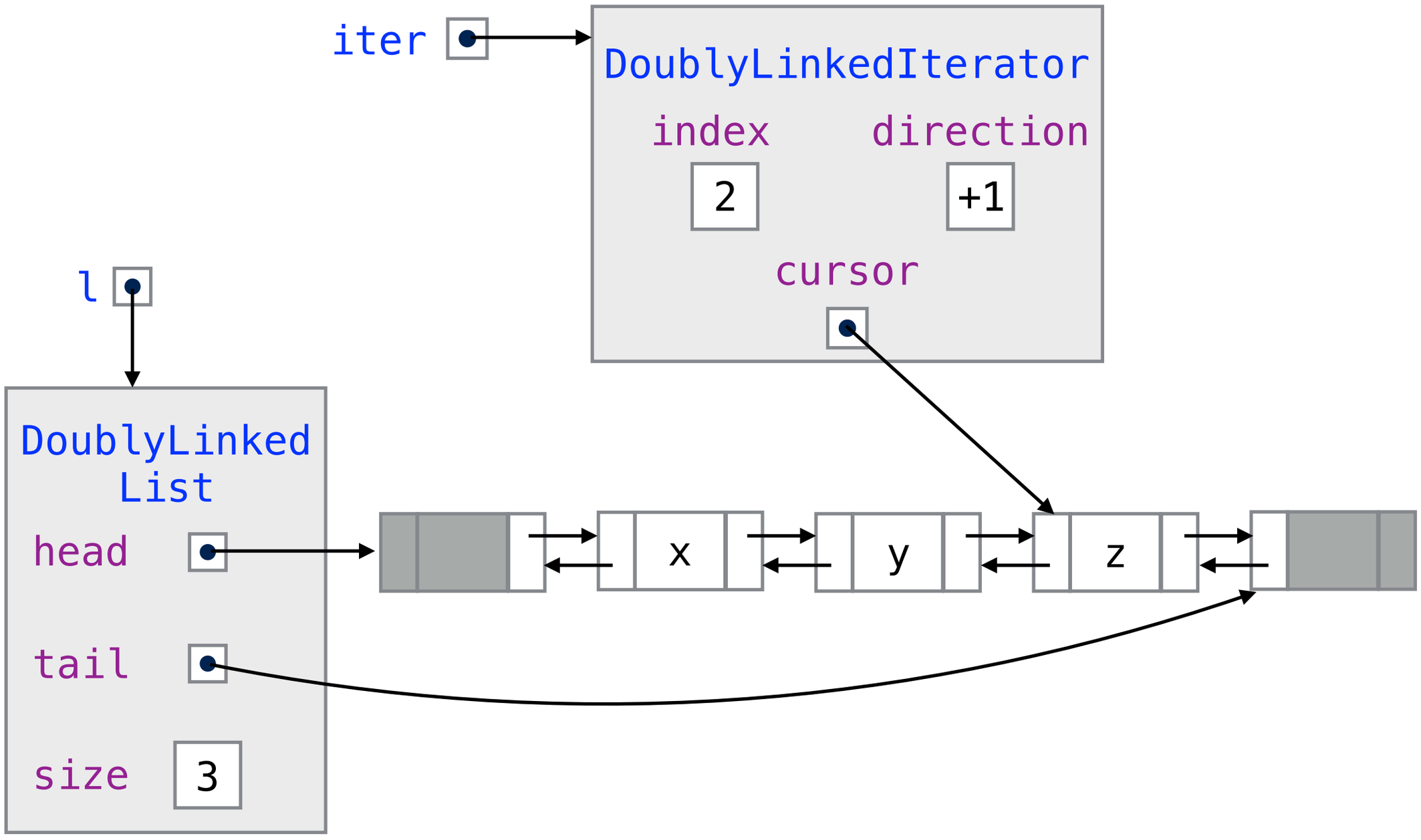

```
iter.hasNext() == false
```

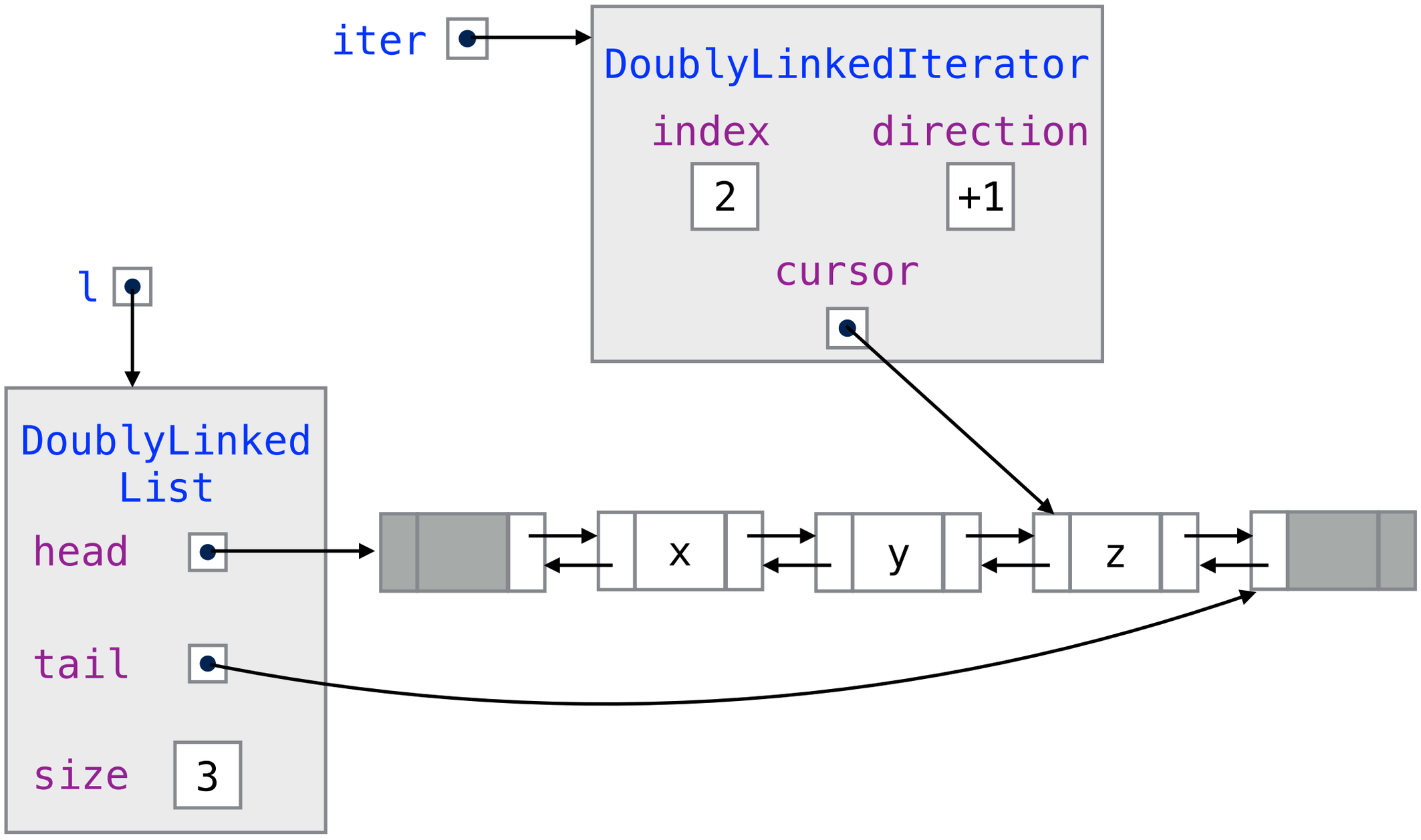


iter.previous()

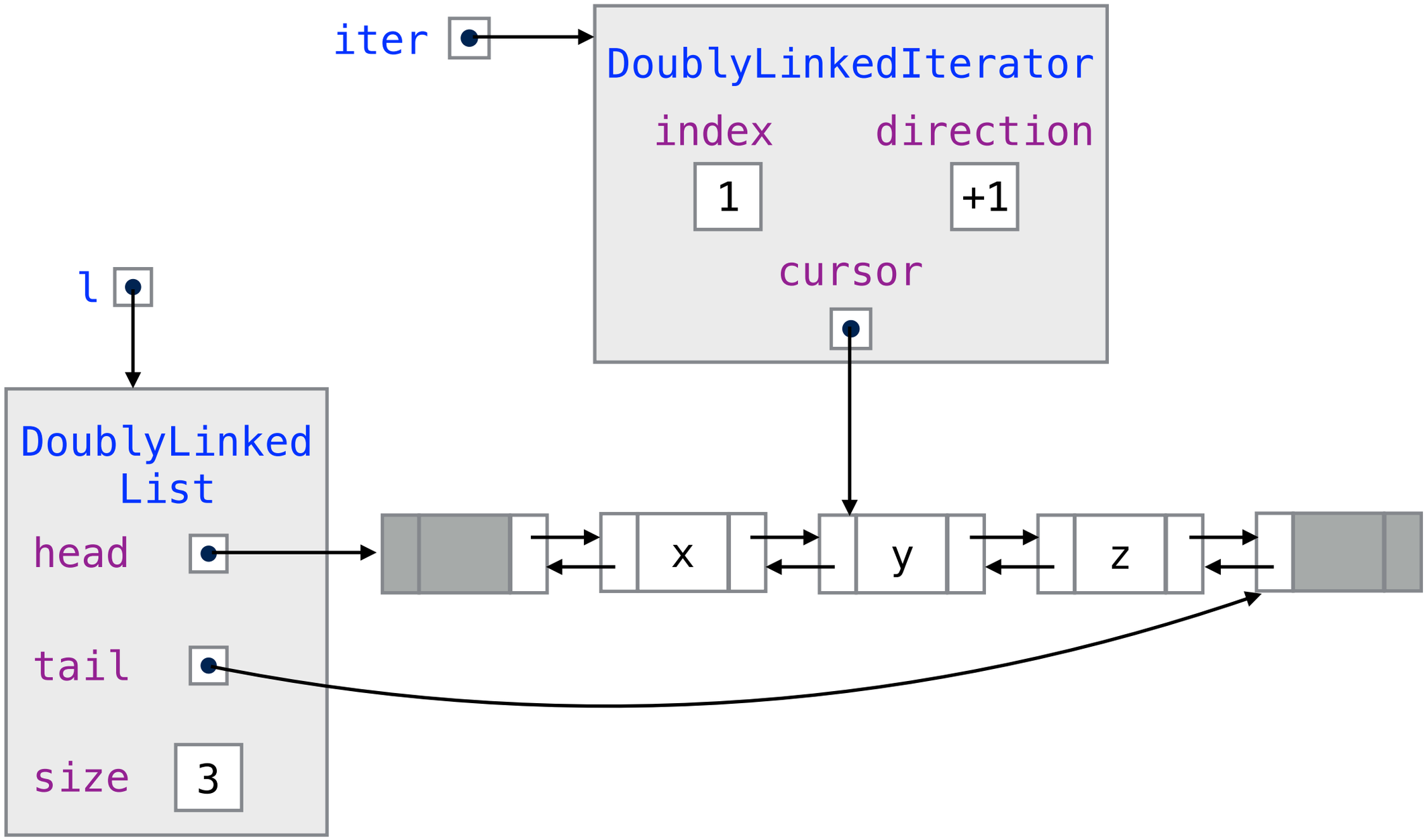

iter
DoublyLinkedIterator
index
direction
2
+1
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z


z

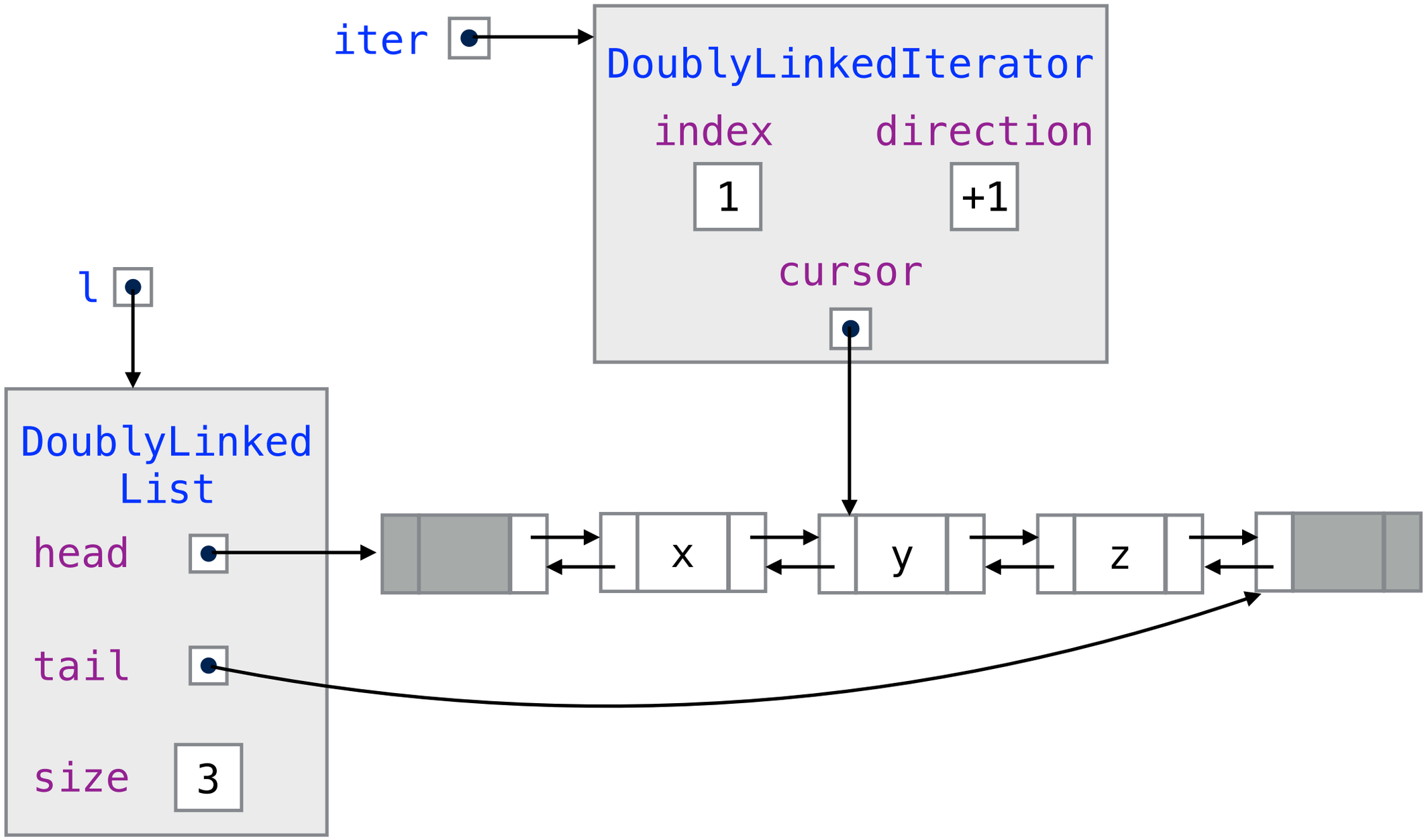

iter
DoublyLinkedIterator
index
direction
2
+1
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z

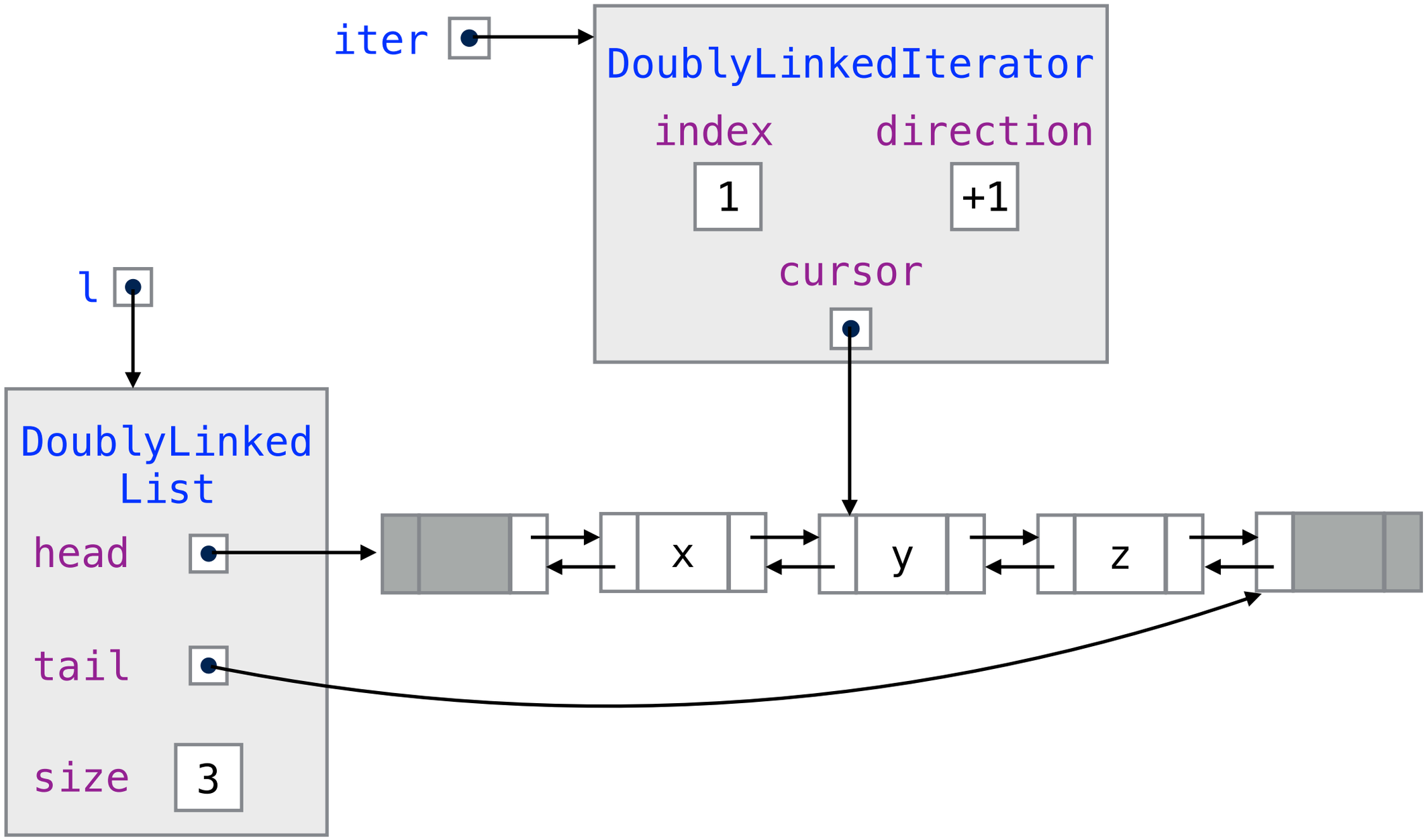


iter.previous()

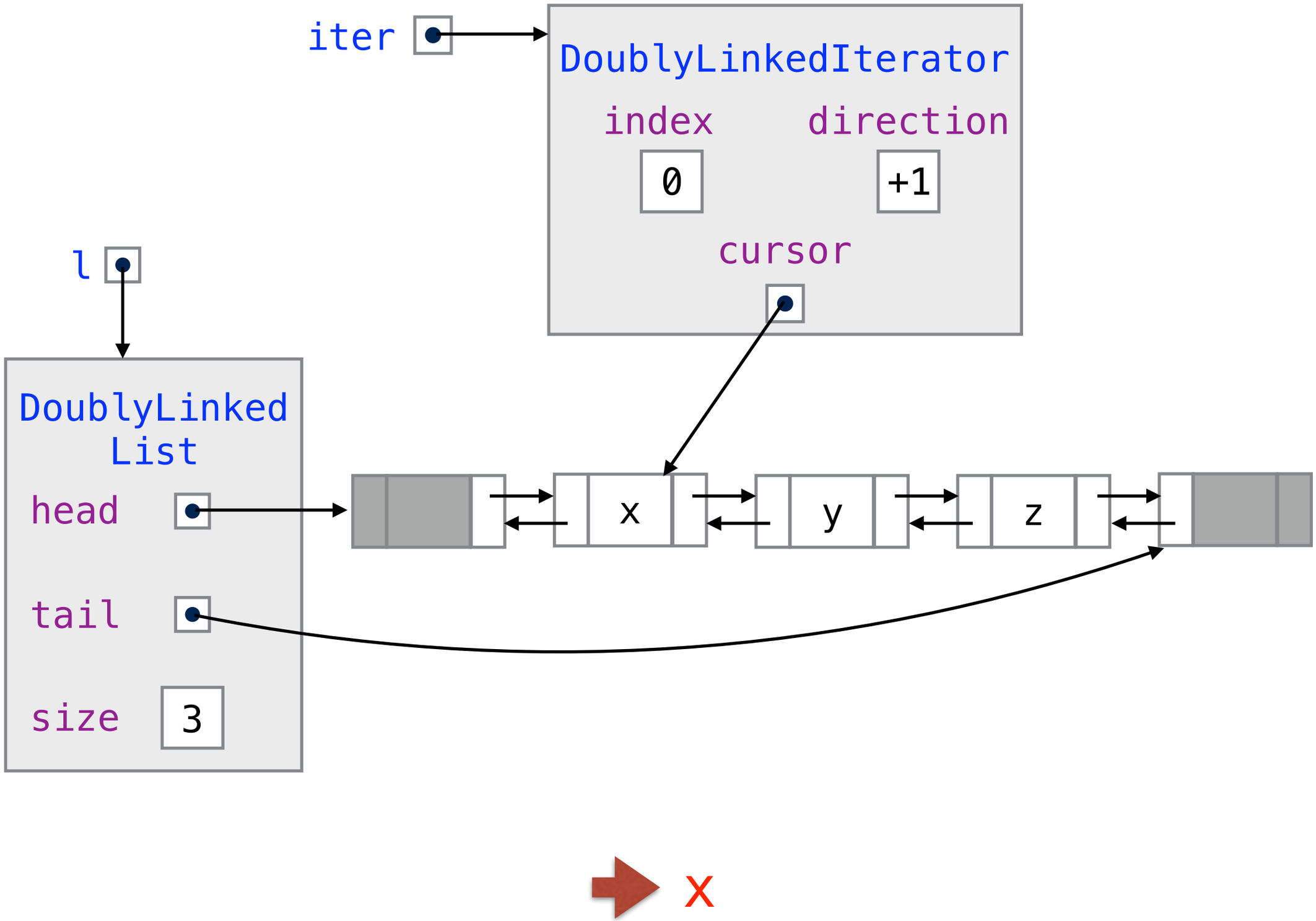

iter
DoublyLinkedIterator
index
direction
1
+1
cursor
l
DoublyLinked List
head
tail
size
3
x
y
z

y

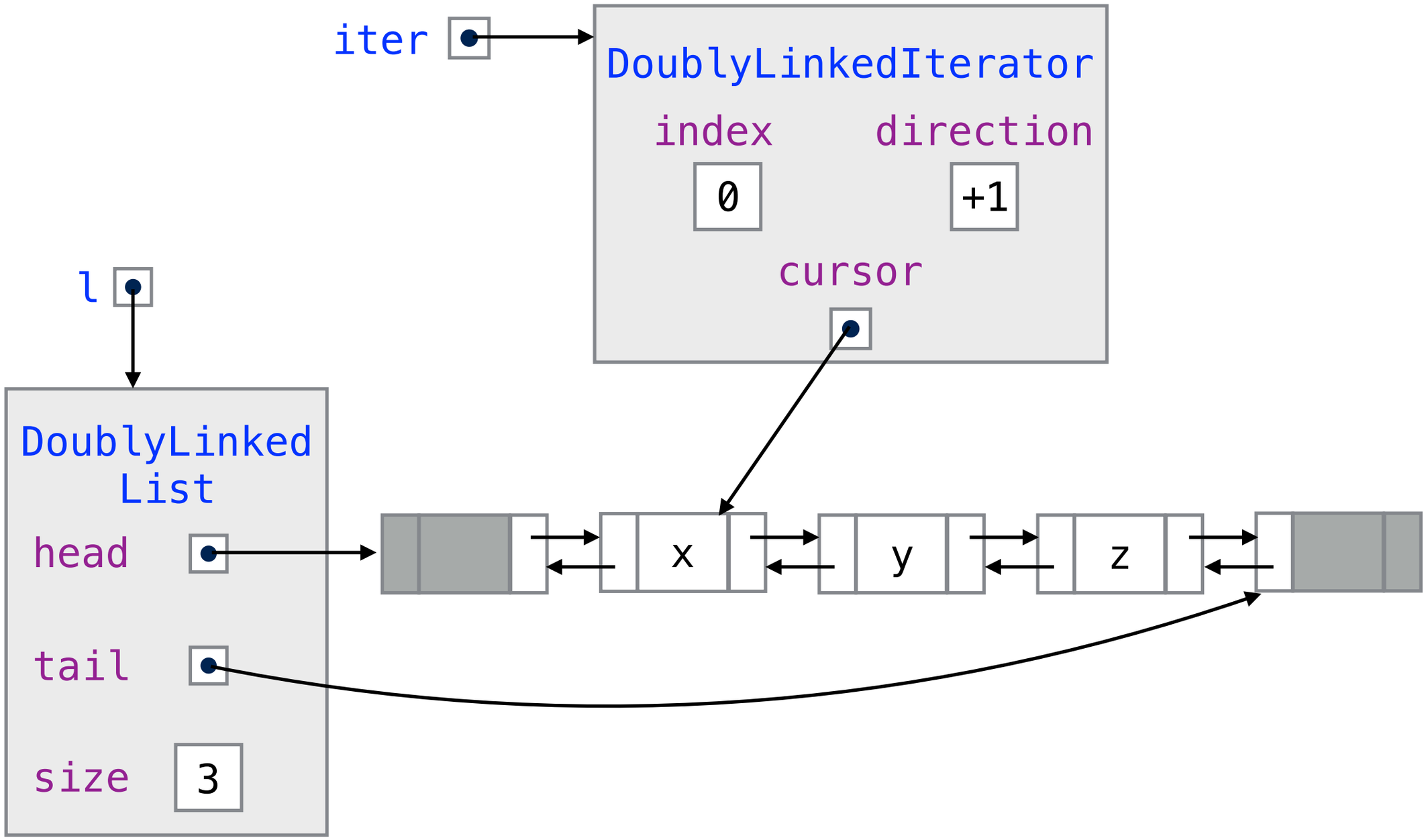

iter
DoublyLinkedIterator
index
direction
1
+1
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z

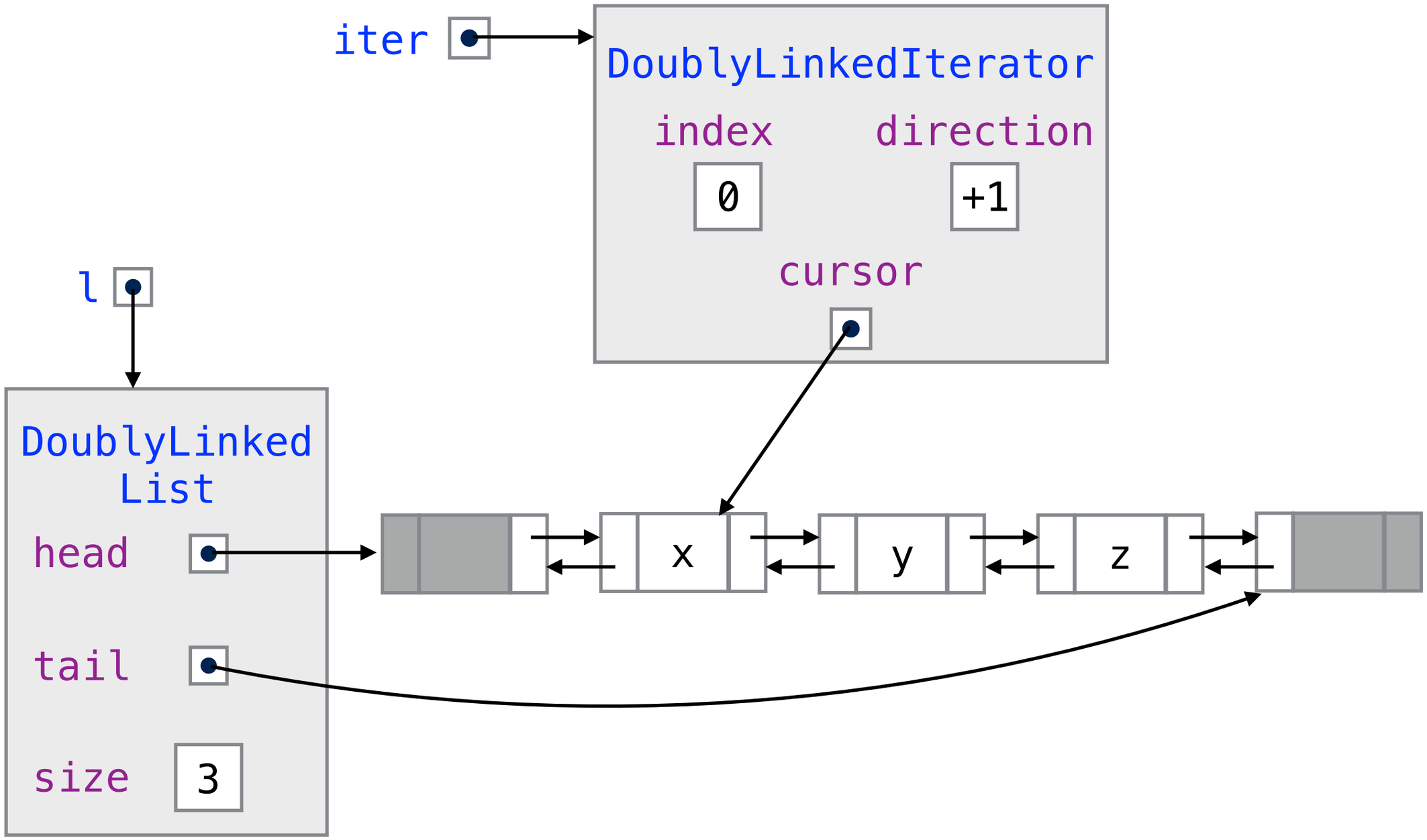


iter.previous()


iter
DoublyLinkedIterator
index
direction
0
+1
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z

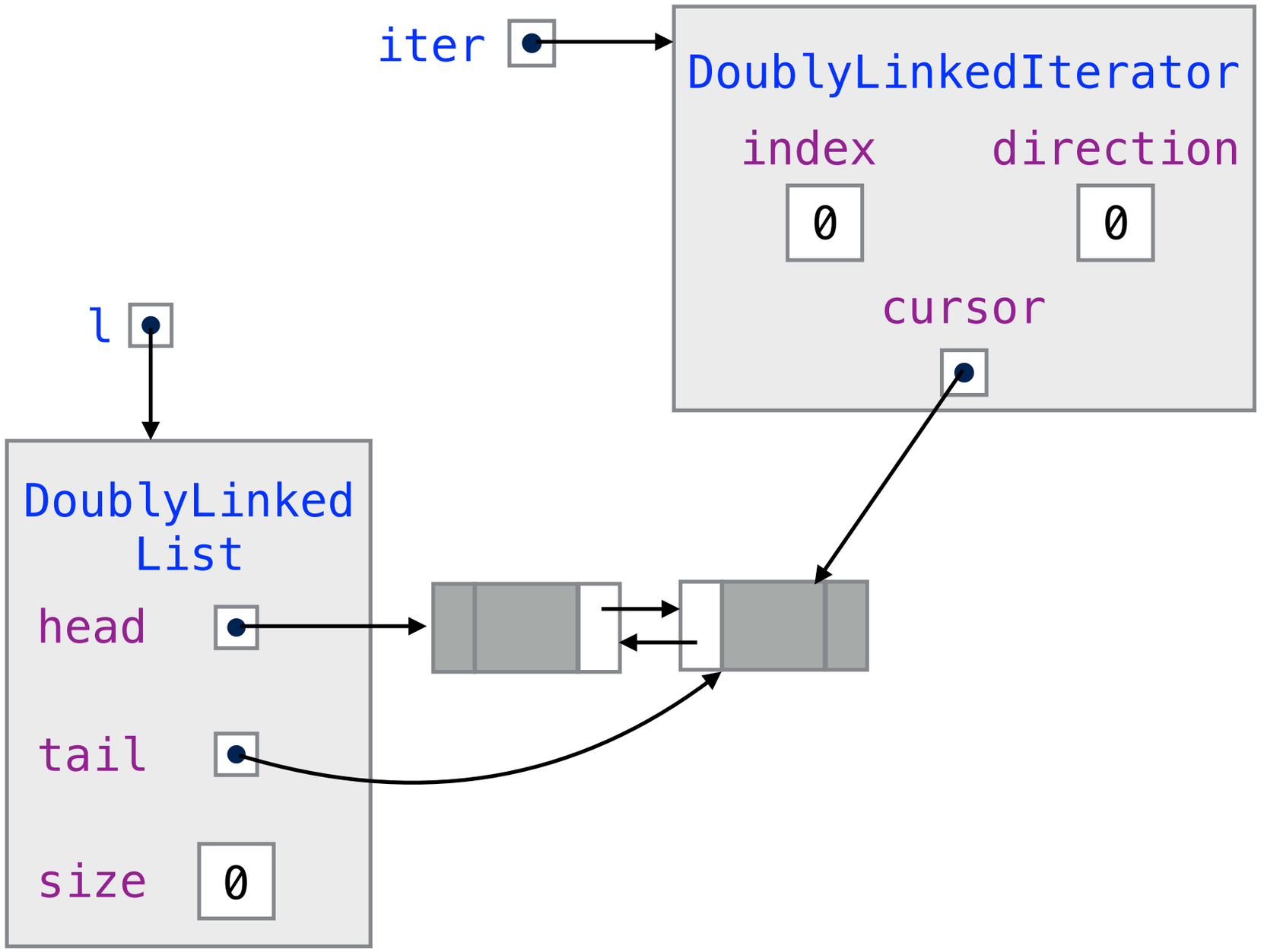
x

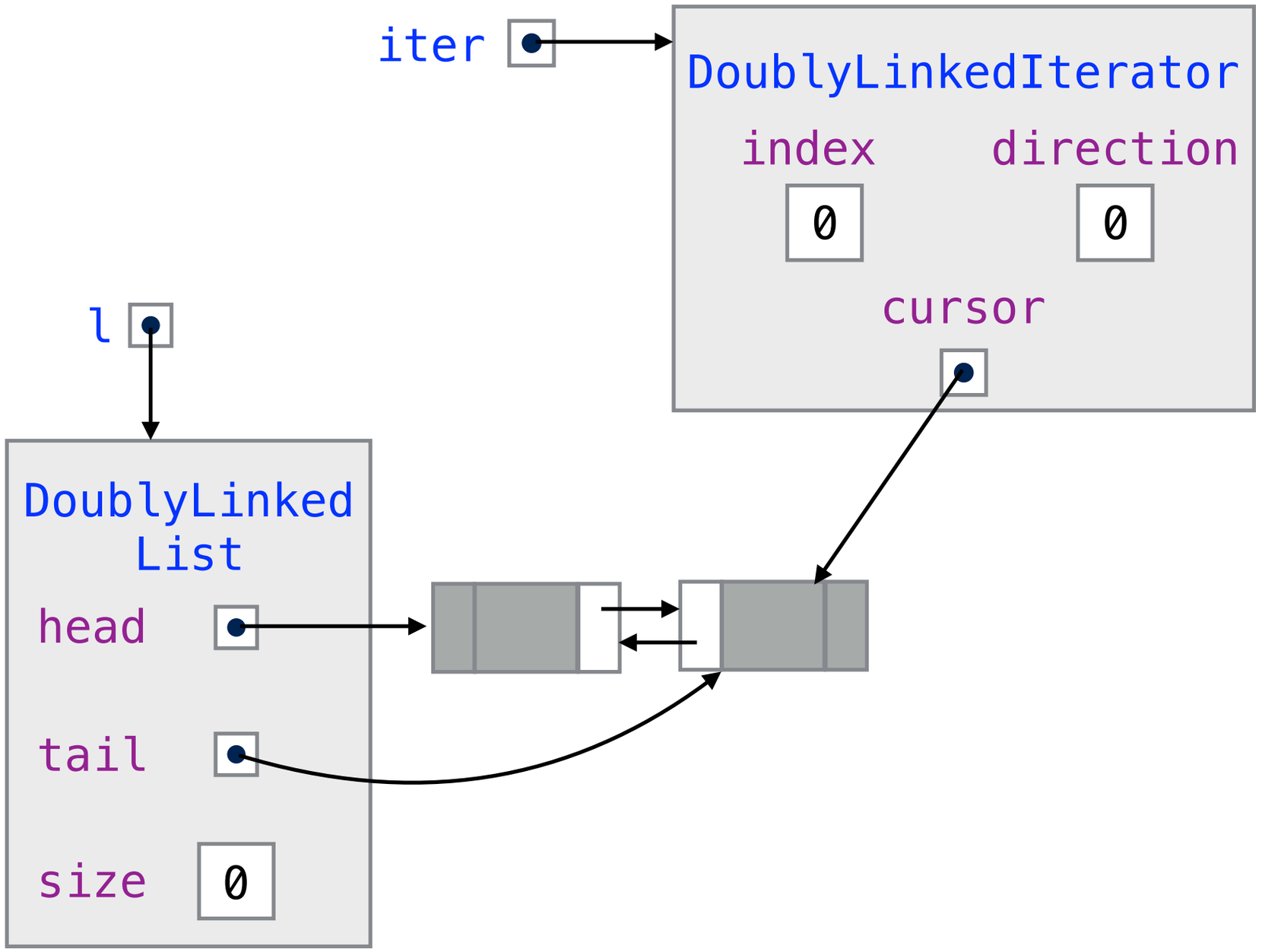

iter
DoublyLinkedIterator
index
direction
0
+1
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z



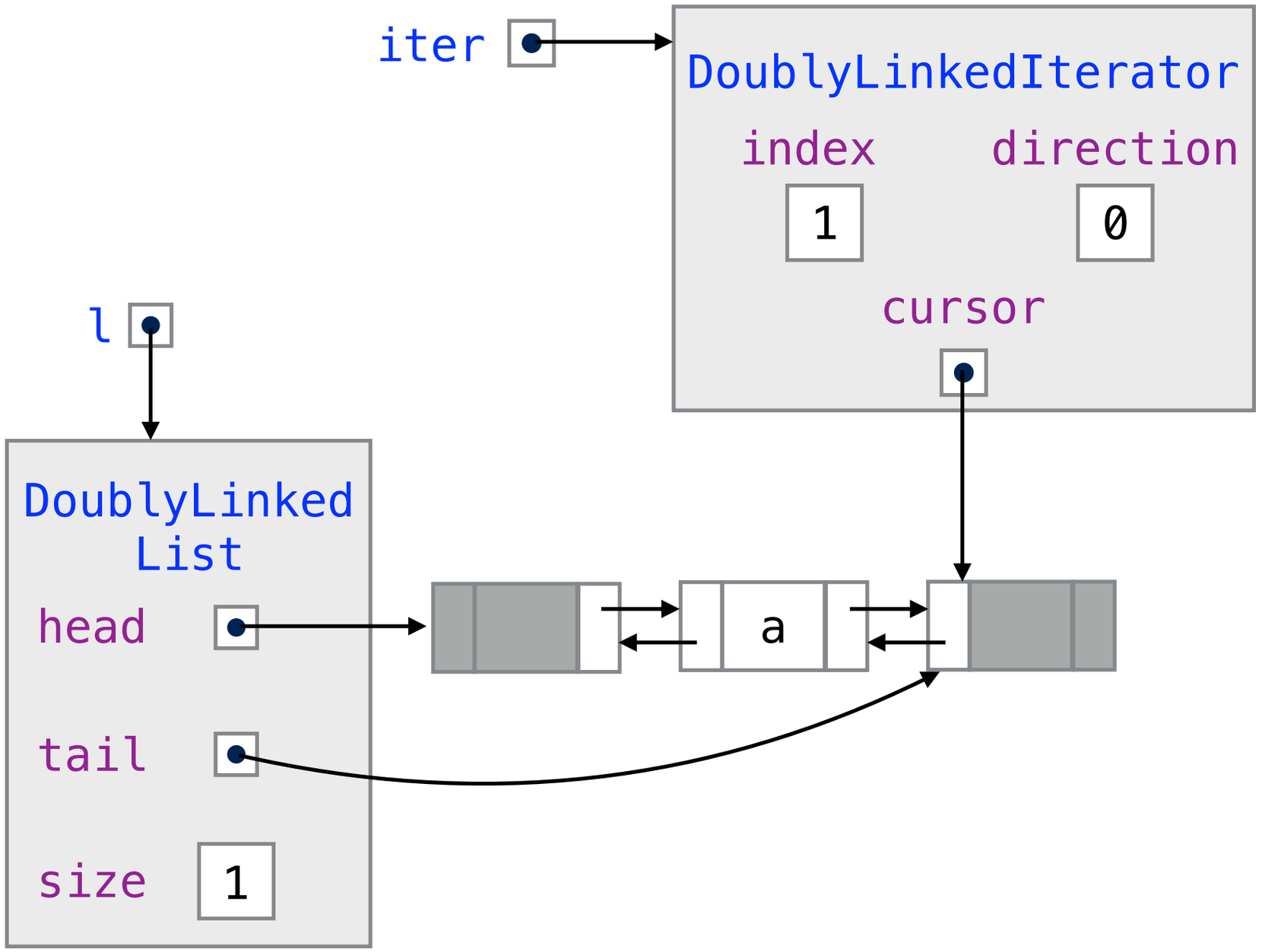

```
iter.hasPrevious() == false
```

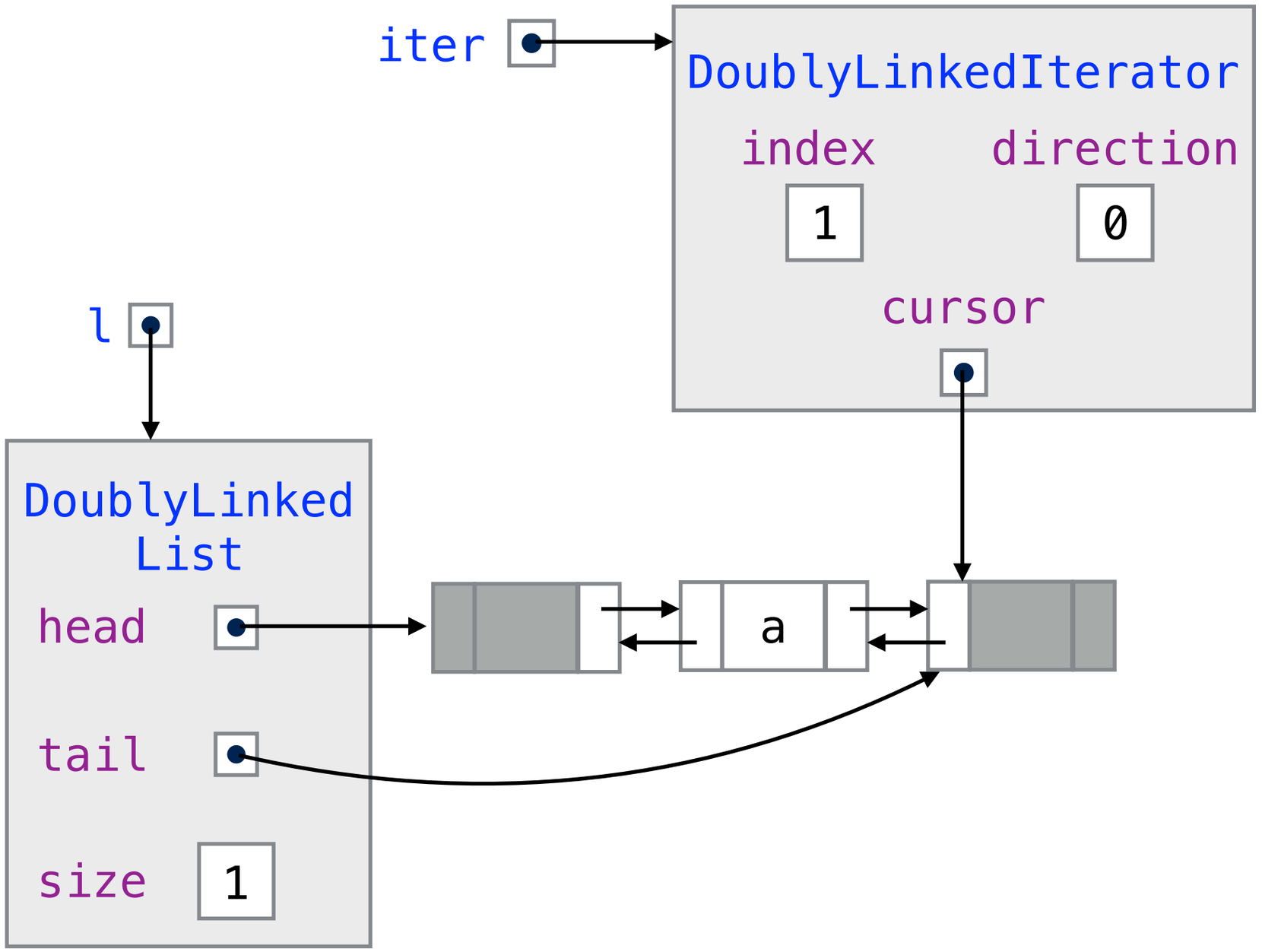
Iterators: `add()`


iter
DoublyLinkedIterator
index
direction
0
0
cursor
l
DoublyLinked
List
head
tail
size
0

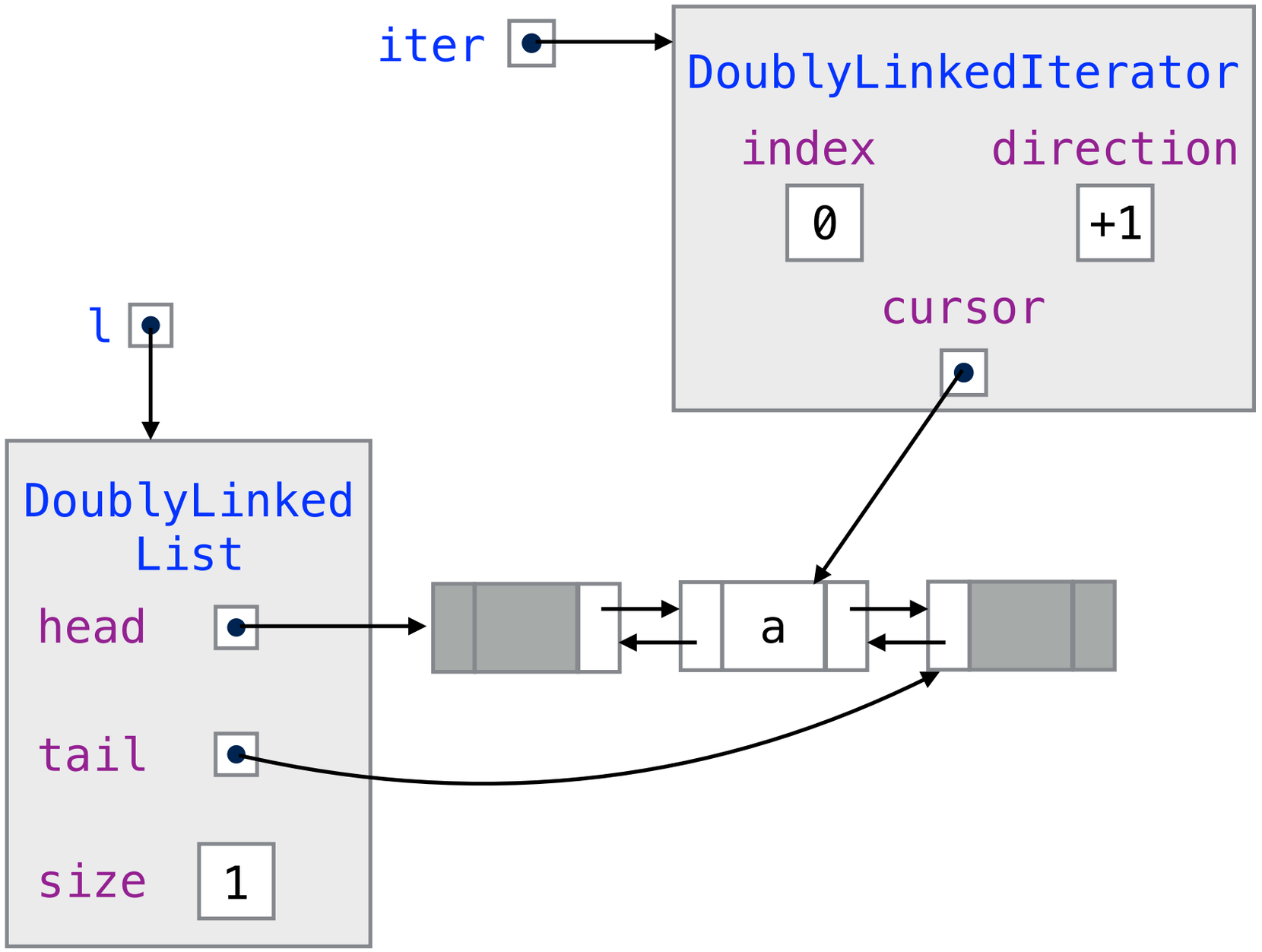

iter
DoublyLinkedIterator
index
direction
0
0
cursor
l
DoublyLinked
List
head
tail
size
0

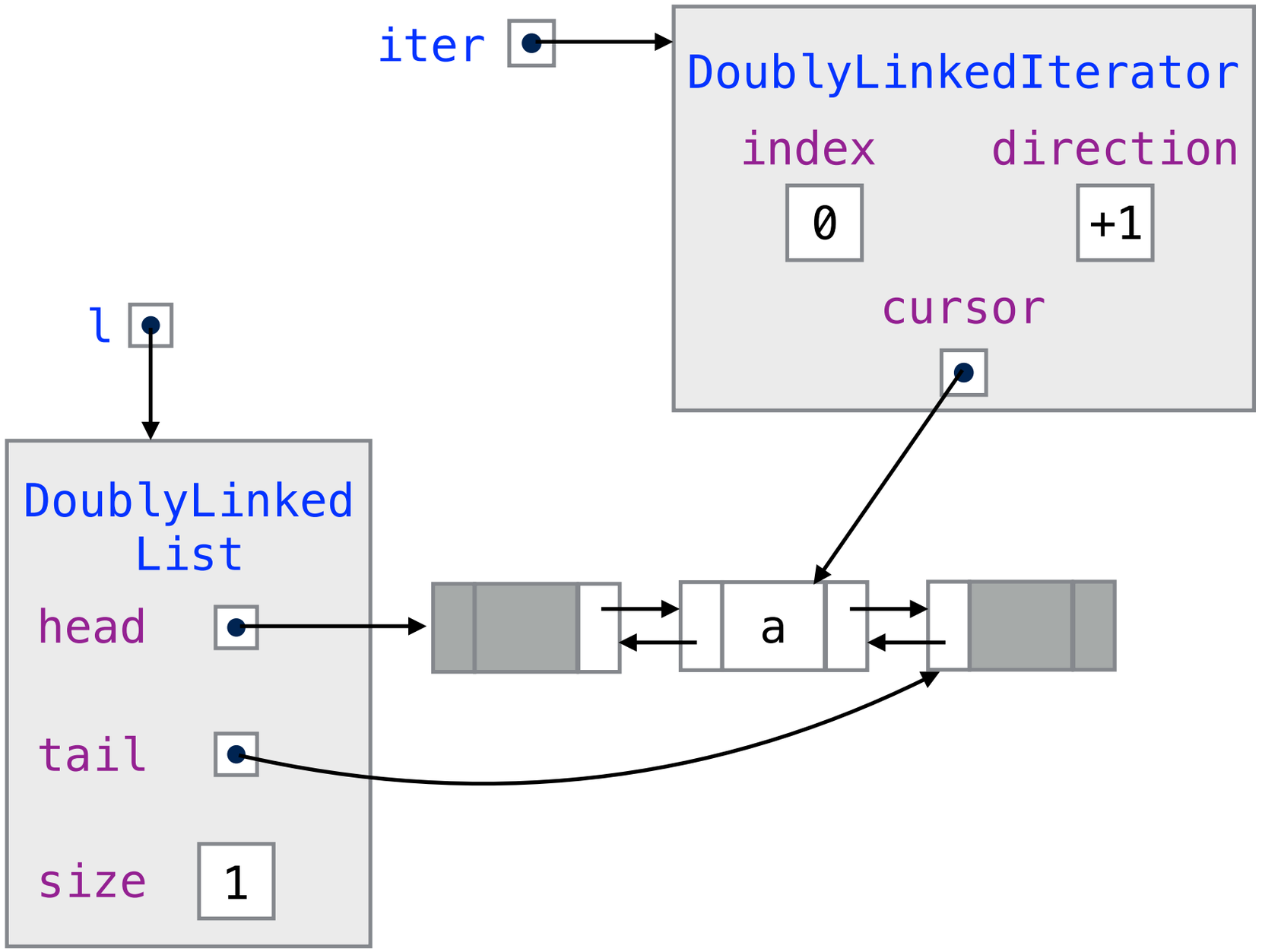
iter.add(“a”)


iter
DoublyLinkedIterator
index
direction
1
0
cursor
l
DoublyLinked
List
head
tail
size
1
a

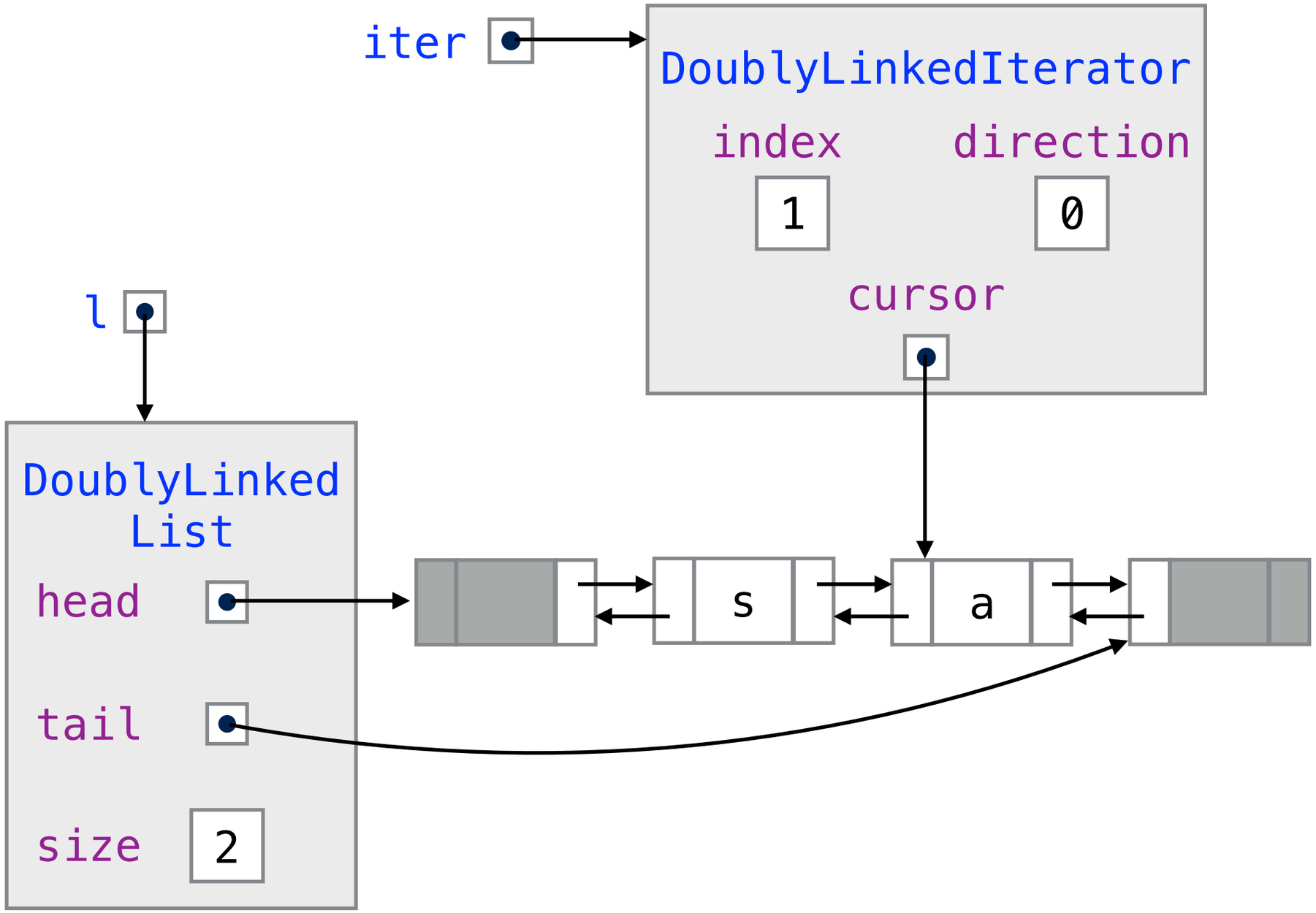


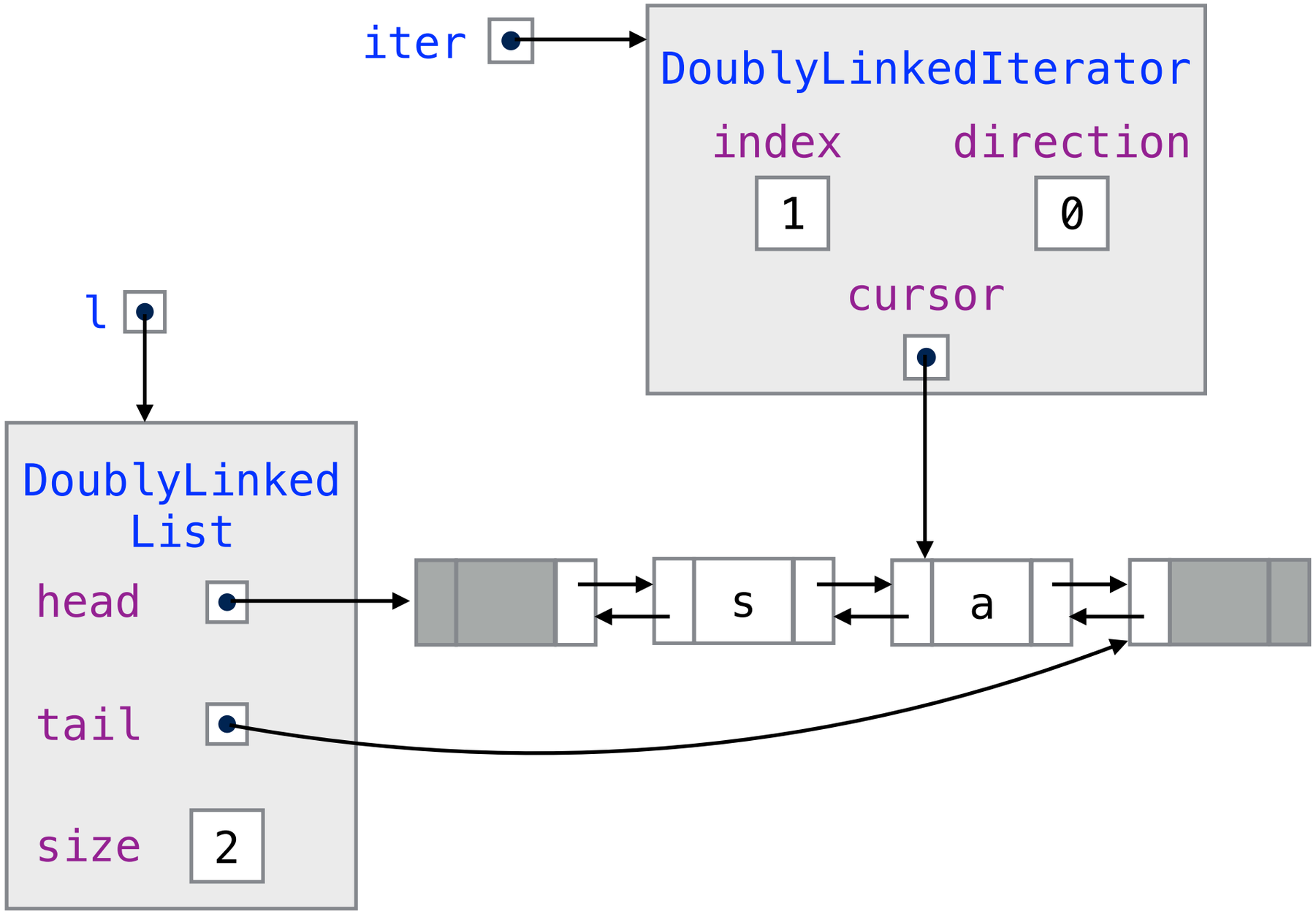
iter.previous()


iter
DoublyLinkedIterator
index
direction
0
+1
cursor
l
DoublyLinked
List
head
tail
size
1
a

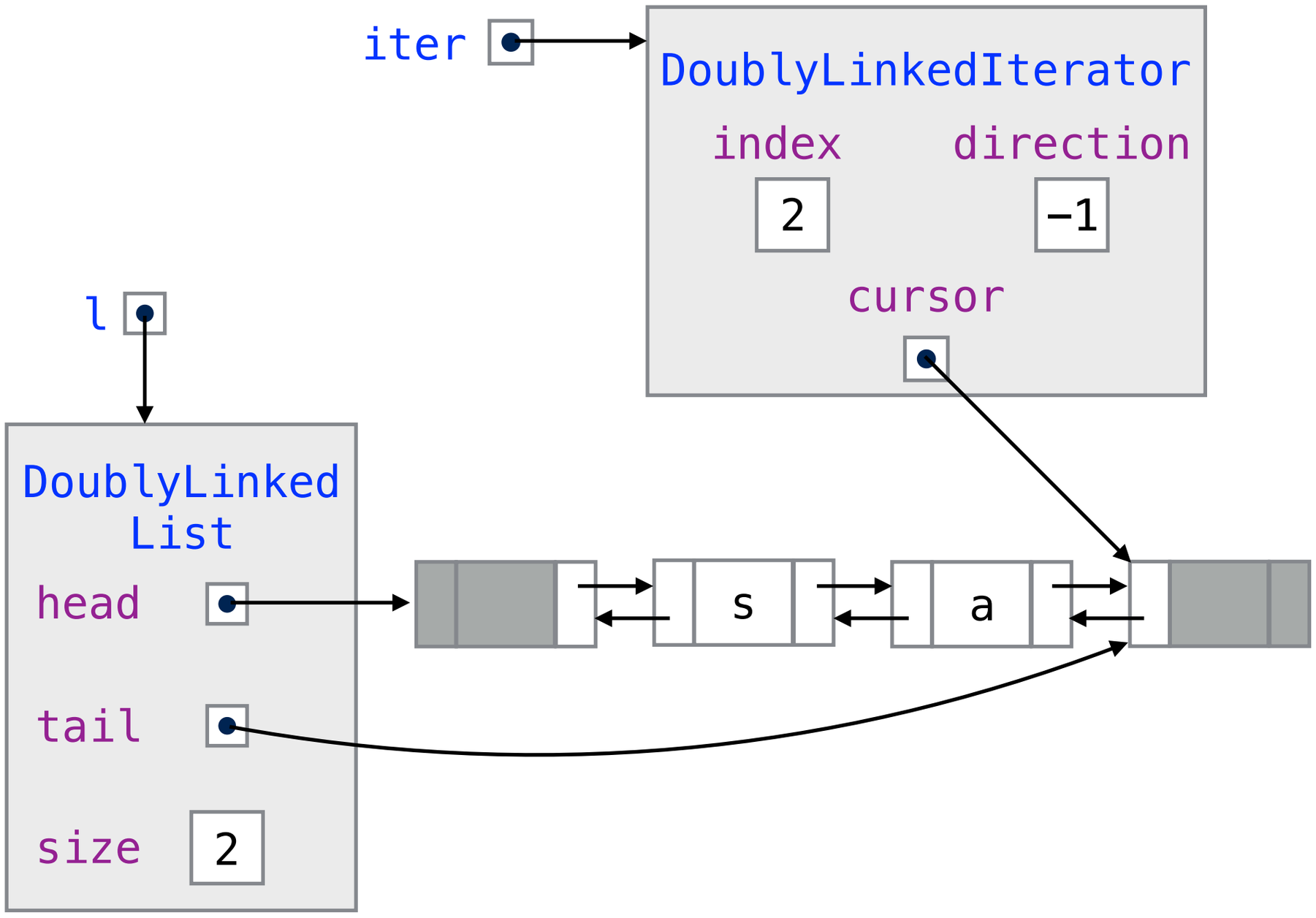

iter
DoublyLinkedIterator
index
direction
0
+1
cursor
l
DoublyLinked
List
head
tail
size
1
a

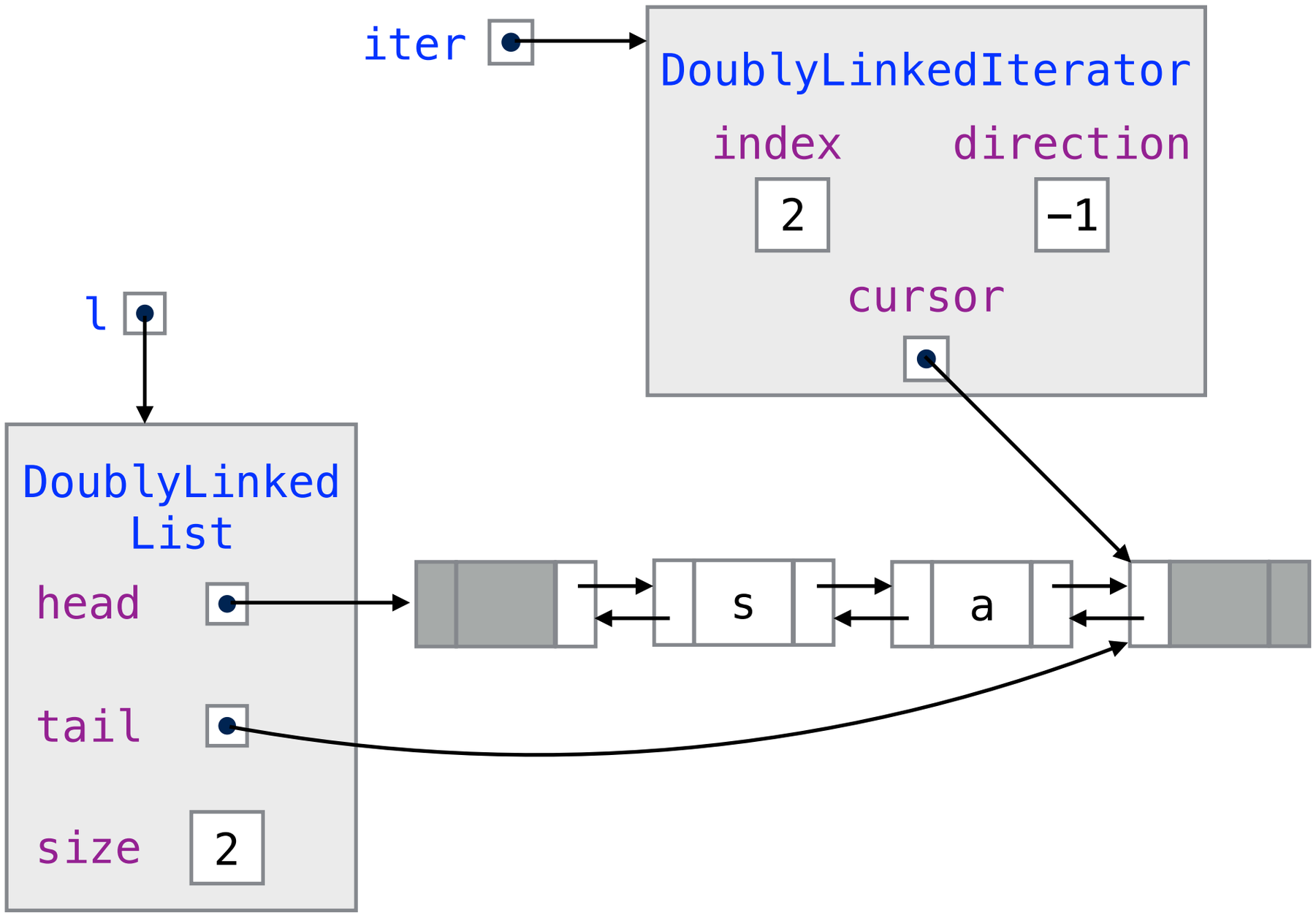
iter.add(“s”)


iter
DoublyLinkedIterator
index
direction
1
0
cursor
l
DoublyLinked
List
head
tail
size
2
s
a

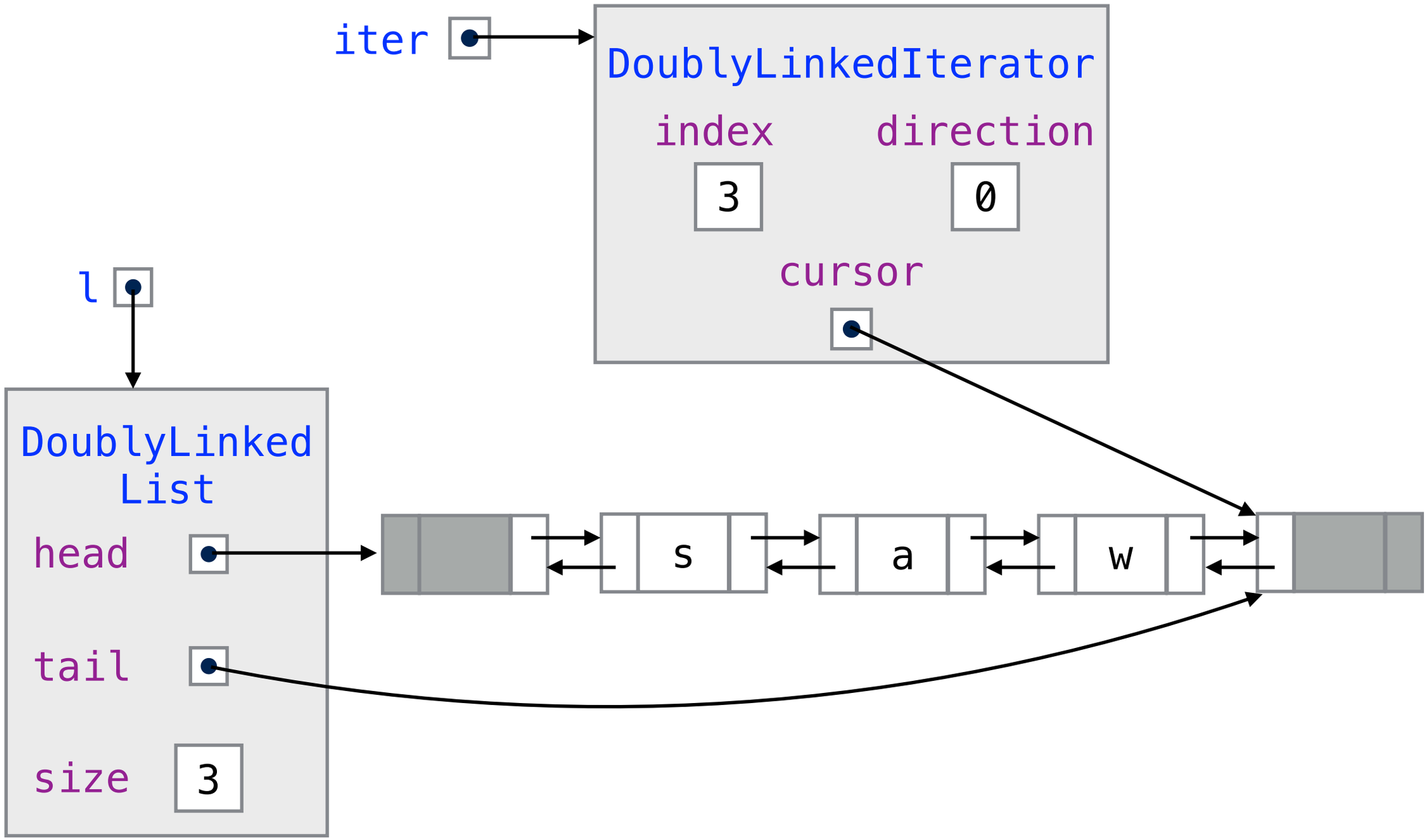

iter
DoublyLinkedIterator
index
direction
1
0
cursor
l
DoublyLinked
List
head
tail
size
2
s
a

iter.next()

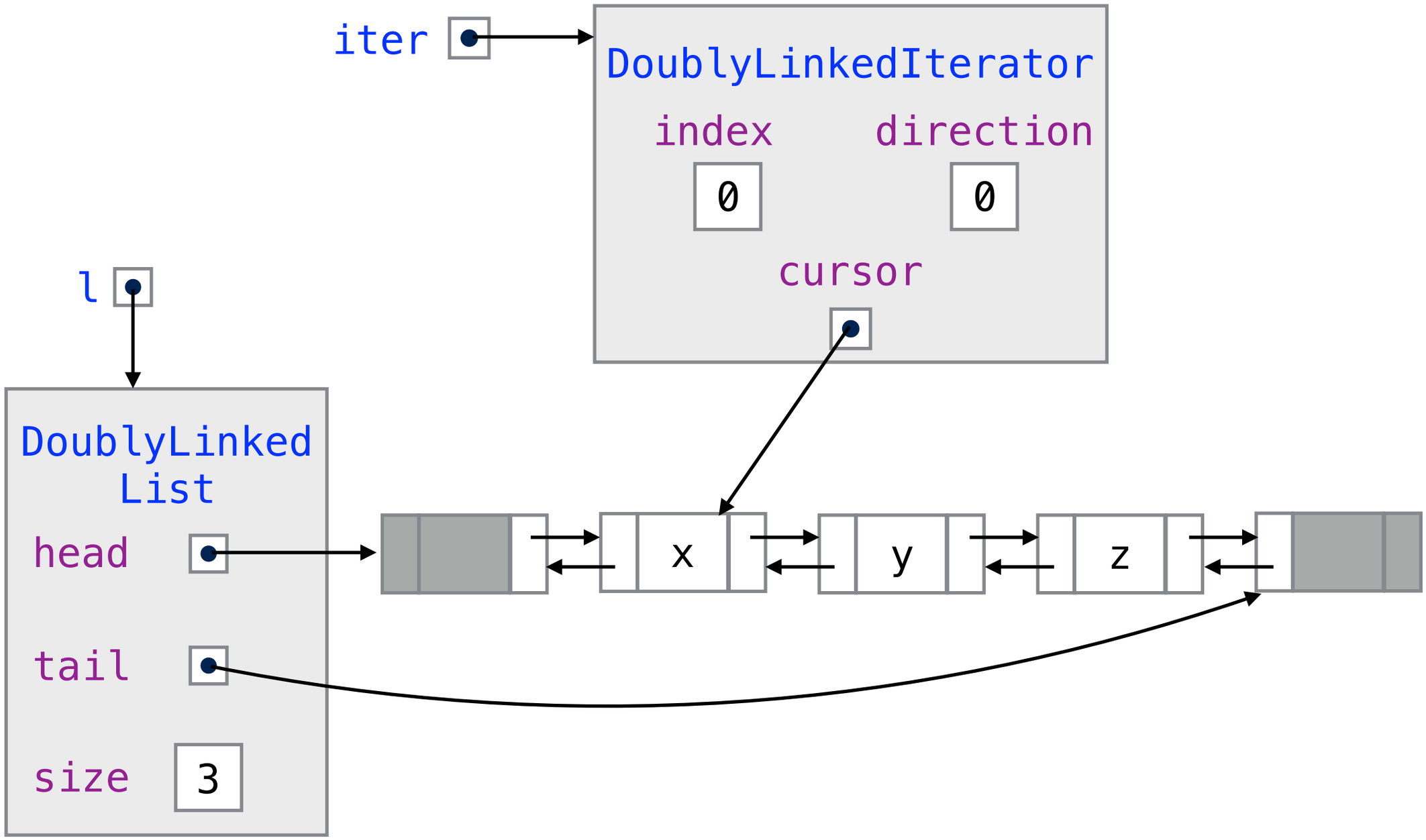

iter
DoublyLinkedIterator
index
direction
2
-1
cursor
l
DoublyLinked
List
head
tail
size
2
s
a

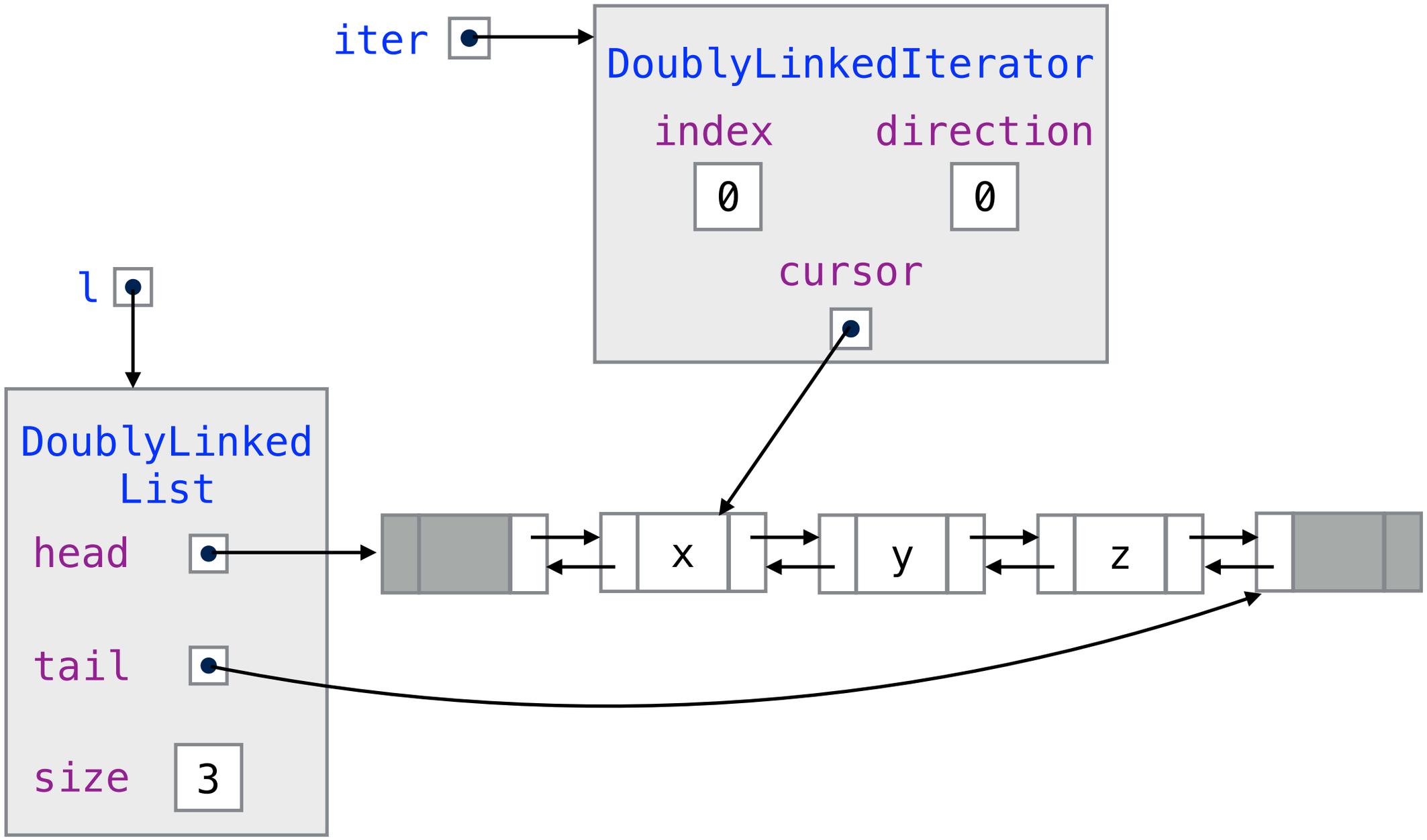

iter
DoublyLinkedIterator
index
direction
2
-1
cursor
l
DoublyLinked List
head
tail
size
2
s
a

iter.add("w")

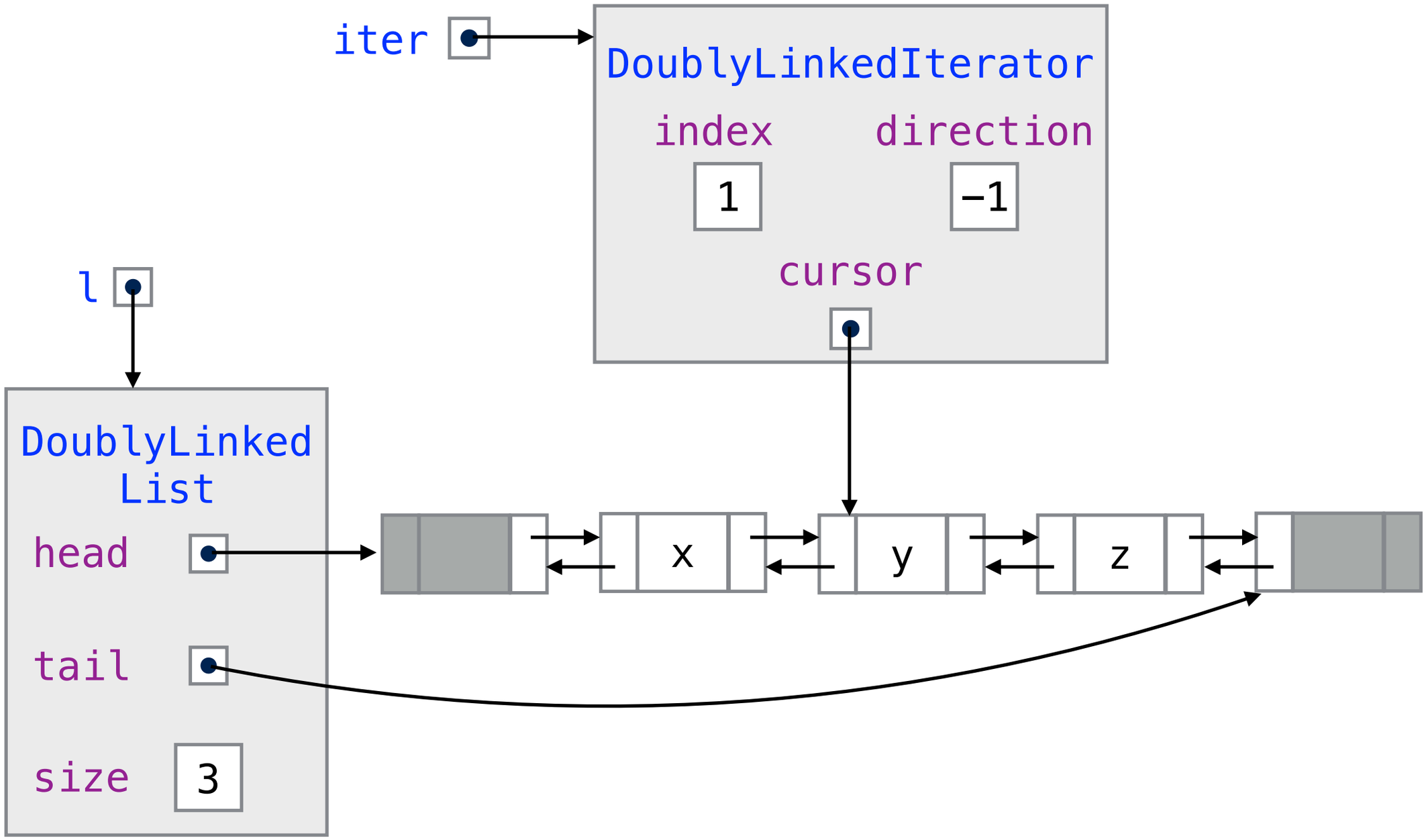

iter
DoublyLinkedIterator
index
direction
3
0
cursor
l
DoublyLinked
List
head
tail
size
3
s
a
w

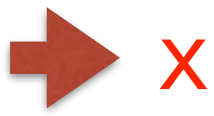
Iterators: `remove()`

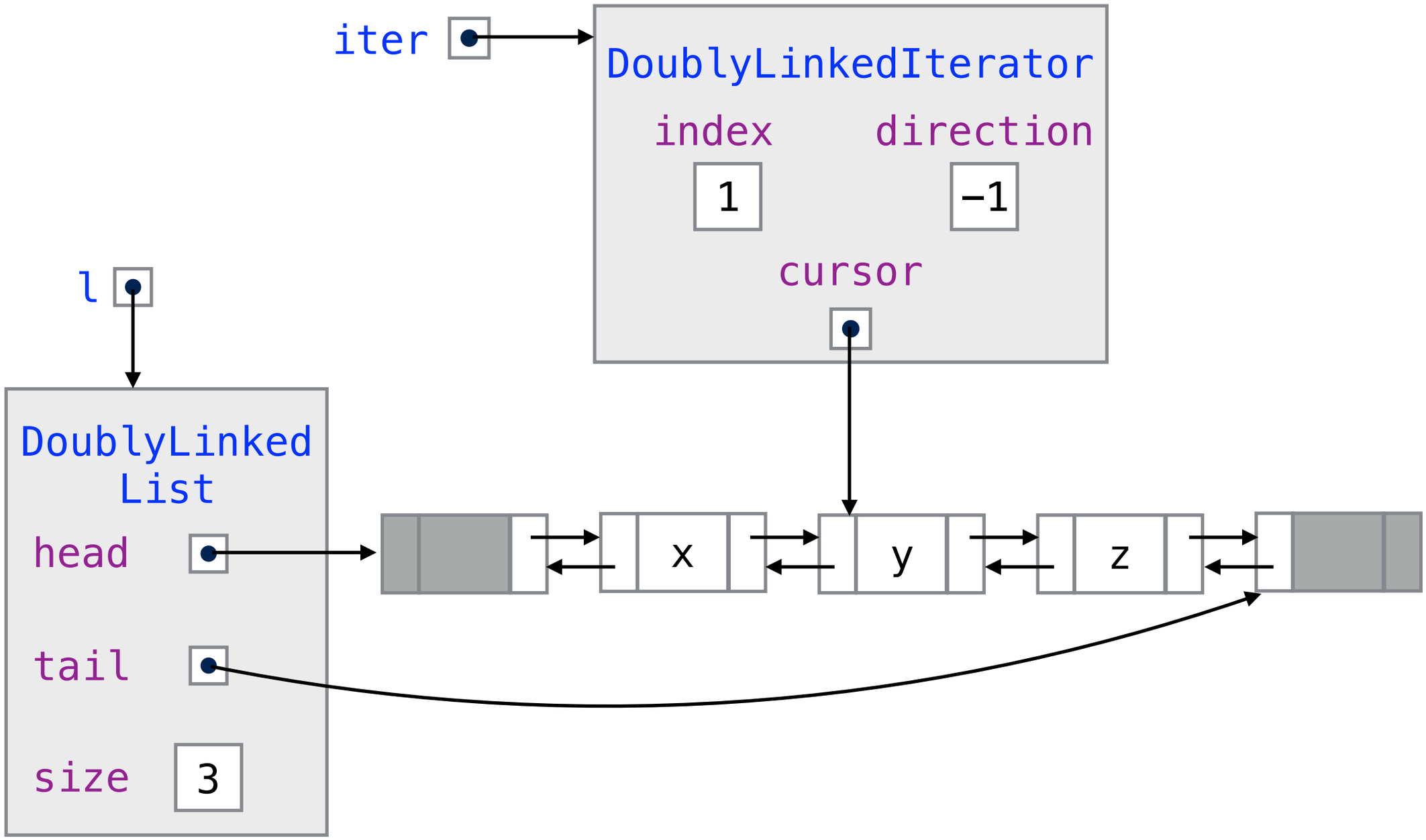

iter
DoublyLinkedIterator
index
direction
0
0
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z


iter
DoublyLinkedIterator
index
direction
0
0
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z

iter.next()


iter
DoublyLinkedIterator
index
direction
1
-1
cursor
l
DoublyLinked List
head
tail
size
3
x
y
z


x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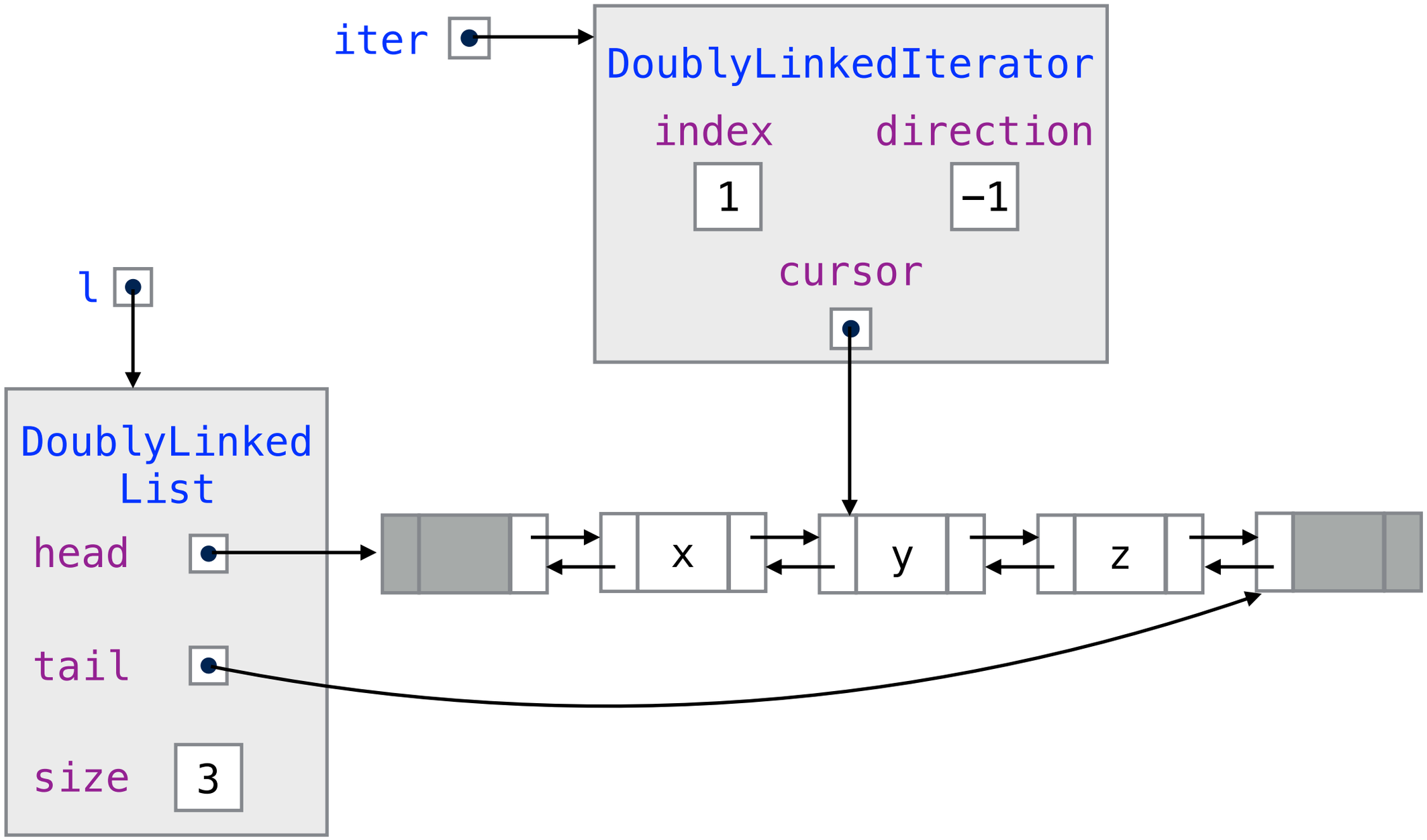
-1
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z


iter
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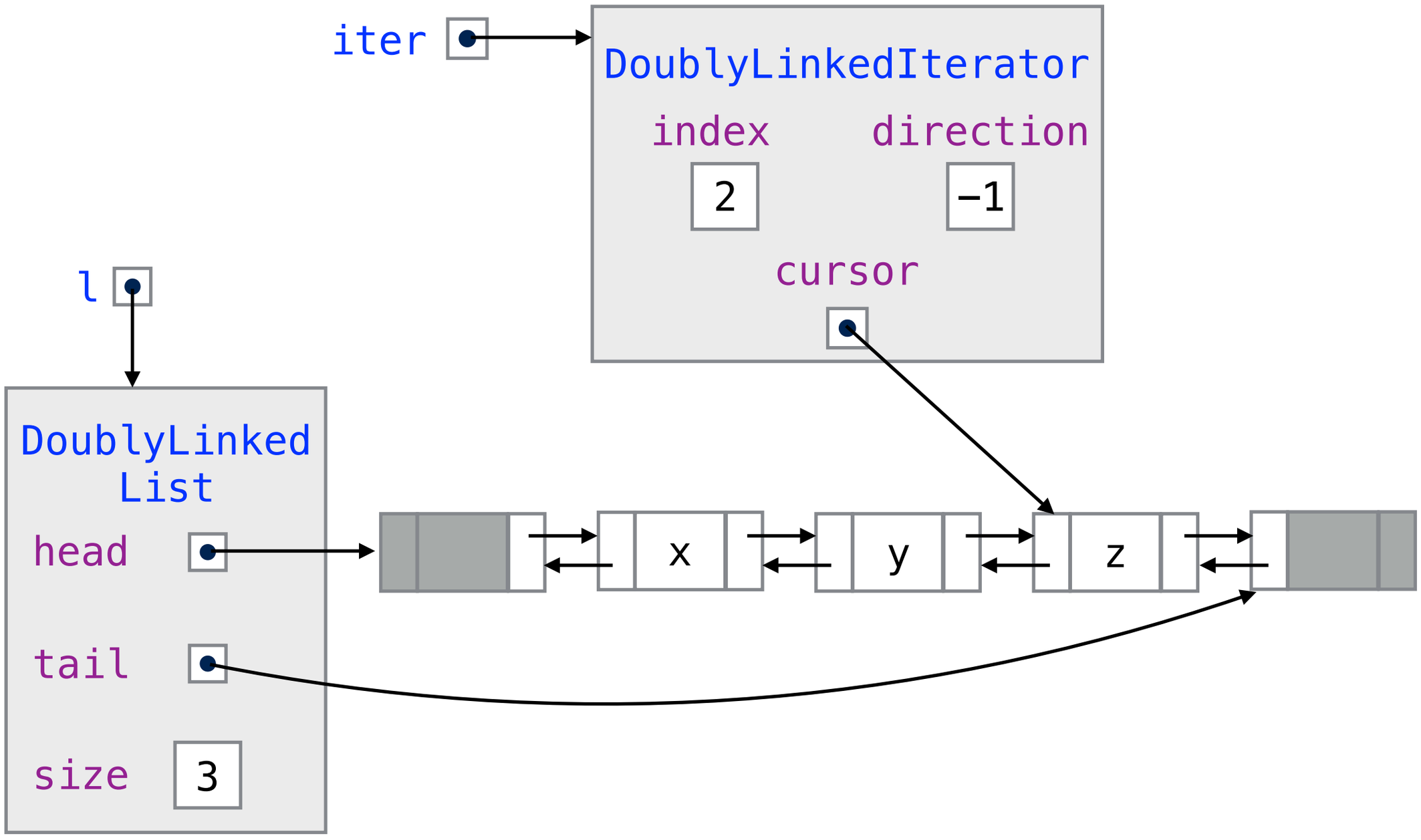
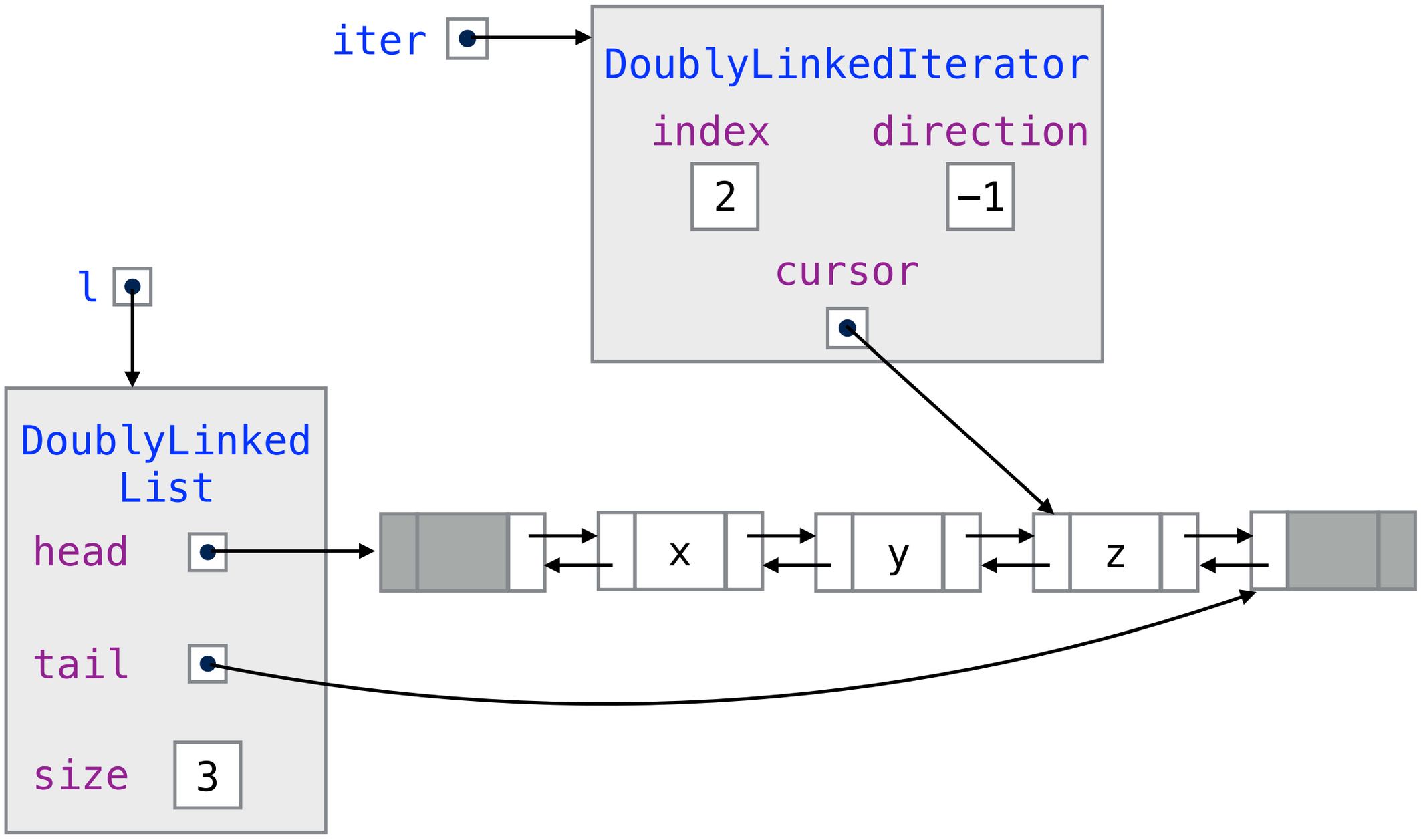
index
direction
1
-1
cursor
l
DoublyLinked
List
head
tail
size
3
x
y
z

iter.next()


iter
DoublyLinkedIterator
index
direction
2
-1
cursor
l
DoublyLinked List
head
tail
size
3
x
y
z

y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DoublyLinkedIterator
index
direction
2
-1
cursor
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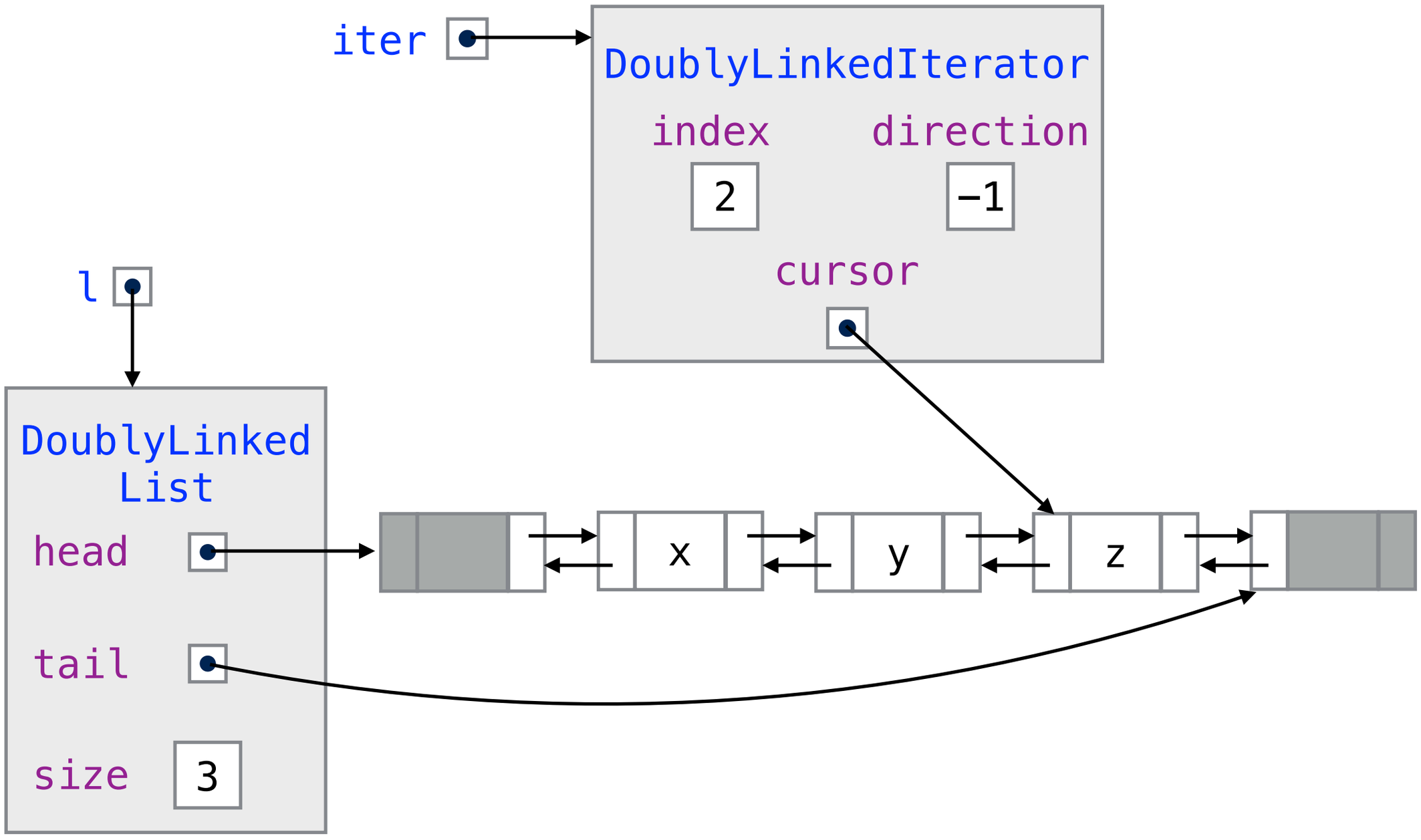
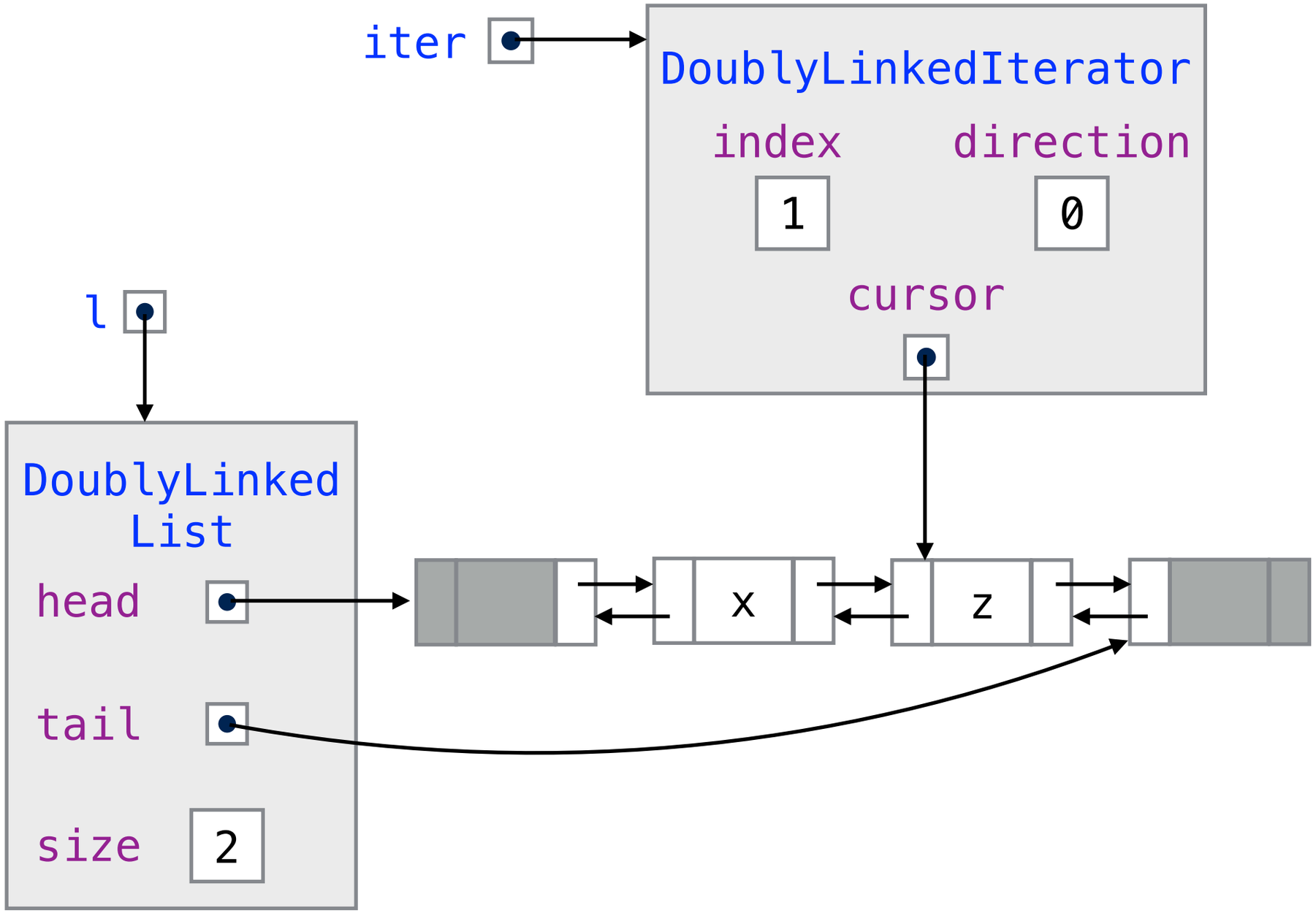
DoublyLinked
List
head
tail
size
3
x
y
z


iter
DoublyLinkedIterator
index
direction
2
-1
cursor
l
DoublyLinked List
head
tail
size
3
x
y
z

iter.remove()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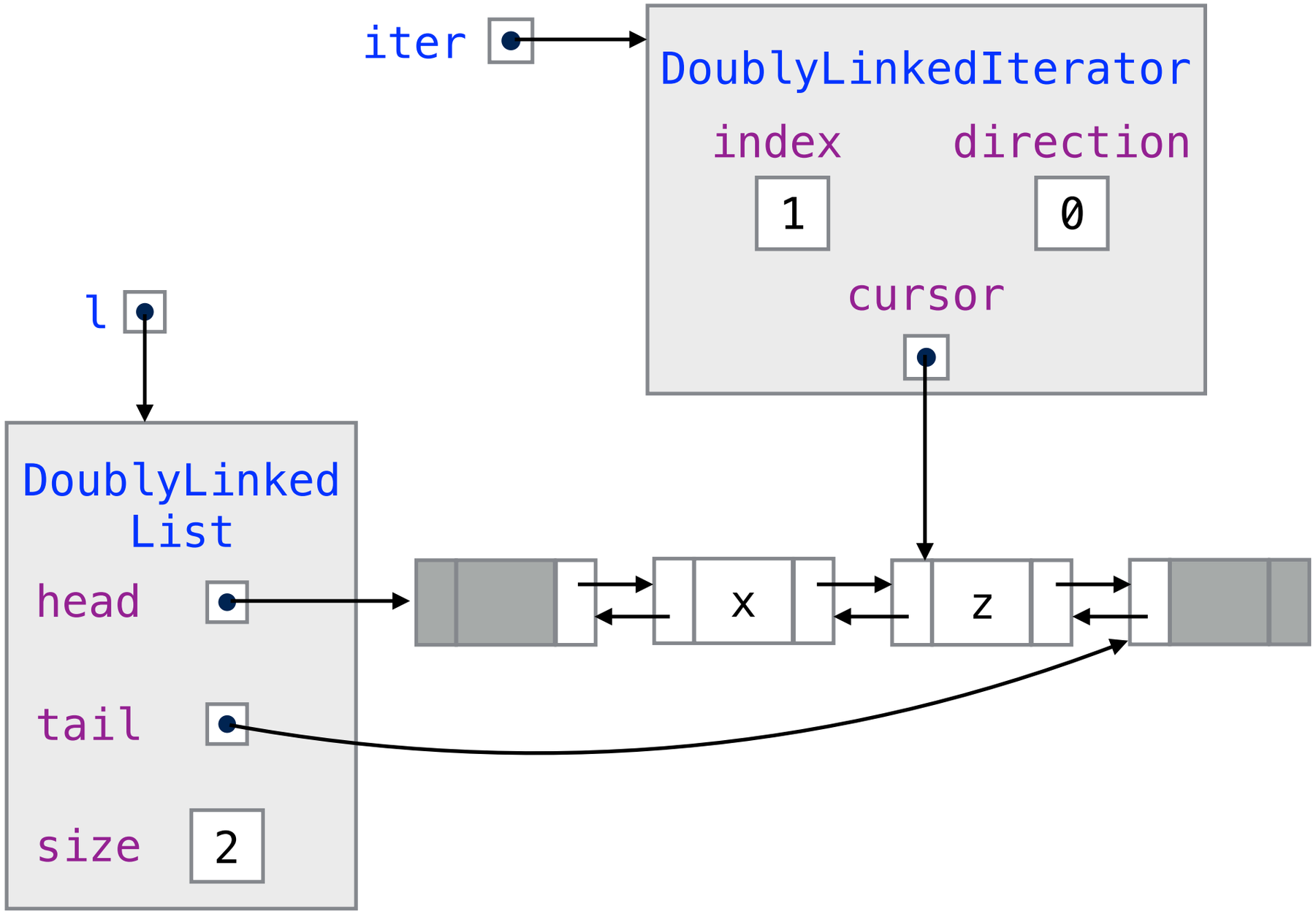
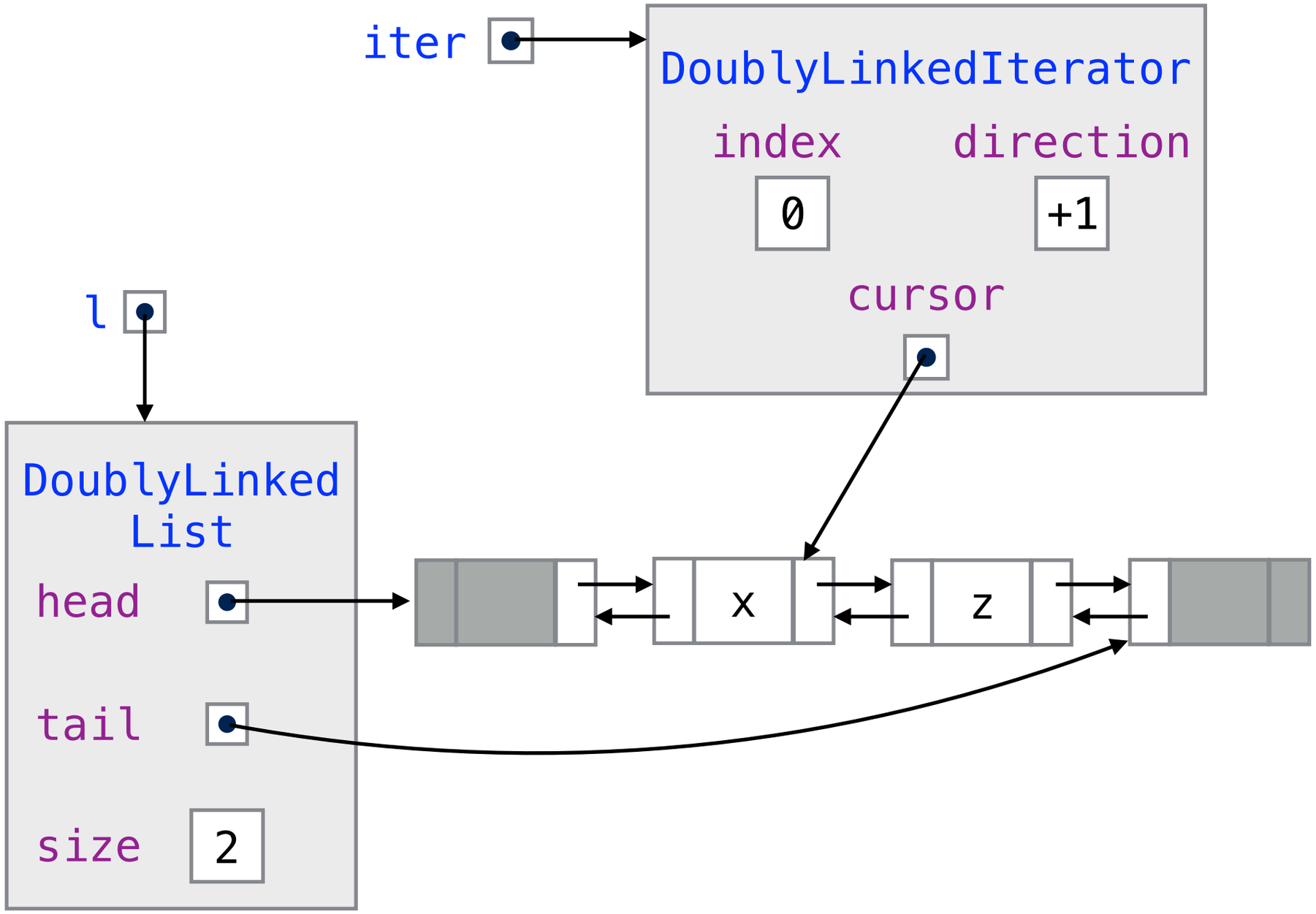
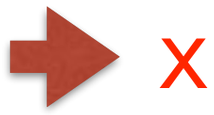
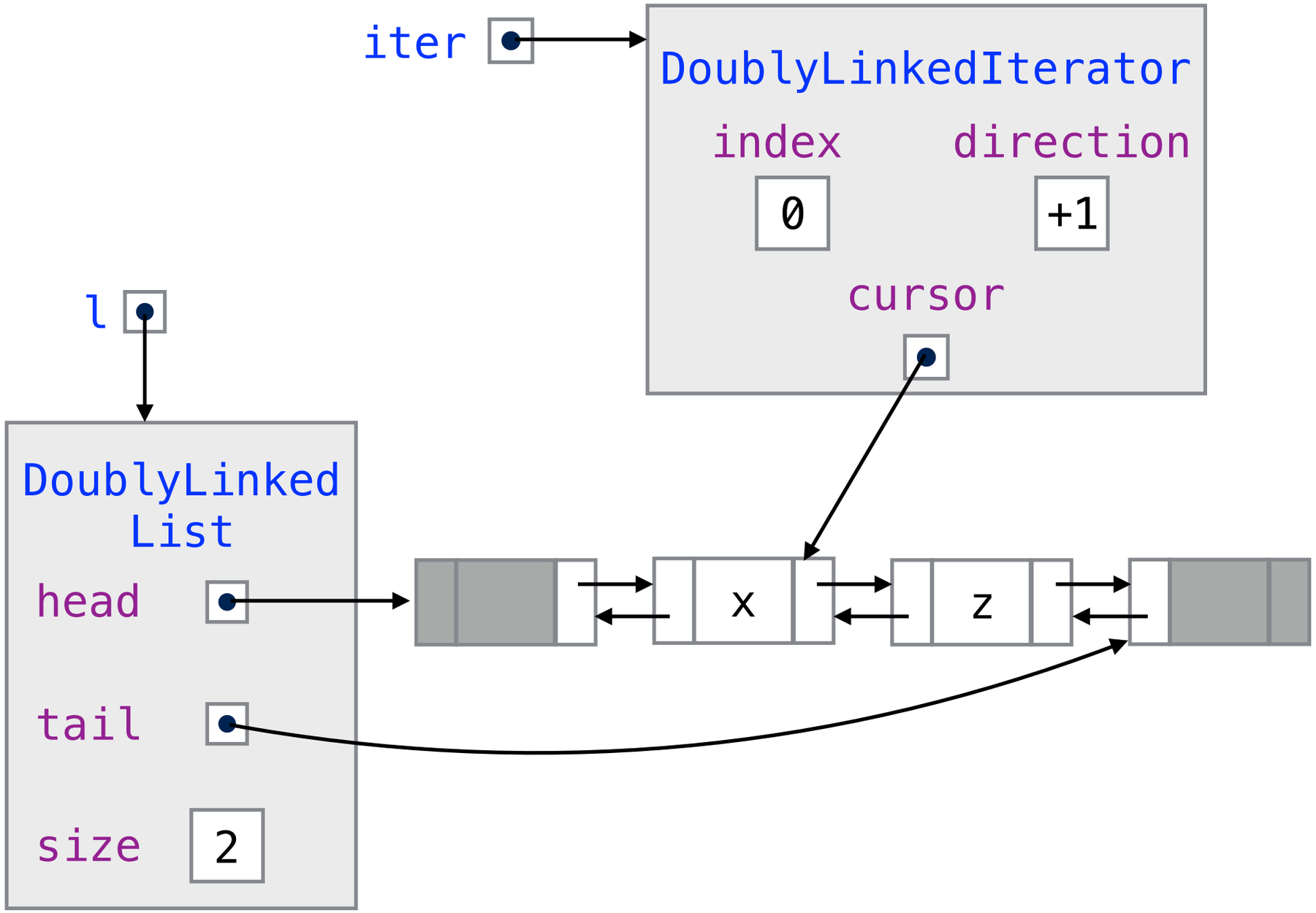
DoublyLinkedIterator
index
direction
1
0
cursor
l
DoublyLinked
List
head
tail
size
2
x
z

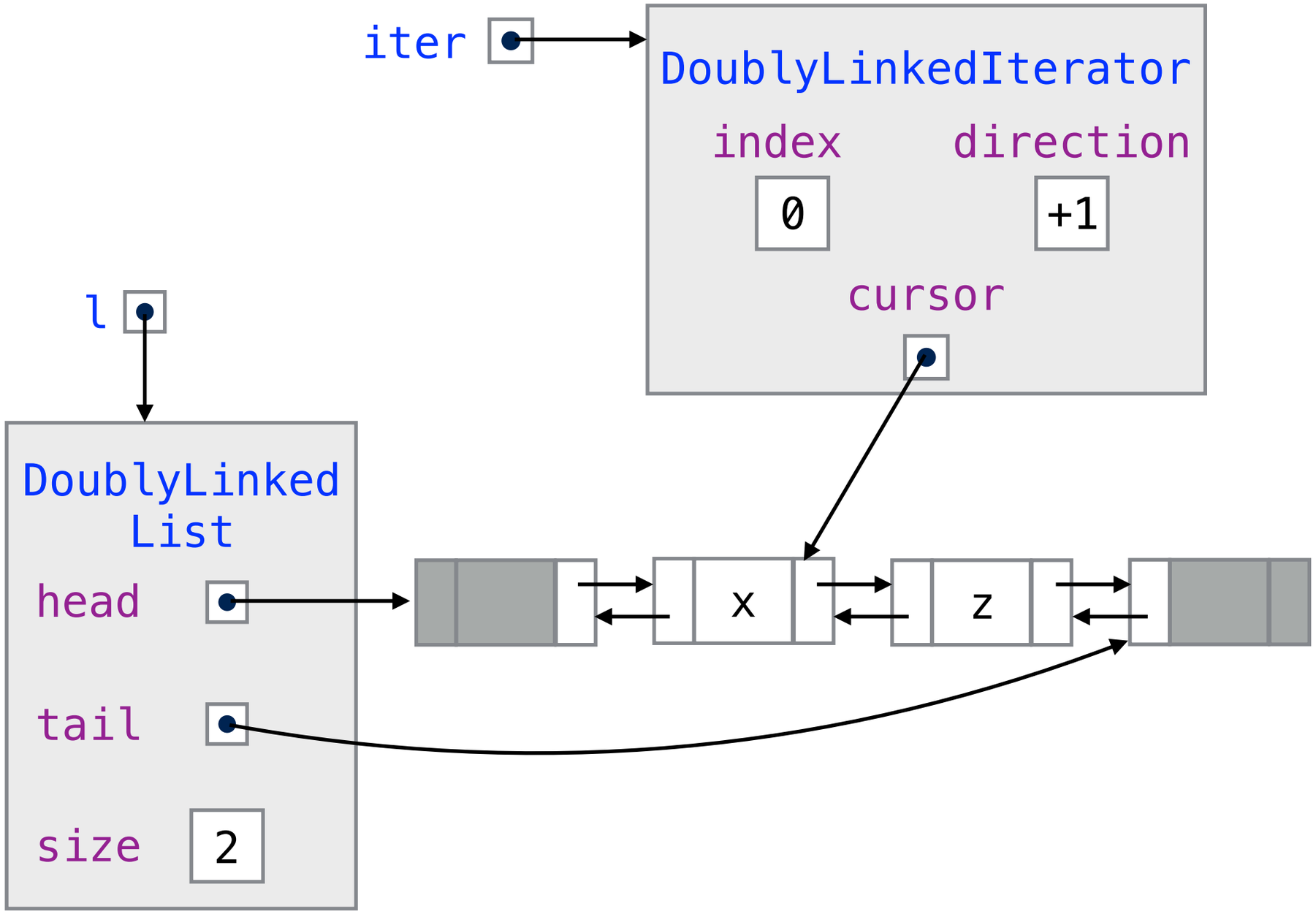


iter.previous()

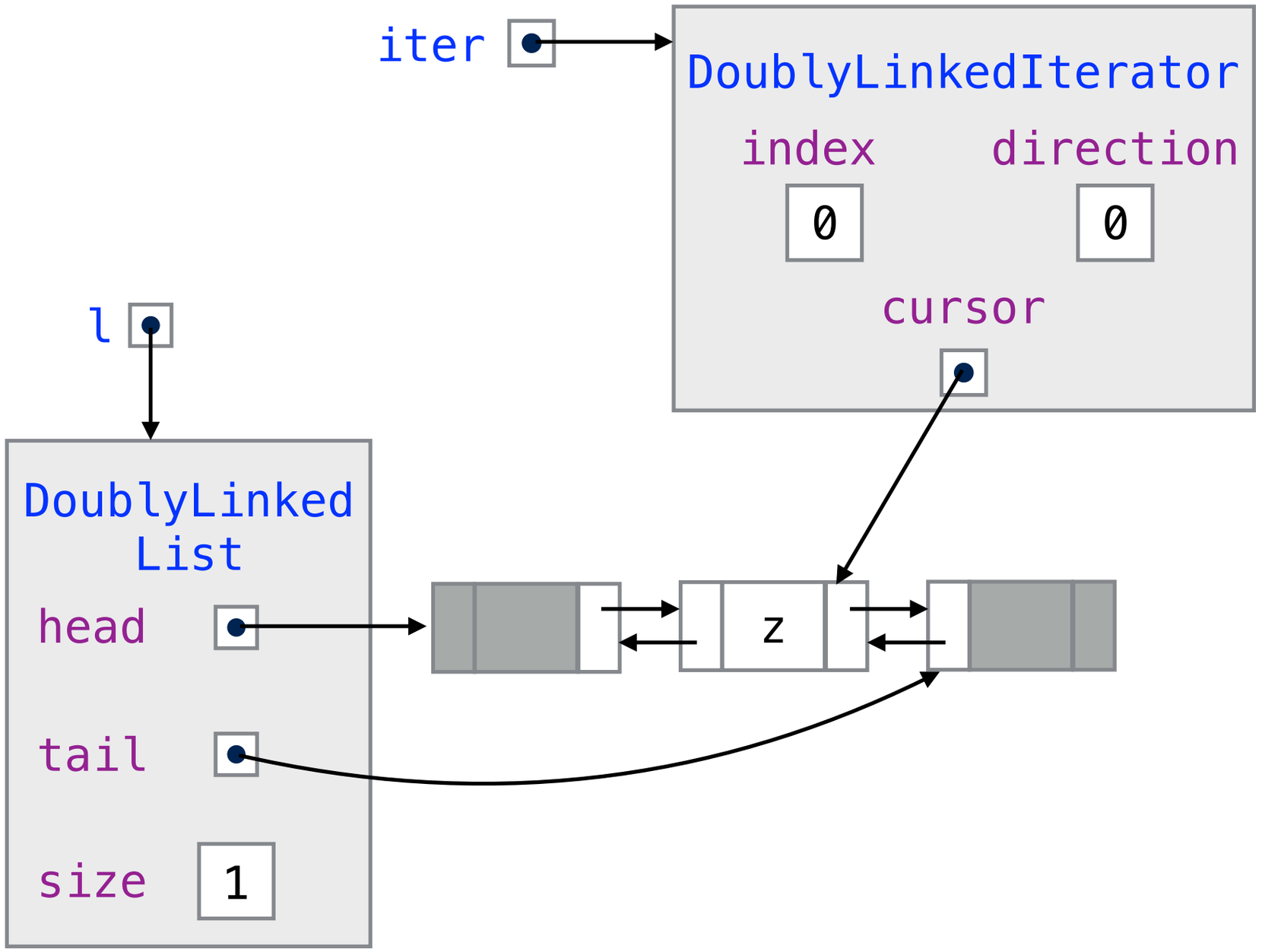

iter
DoublyLinkedIterator
index
direction
0
+1
cursor
l
DoublyLinked List
head
tail
size
2
x
z


x


iter
DoublyLinkedIterator
index
direction
0
+1
cursor
l
DoublyLinked
List
head
tail
size
2
x
z


iter
DoublyLinkedIterator
index
direction
0
+1
cursor
l
DoublyLinked List
head
tail
size
2
x
z

iter.remove()


iter
DoublyLinkedIterator
index
direction
0
0
cursor
l
DoublyLinked
List
head
tail
size
1
z

iter.remove()