Iterators

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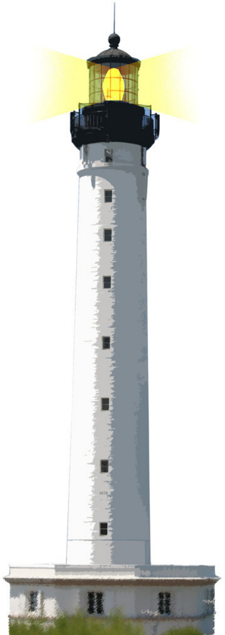
W3S09

http://www.pharo.org



What You Will Learn

- Understand the power of iterators
- Offer an overview of iterators

Pharo code is Compact!

```
ArrayList<String> strings = new ArrayList<String>();
for(Person person: persons)
   strings.add(person.name());
```

is expressed as

```
strings := persons collect: [ :person | person name ]
```

- Yes in Java 8.0 it is finally simpler

```
strings = persons.stream().map(person -> person.getName())
```

- But it is like that in Pharo since day one!
- Iterators are deep into the core of the language and libraries

A First Iterator - collect:

collect: applies the block to each element and returns a collection (of the same kind than the receiver) with the results

```
#(2 −3 4 −35 4) collect: [ :each | each abs ]
> #(2 3 4 35 4)
```

- collect: evaluates the block for each element (using value:)
- In the block, each element is sent abs (absolute)
- collect: returns a new collection (of the same kind of the receiver) with all results
- [Think object] We ask the collection to do something for us

Another collect: Example

We want to know if each elements is odd or even

```
#(16 11 68 19) collect: [ :i | i odd ]
```

```
> #(false true false true)
```

Choose your camp!

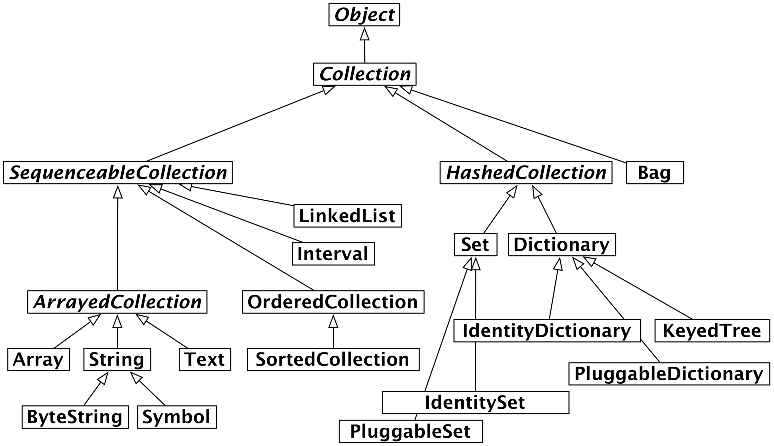
```
#(16 11 68 19) collect: [ :i | i odd ]
```

We can also do it that way! (We copied the definition of collect:)

```
| result |
aCol :=  #(16 11 68 19).
result := aCol species new: aCol size.
1 to: aCollection size do:
   [ :each | result at: each put: (aCol at: each) odd ].
^ result
```

Part of the Collection Hierarchy

Iterators work polymorphically on the entire collection hierarchy. Below a part of the Collection hierarchy.



Think objects!

- With iterators we **tell** the collection to **iterate on itself**
- As a client we do not have to know the internal logic of the collection
- Each collection can implement differently the iterator

Basic Iterators Overview

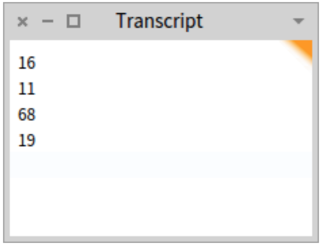
- do: (iterate)
- collect: (iterate and collect results)
- select: (select matching elements)
- reject: (reject matching elements)
- detect: (get first element matching)
- detect:ifNone: (get first element matching or a default value)
- includes: (test inclusion)
- and a lot more...

do: an Action on Each Clement

- Iterates on each elements
- Applies the block on each elements

```
#(16 11 68 19) do: [ :each | Transcript show: each ; cr ]
```

Here we print each element and insert a carriage return



```
16
11
68
19
```

select: Elements Matching a Criteria

To select some elements, use select:

```
#(16 11 68 19) select: [ :i | i odd ]
> #(11 19)
```

With Unary Messages, No Block Needed

When a block is just one message, we can pass an unary message selector

```
#(16 11 68 19) select: [ :i | i odd ]
```

is equivalent to

```
#(16 11 68 19) select: #odd
```

reject: Some Elements Matching a Criteria

To filter some elements, use reject:

```
#(16 11 68 19) reject: [ :i | i odd ]
> #(16 68)
```

detect: The First Elements That...

To find the first element that matches, use detect:

```
#(16 11 68 19) detect: [ :i | i odd ]
> 11
```

detect:ifNone:

To find the first element that matches else return a value, use detect:ifNone:

```
#(16 12 68 20) detect:  [ :i | i odd ] ifNone: [ 0 ]
> 0
```

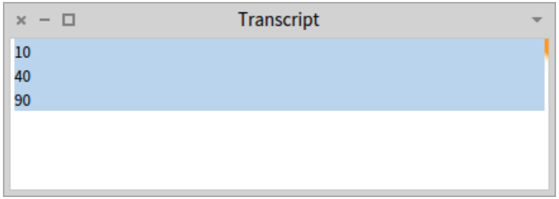
Some Powerful Iterators

- anySatisfy: (tests if one object is satisfying the criteria)
- allSatisfy: (tests if all objects are satisfying the criteria)
- reverseDo: (do an action on the collection starting from the end)
- doWithIndex: (do an action with the element and its index)
- pairsDo: (evaluate aBlock with my elements taken two at a time.)
- permutationsDo: ...

Iterating Two Structures

To iterate with:do:

```
#(1 2 3)
   with:  #(10 20 30)
   do: [ :x :y | Transcript show: (y * x) ; cr ]
```



```
10
40
90
```

with:do: requires two structures of the same length

Use do:separatedBy:

```
String streamContents: [ :s |
   #('a' 'b' 'c')
      do: [ :each | s << each ]
      separatedBy: [ s << ', ' ]
]
> 'a, b, c'
```

Grouping Elements

To group elements according to a grouping function:
groupedBy:

```
#(1 2 3 4 5 6 7) groupedBy: #even
> a OrderedDictionary(false->#(1 3 5 7) true->#(2 4 6) )
```

Flattening Results

How to remove one level of nesting in a collection? Use flatCollect:

```
#( #(1 2) #(3) #(4) #(5 6)) collect: [ :each | each ]
> #(#(1 2) #(3) #(4) #(5 6)))
```

```
#( #(1 2) #(3) #(4) #(5 6)) flatCollect: [ :each | each ]
> #(1 2 3 4 5 6 )
```

Opening The Box

- You can learn and discover the system
- You can define your own iterator
- For example how do: is implemented?

```
SequenceableCollection >> do: aBlock
  "Evaluate aBlock with each of the receiver's elements as the
      argument."

  1 to: self size do: [:i | aBlock value: (self at: i)]
```

Analysis

- Iterators are really powerful because they support polymorphic code
- All the collections support them
- New ones are defined
- Missing controlled navigation as in the Iterator design pattern

Summary

- Iterators are your best friends
- Simple and powerful
- Enforce encapsulation of collections and containers

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