

Hooks and Templates

An application of self-sends are plans for reuse

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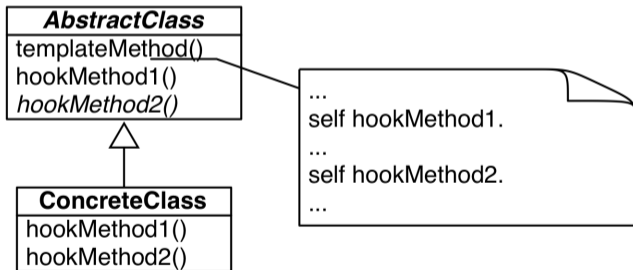
Remember...

- A message send leads to a choice
- A class hierarchy defines the choices
- Code can be reused and refined in subclasses
- Sending a message in a class defines a hook:
 - i.e., a place where subclasses can inject variations



The Template Method

- a template method specifies a skeleton
- the skeleton has hooks, i.e., places to be customized
 - hooks may or may not have a default behavior



printString Template Method

```
(Delay forSeconds: 10) printString  
> 'a Delay(10000 msecs)'
```

```
Object >> printString  
"Answer a String whose characters are a description of the  
  receiver."  
^ self printStringLimitedTo: 50000
```

```
Object >> printStringLimitedTo: limit  
| limitedString |  
limitedString := String  
                  streamContents: [ :s | self printOn: s ]  
                  limitedTo: limit.  
limitedString size < limit ifTrue: [ ^ limitedString ].  
^ limitedString, '...etc...'
```

printOn: Default Hook

```
Node new  
> a Node
```

```
Apple new  
> an Apple
```

Default behavior:

```
Object >> printOn: aStream  
"Append to the argument, aStream, a sequence of characters  
that identifies the receiver."  
| title |  
title := self class name.  
aStream  
  nextPutAll: (title first isVowel ifTrue: [ 'an ' ] ifFalse: [ 'a ' ] );  
  nextPutAll: title
```



printOn: Refinement

```
(Delay forSeconds: 1)  
> a Delay(1000 msecs)
```

Reusing and extending default behavior:

```
Delay >> printOn: aStream  
super printOn: aStream.  
aStream  
  nextPutAll: '(';  
  print: millisecondDelayDuration;  
  nextPutAll: ' msecs)'
```

printOn: Redefinition

```
true not  
> false
```

Redefinition in False:

```
False >> printOn: aStream  
aStream nextPutAll: 'false'
```

printOn: Redefinition

```
1 to: 100  
> (1 to: 100)  
1 to: 100 by: 3  
> (1 to: 100 by: 3)
```

Redefinition in Interval:

```
Interval >> printOn: aStream  
aStream  
  nextPut: $(;  
  print: start;  
  nextPutAll: ' to: '  
  print: stop.  
step ~= 1  
  ifTrue: [ aStream nextPutAll: ' by: '; print: step ].  
aStream nextPut: $)
```



Another Template Method: Object Copy

- copying objects is complex:
 - graph of connected objects
 - cycles
 - each class may want a different copy strategy
- simple solution for simple cases: `copy/postCopy`



Object Copy

`Object >> copy`

"Answer another instance just like the receiver. Subclasses typically override `postCopy`. Copy is a template method in the sense of Design Patterns. So do not override it. Override `postCopy` instead. Pay attention that normally you should call `postCopy` of your superclass too."

`^ self shallowCopy postCopy`

`Object >> shallowCopy`

"Answer a copy of the receiver which shares the receiver's instance variables. Subclasses that need to specialize the copy should specialize the `postCopy` hook method."

`<primitive: 148>`

...



Default hook

`Object >> postCopy`

"I'm a hook method in the sense of Design Patterns
TemplateHook/Methods. I'm called by copy. self is a
shallow copy, subclasses should copy fields as necessary
to complete the full copy"

`^ self`



postCopy: Refinement

```
Collection subclass: #Bag  
instanceVariableNames: 'contents'  
classVariableNames: ''  
package: 'Collections-Unordered'
```

```
Bag >> postCopy  
super postCopy.  
contents := contents copy
```

postCopy: Deeper copy

Dictionary >> postCopy

"Must copy the associations, or later store will affect both the original and the copy"

```
array := array collect: [ :association |  
  association ifNotNil: [ association copy ] ]
```

Conclusion

- Template Method is a very common design pattern
- Sending a message defines a hook
- Sending a message increases potential reuse



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