Creating Flexible Interfaces

Based on POODR Chapter 4

Requests, not Objects

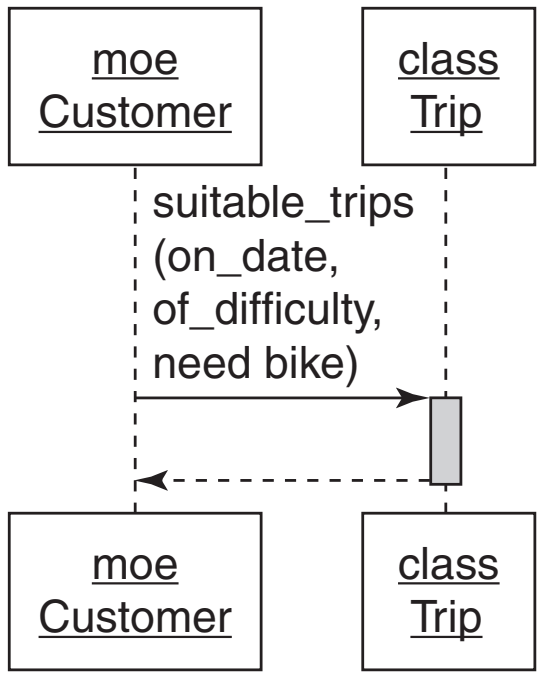
- Domain objects correspond to nouns —
  - easy to find, but:
  - *not* at the design center of your application.
  - can be a *trap* for the unwary: important objects may be missing
- Sequence diagrams are a vehicle for exposing, experimenting with, and ultimately defining [the requests that pass between objects, that is,] ... interfaces.
- “I need to send this message, who should respond to it?” is the first step [towards more flexible applications].
- You don’t send messages because you have objects, you have objects because you send messages.

Objects Behave

Focus *Not* on the data in an object, but on

- the requests that are made on it (its *interface*)
- the requests that it makes of its collaborators

- Think about "co-data" rather than data
- *Any* object can be represented without data
  - *except* for the stream of requests that has been made of it (with their arguments)



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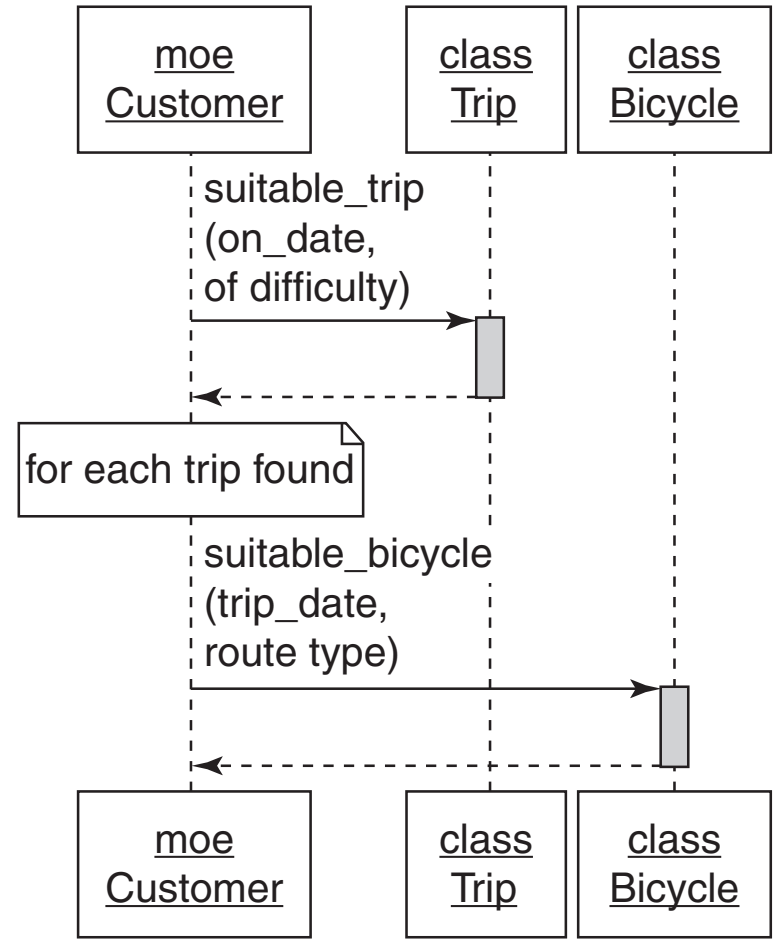

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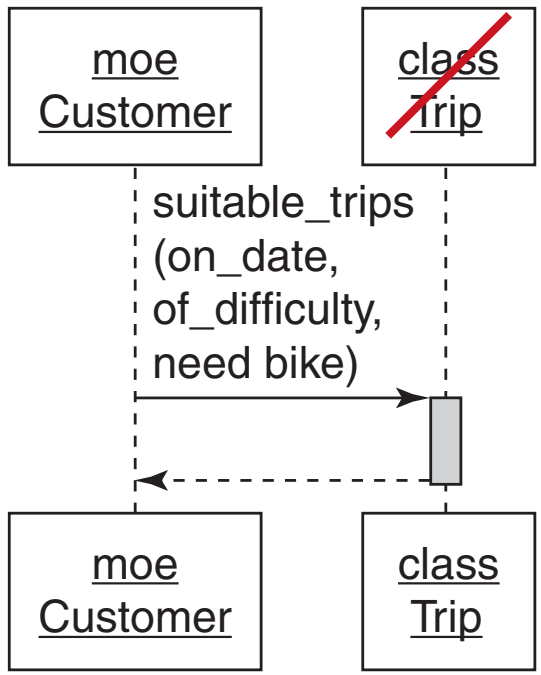

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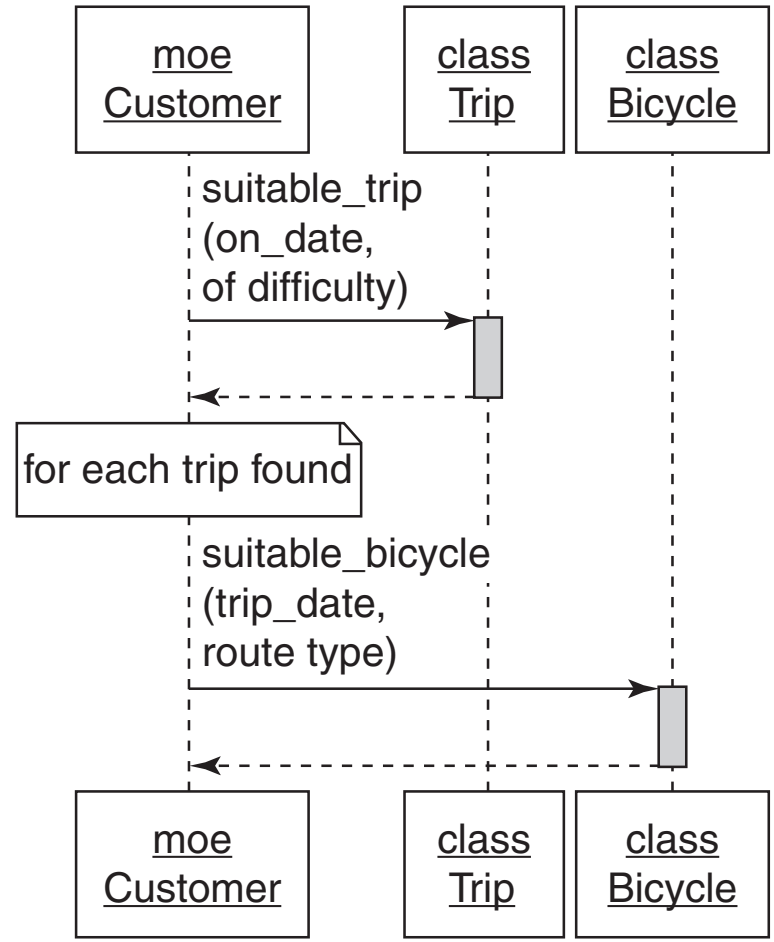

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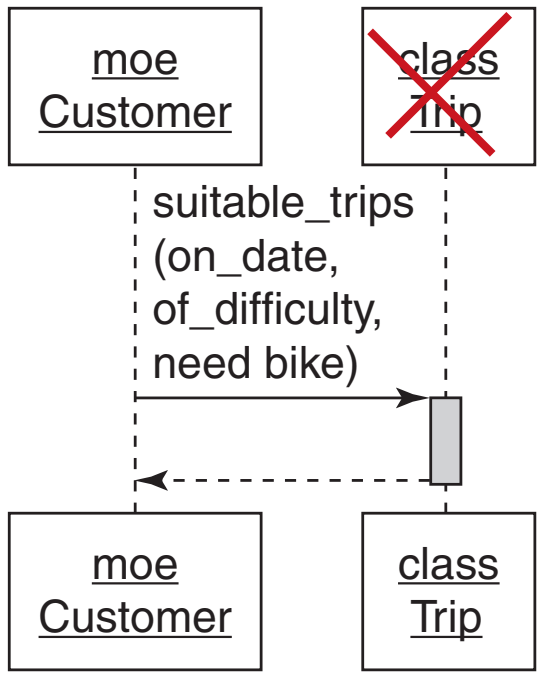

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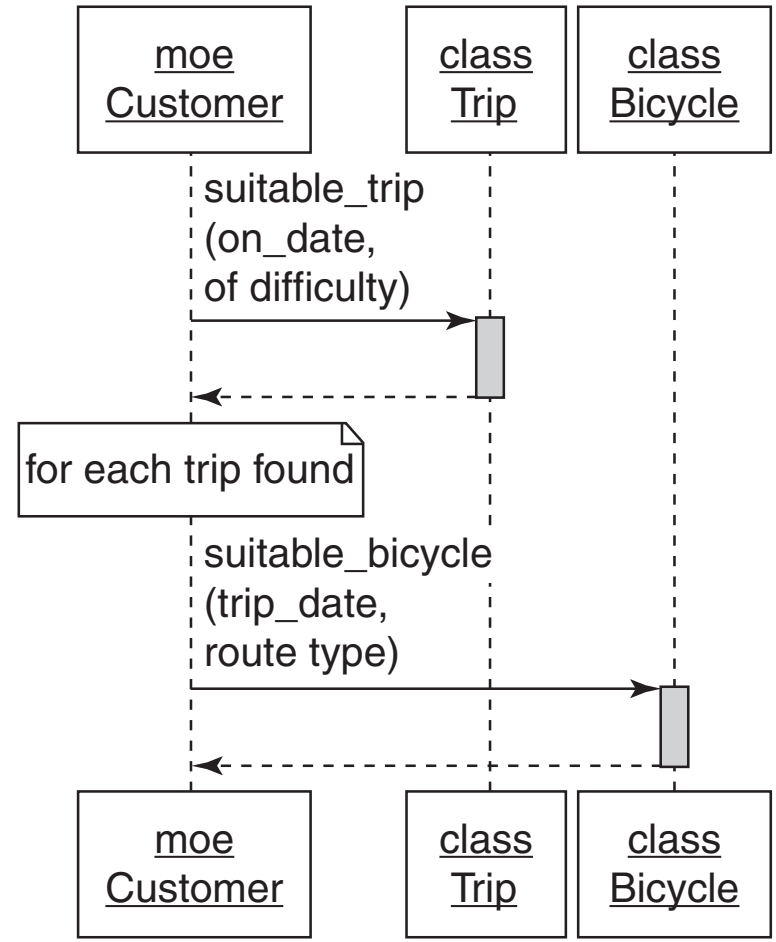

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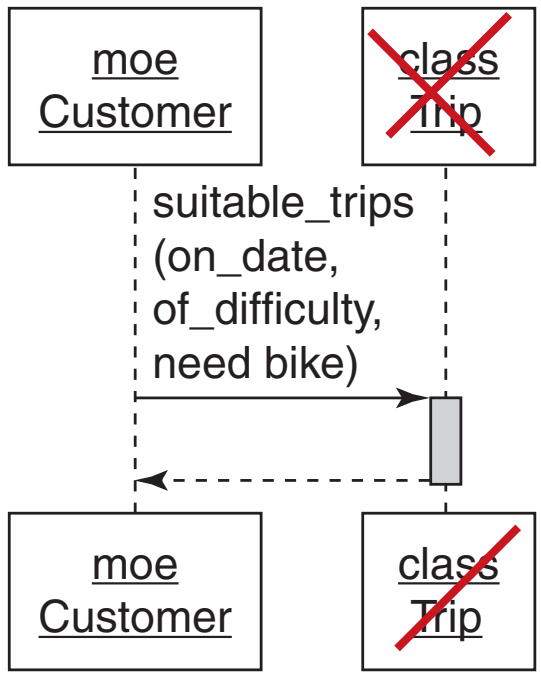

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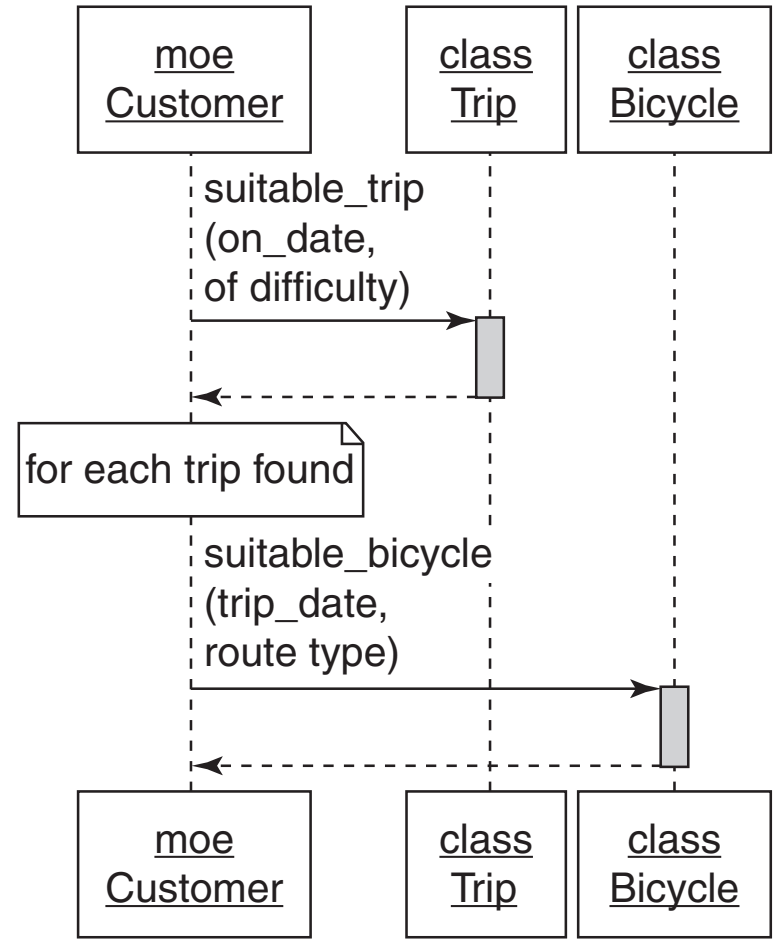

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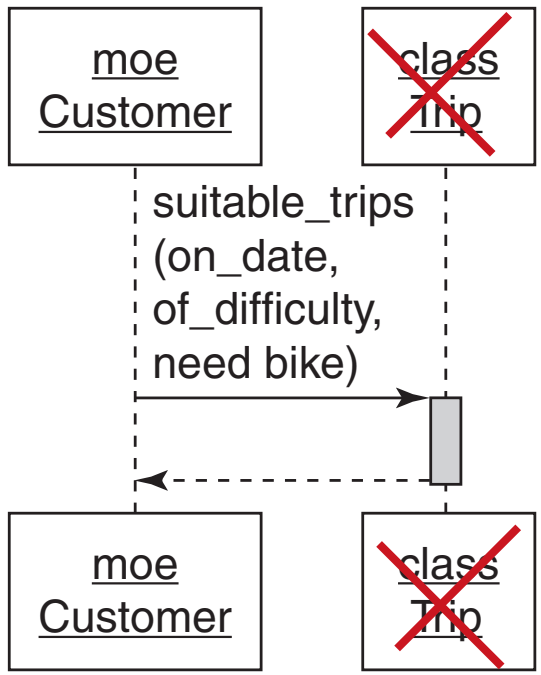

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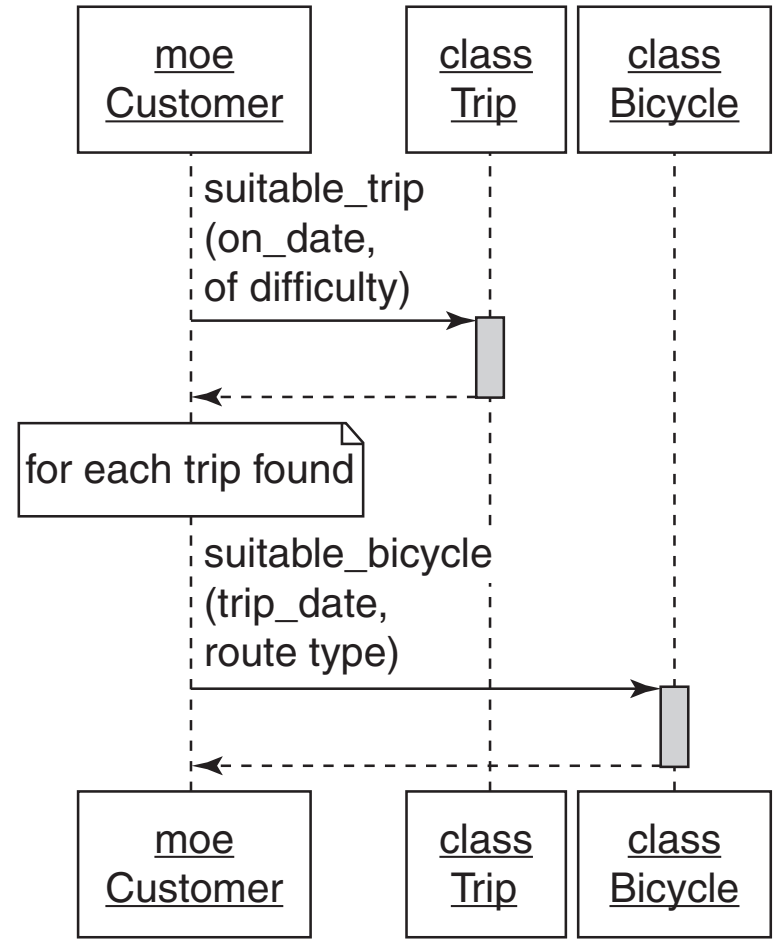

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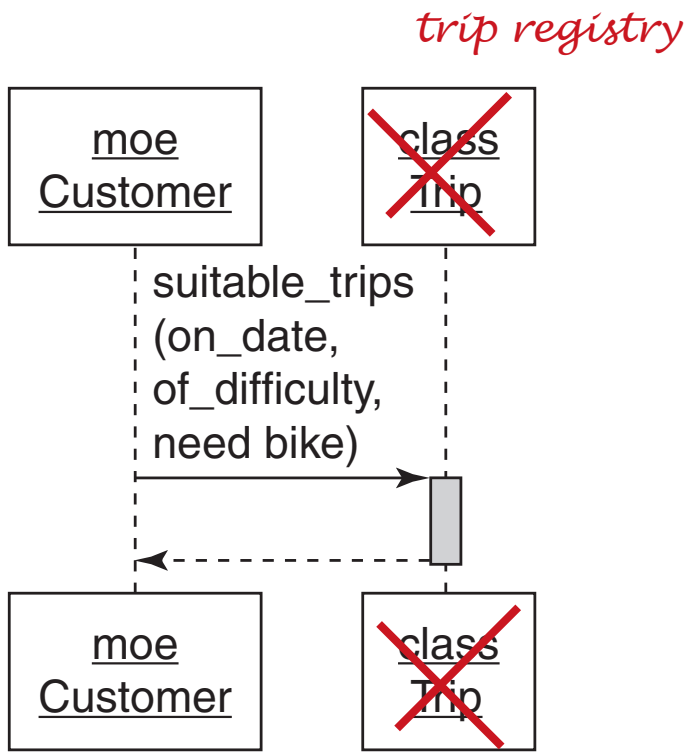

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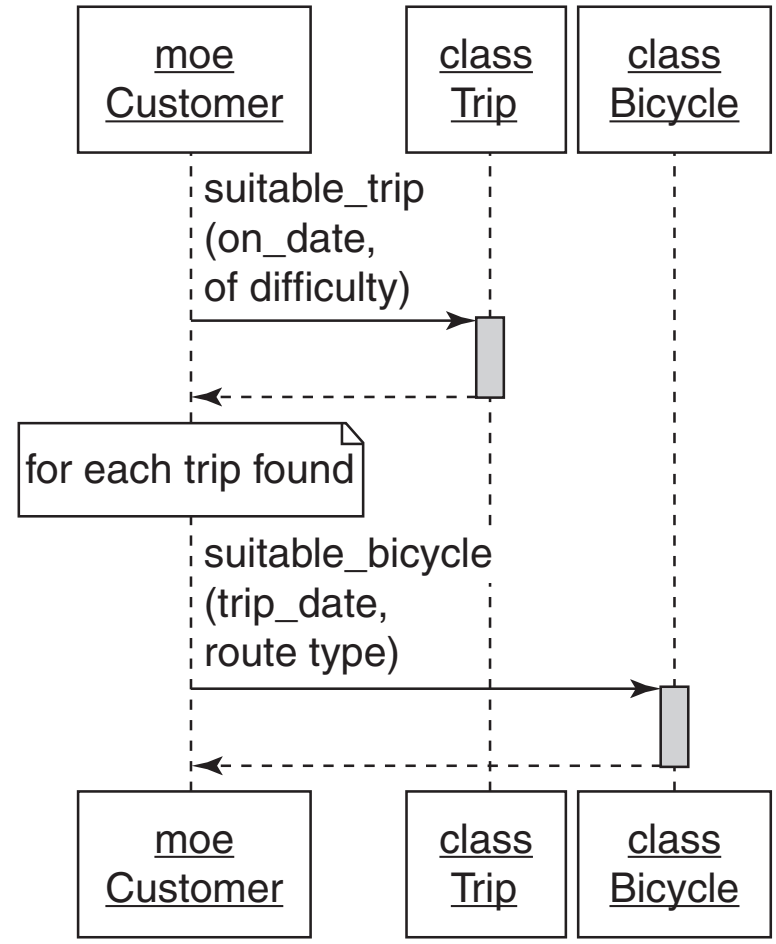

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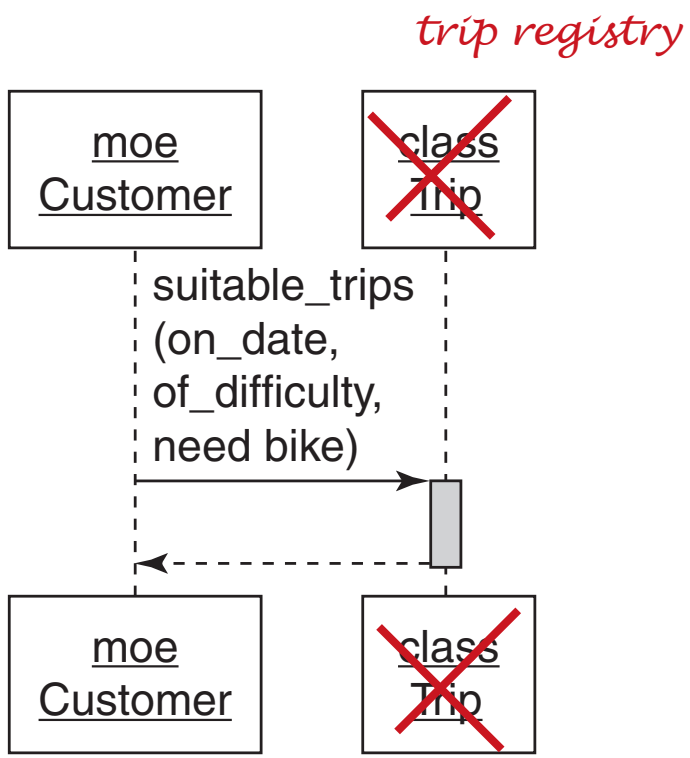

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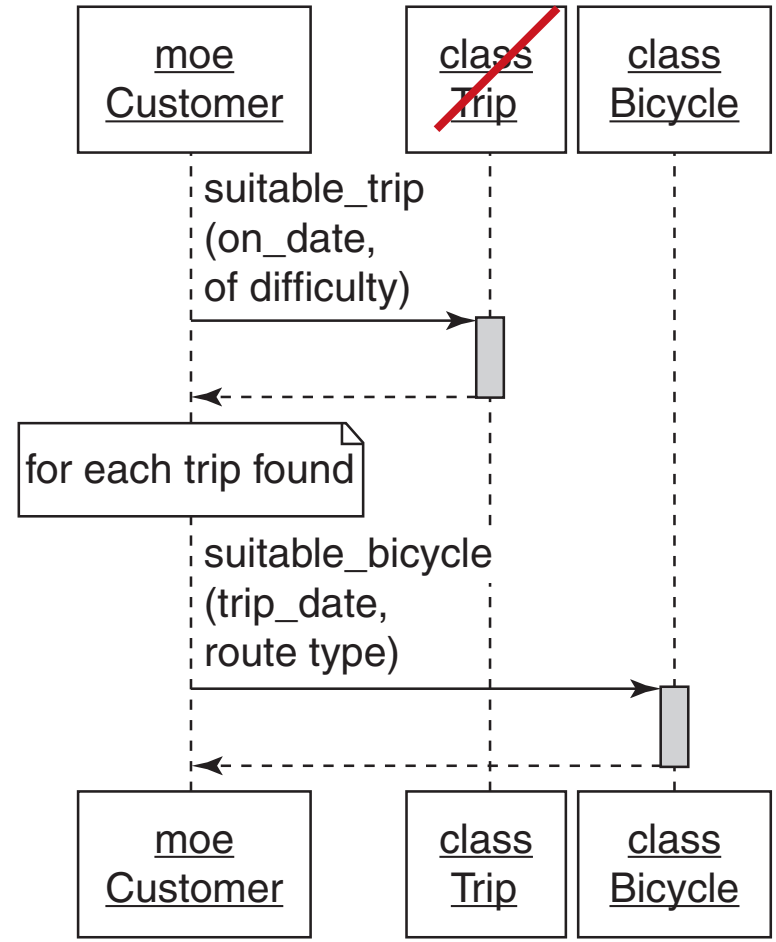

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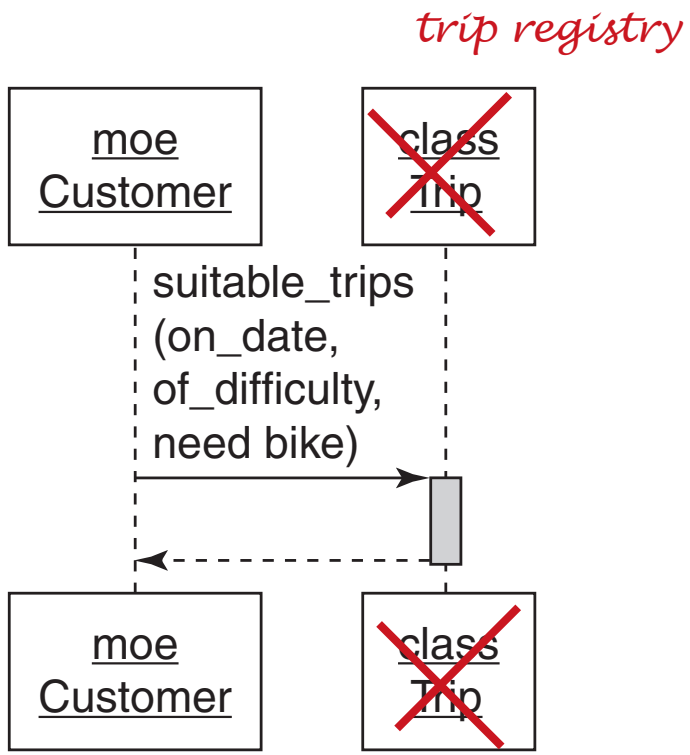

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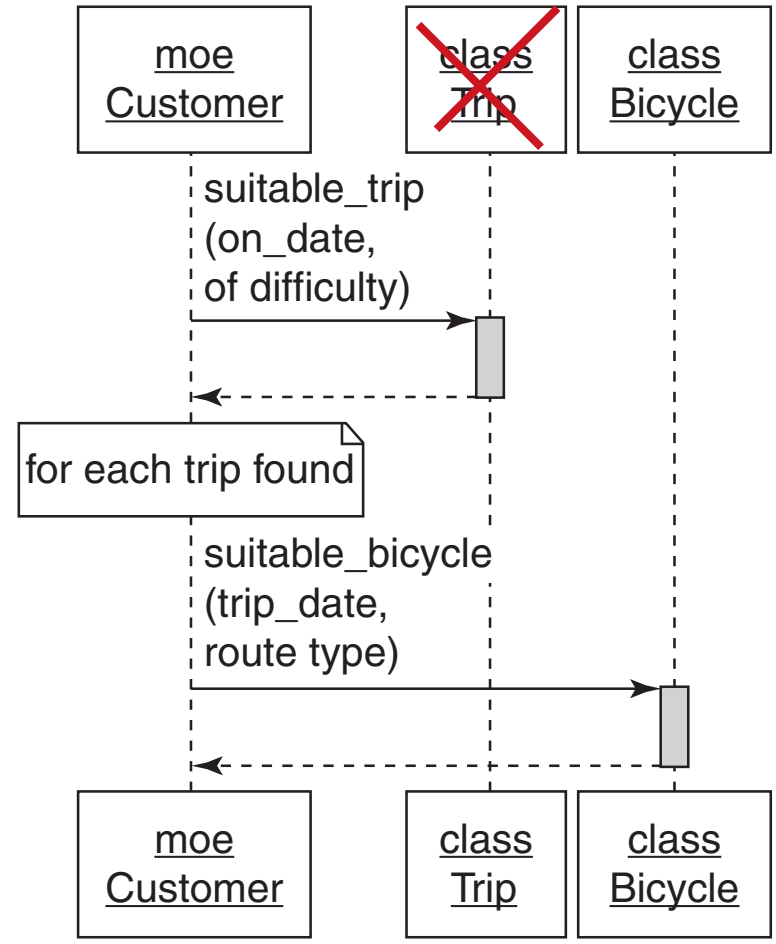

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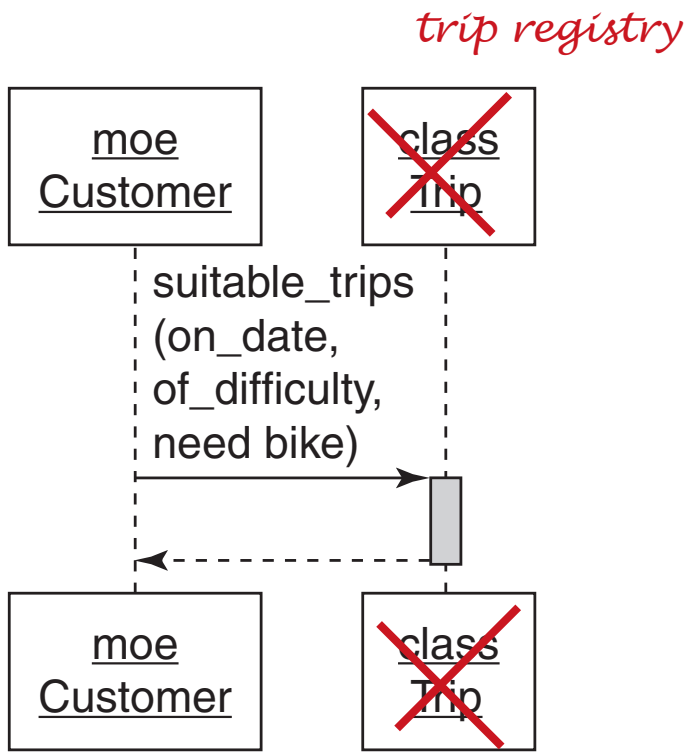

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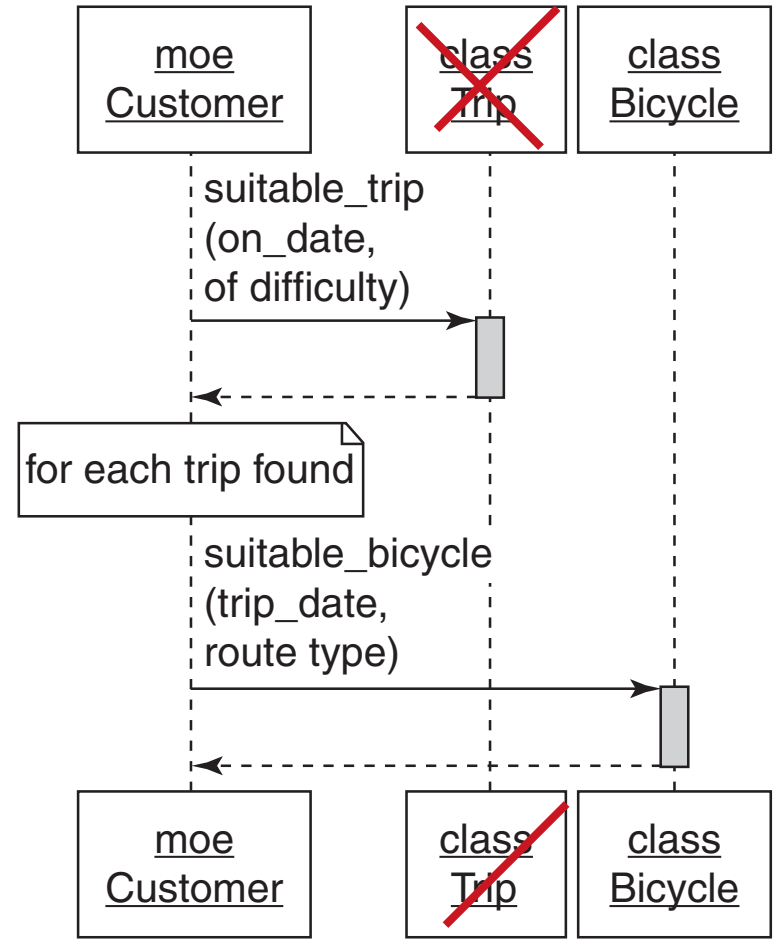

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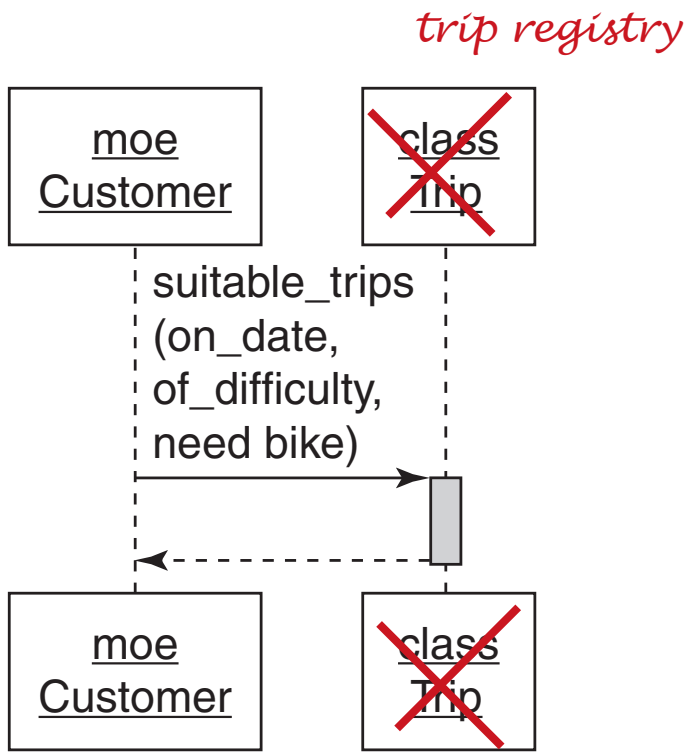

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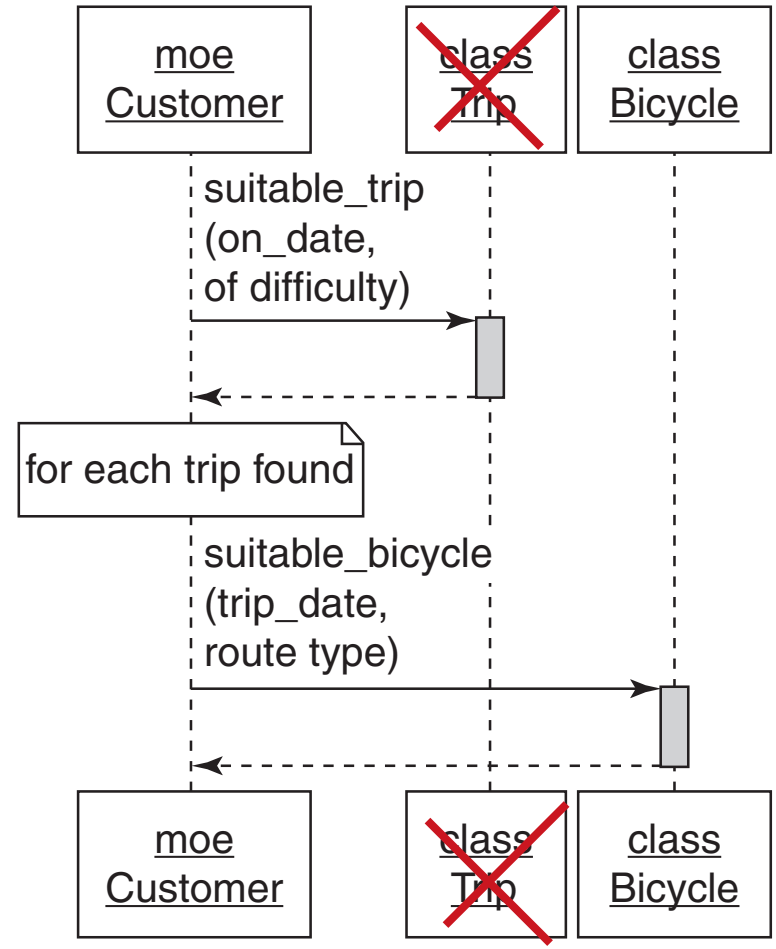

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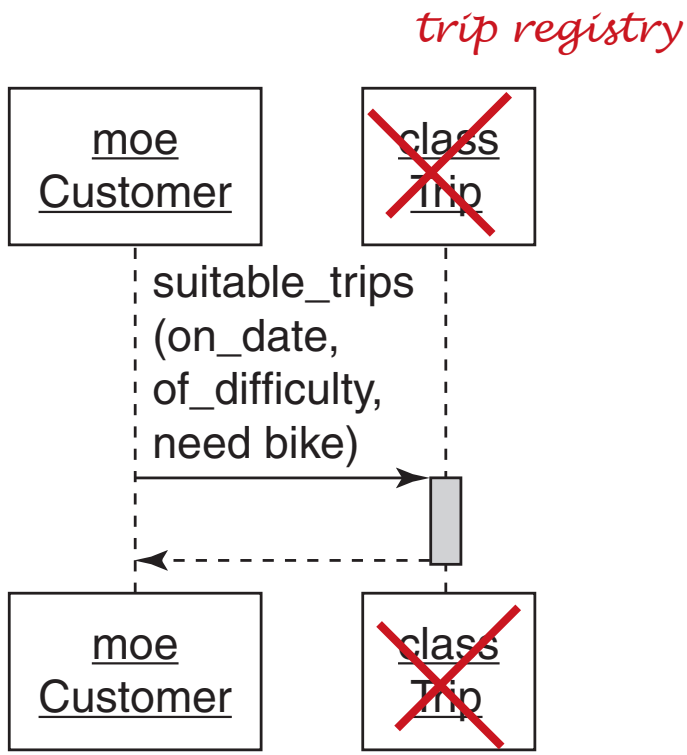

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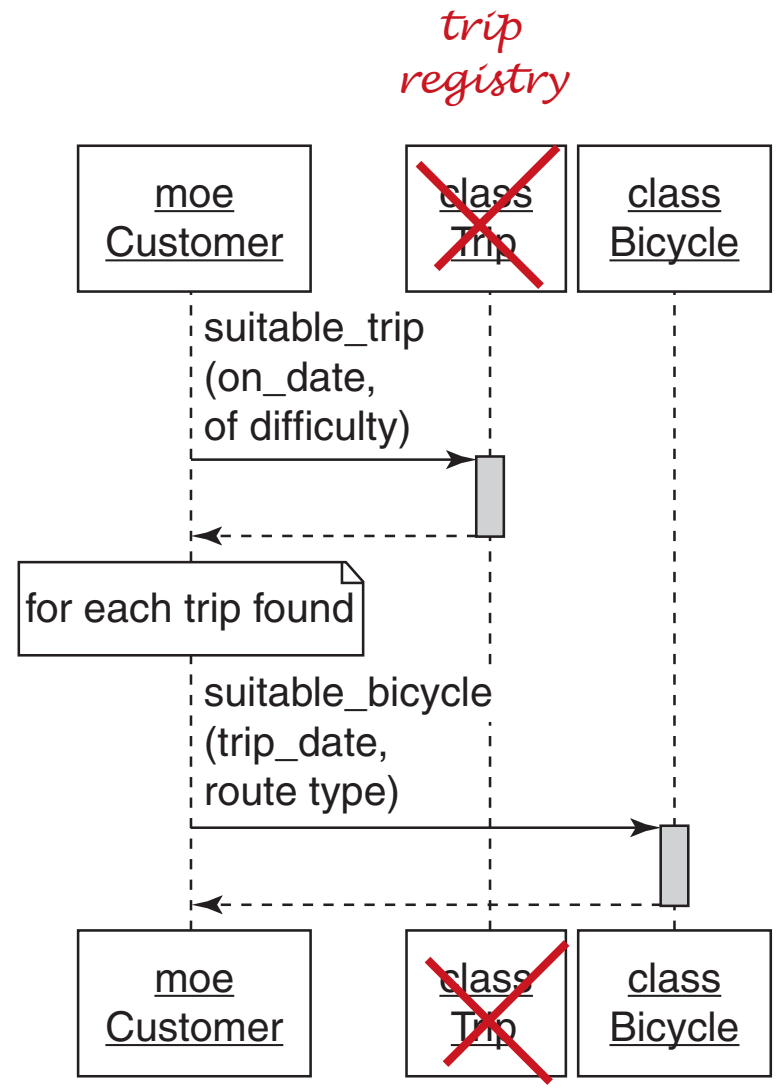

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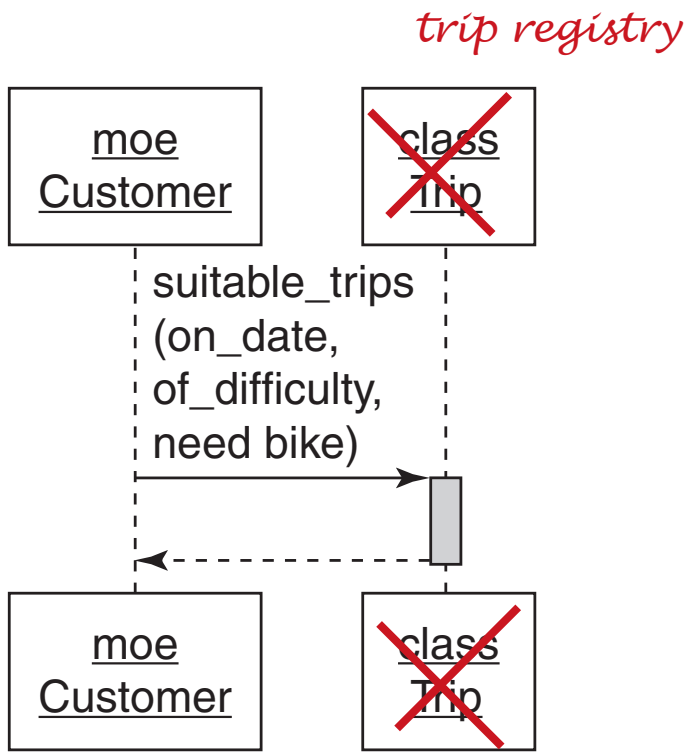

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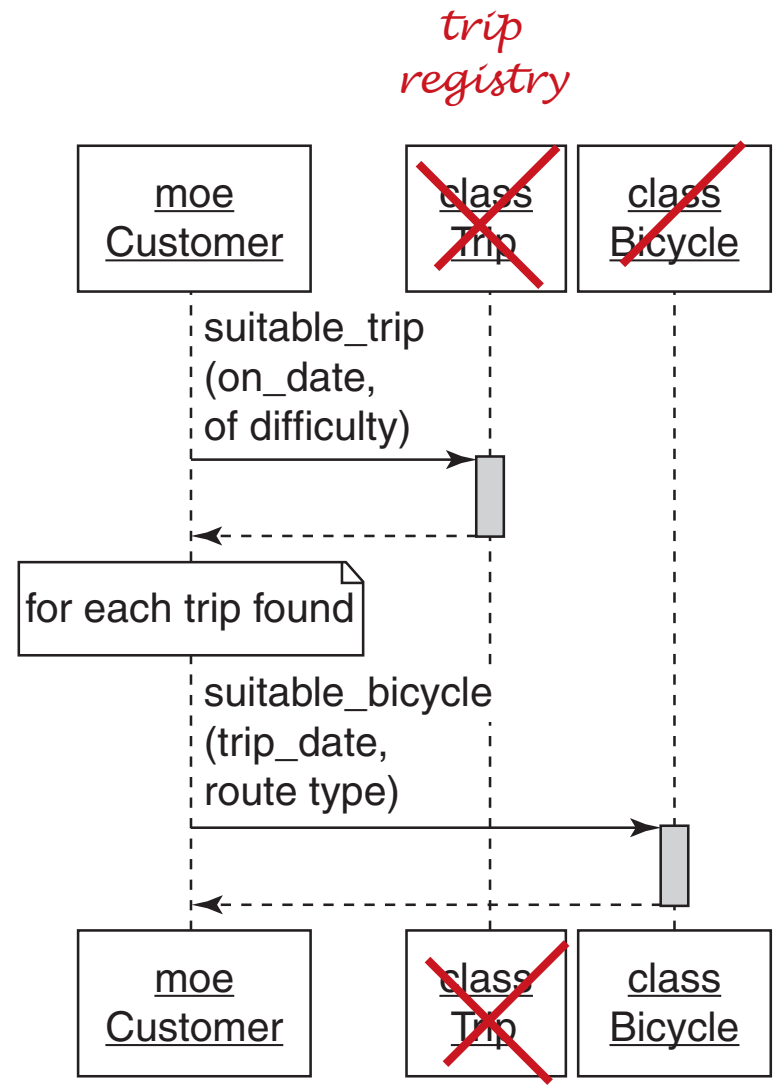

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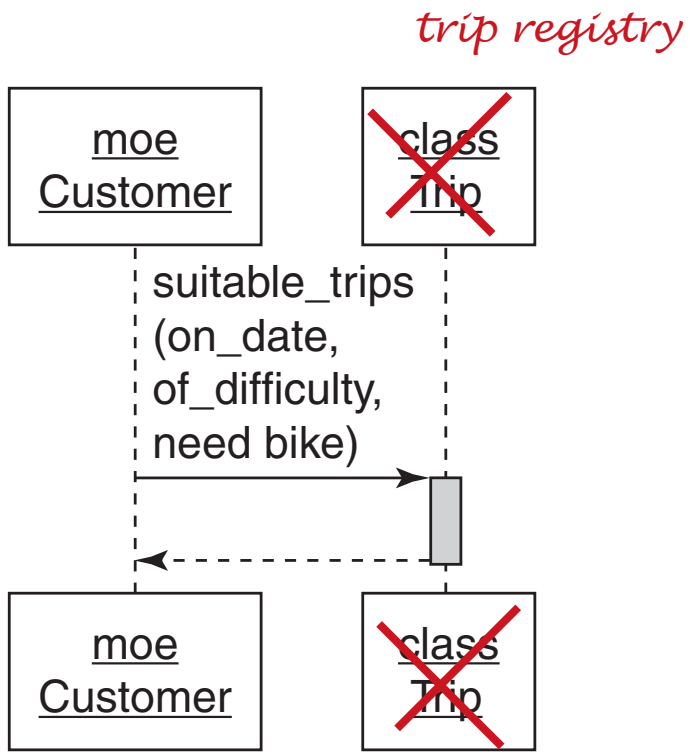

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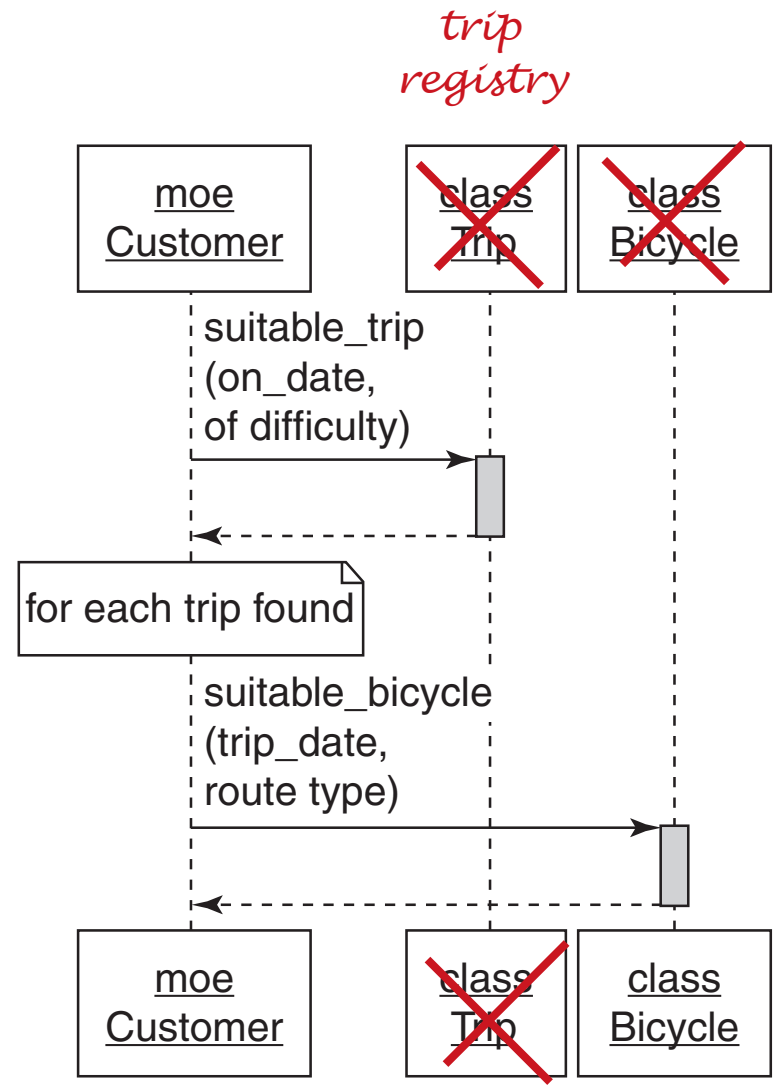

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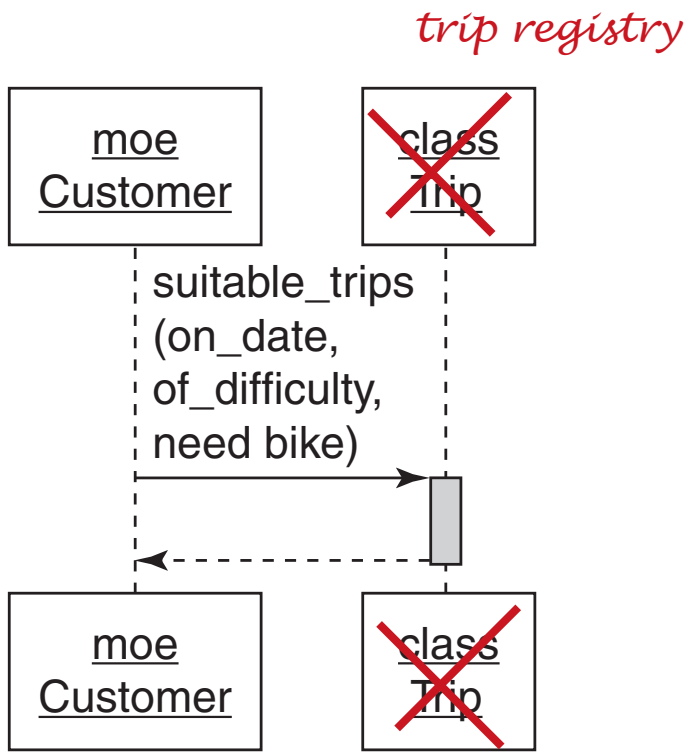

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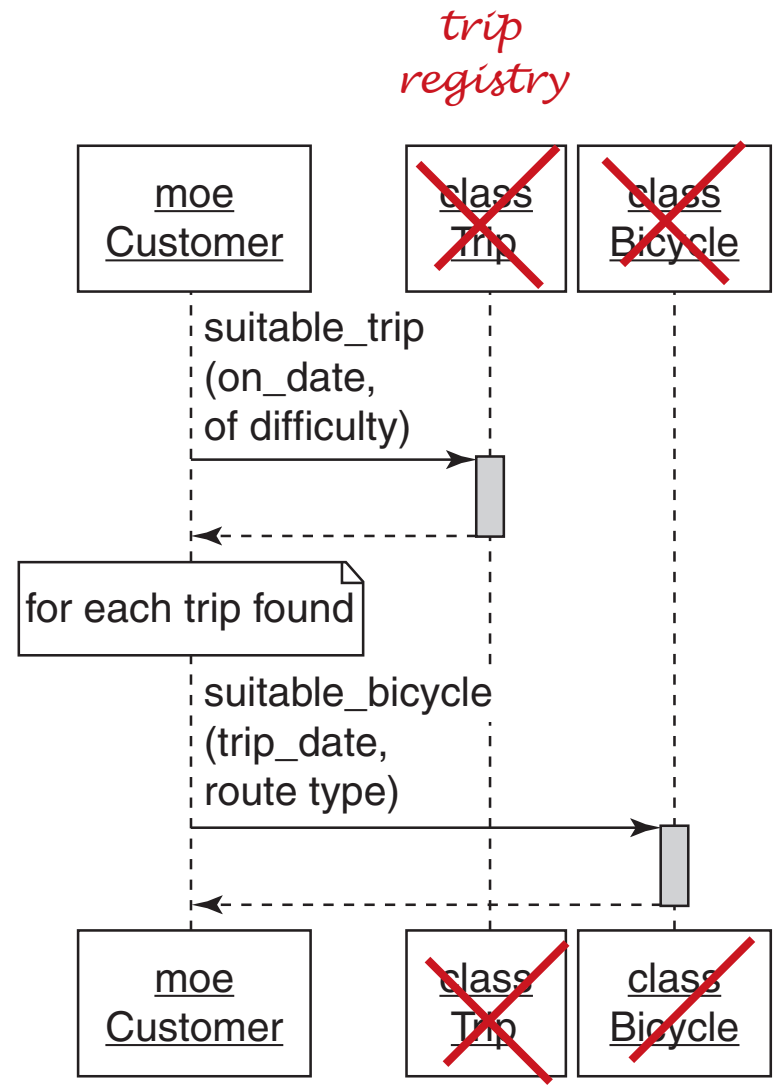

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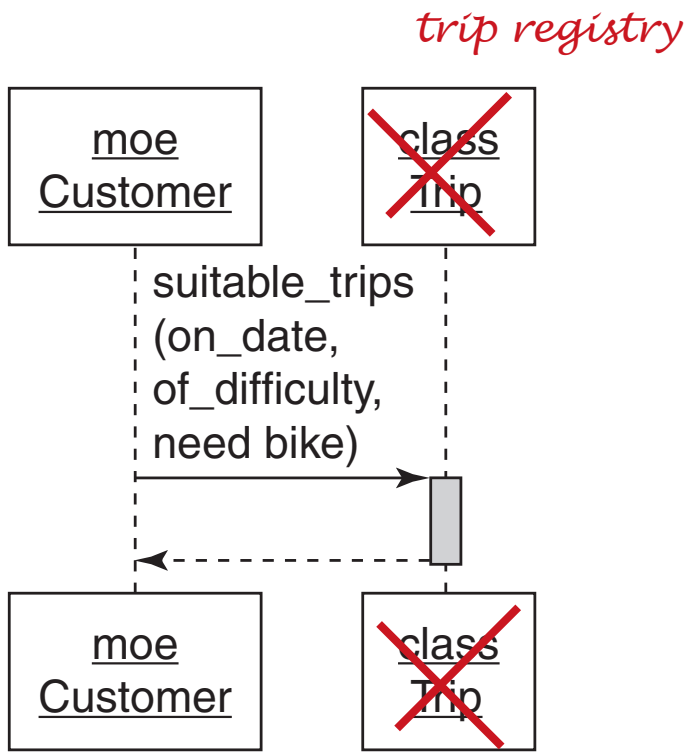

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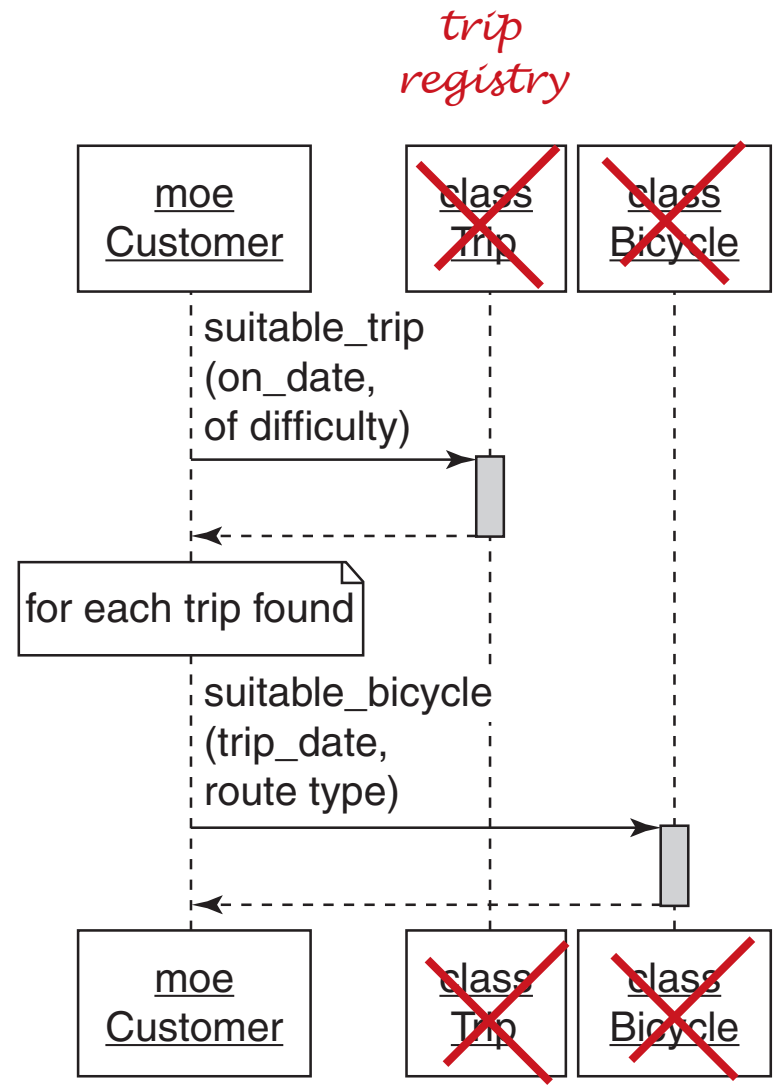

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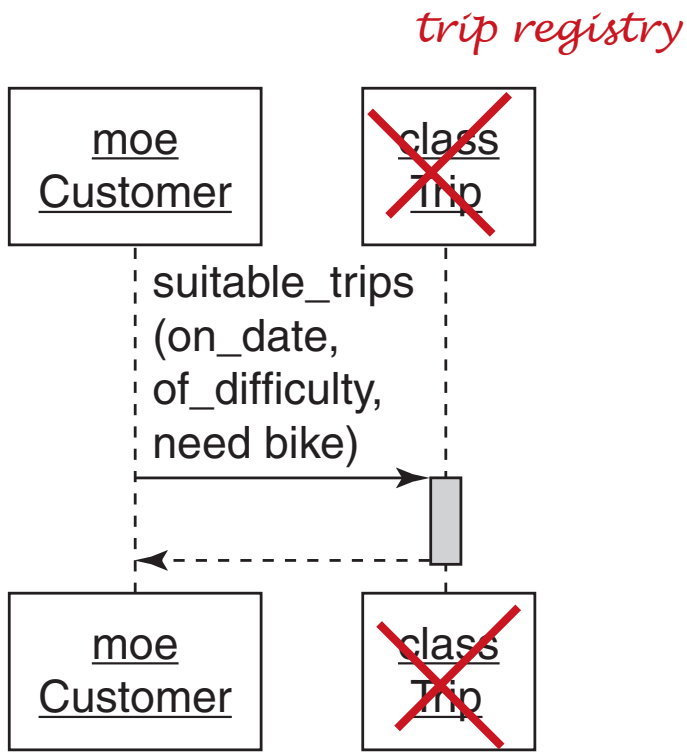

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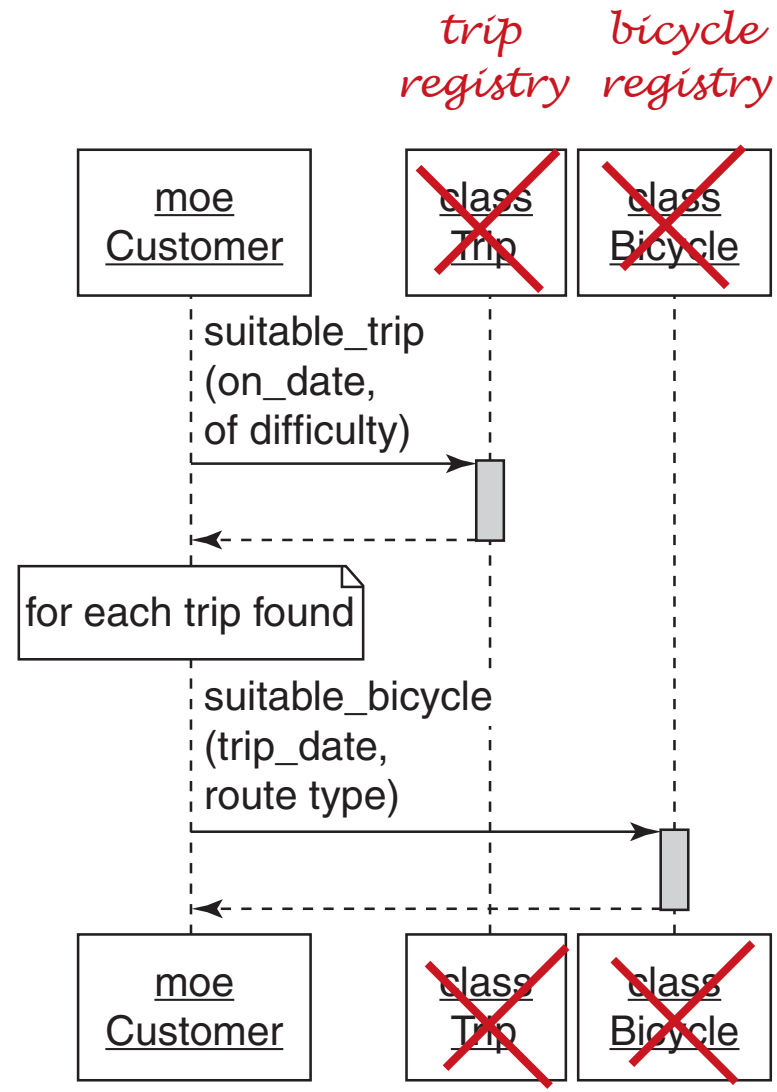

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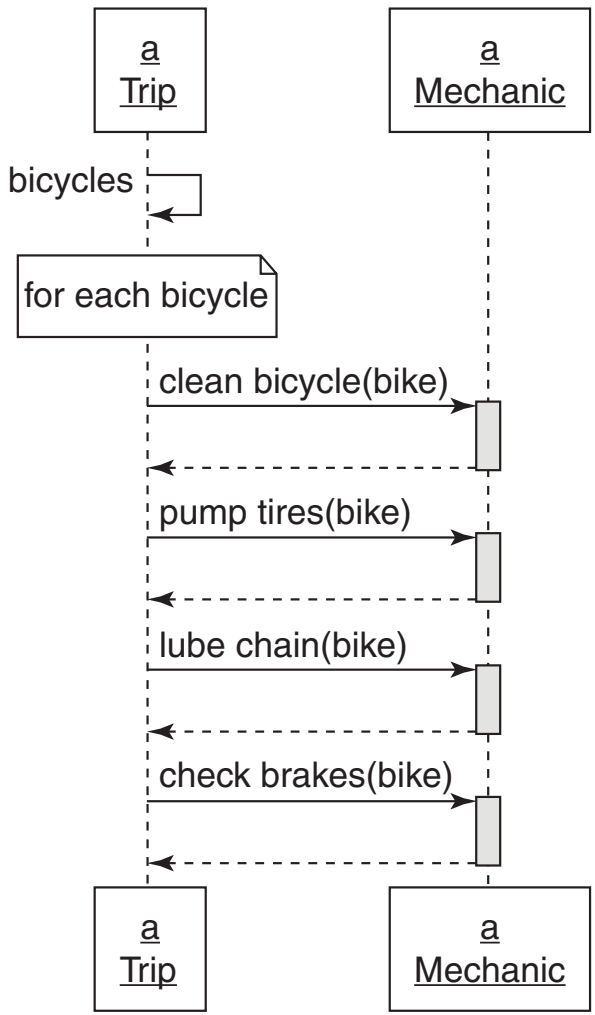


Figure 4.5
A *Trip* tells a *Mechanic* how to prepare each *Bicycle*.

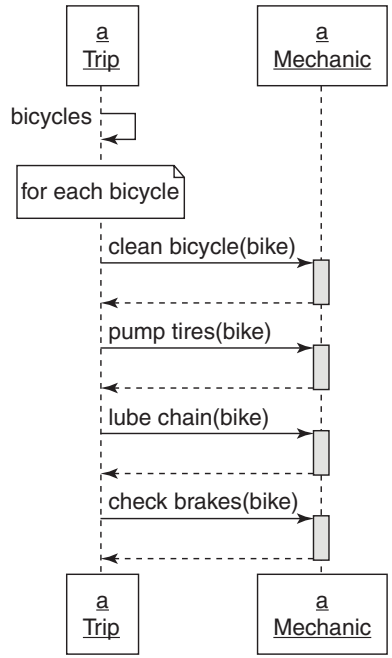
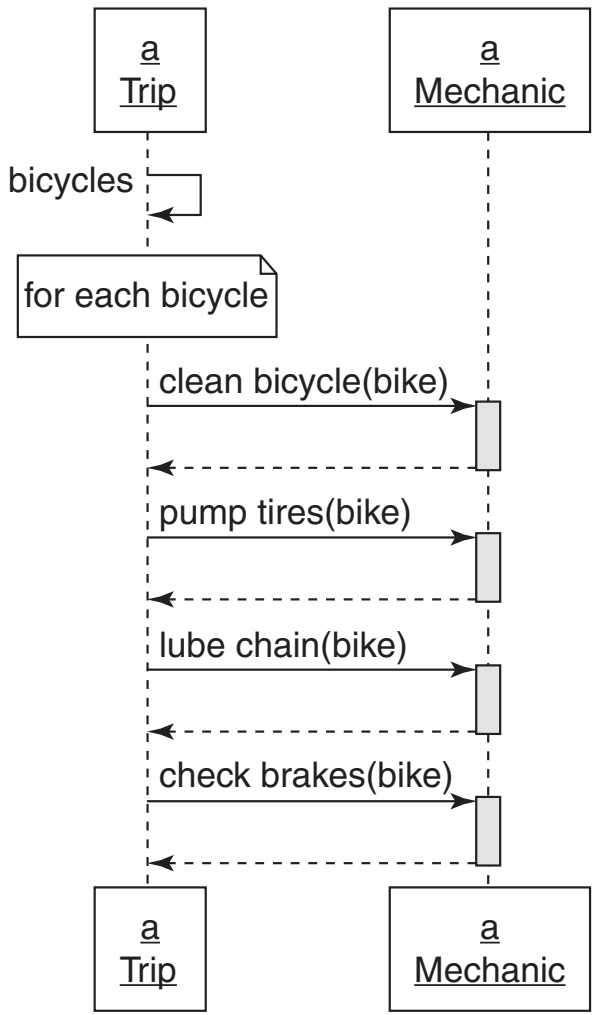


Figure 4.5

Figure 4.5 is quite procedural. A `Trip` tells a `Mechanic` how to prepare a `Bicycle`, almost as if `Trip` were the main program and `Mechanic` a bunch of callable functions. In this design, `Trip` is the only object that knows exactly how to prepare a bike; getting a bike prepared requires using a `Trip` or duplicating the code. `Trip`'s context is large, as is `Mechanic`'s public interface. These two classes are not islands with bridges between them, they are instead a single, woven cloth.

Many new object-oriented programmers start out working just this way, writing procedural code. It's inevitable; this style closely mirrors the best practices of their former procedural languages. Unfortunately, coding in a procedural style defeats the purpose of object orientation. It reintroduces the exact maintenance issues that OOP is designed to avoid.



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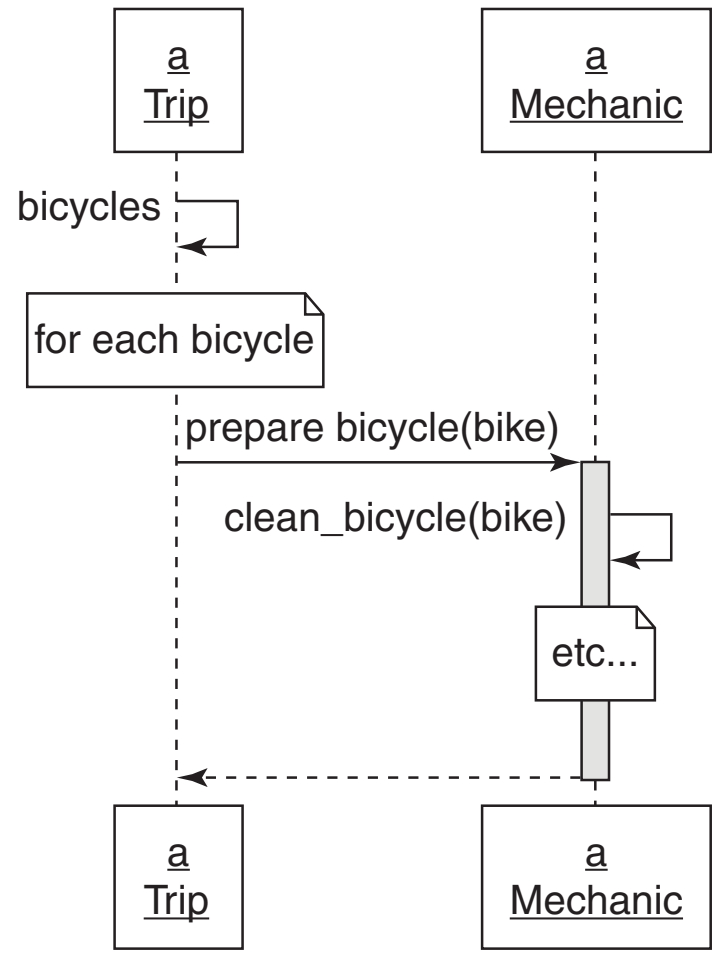
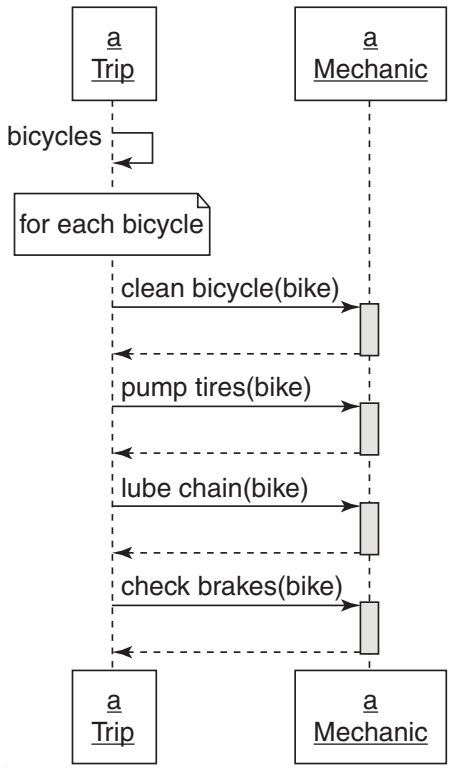


Figure 4.6 A *Trip* asks a *Mechanic* to prepare each *Bicycle*.

Figure 4.6 is more object-oriented. Here, a `Trip` *asks* a `Mechanic` to prepare a `Bicycle`. `Trip`'s context is reduced, and `Mechanic`'s public interface is smaller. Additionally, `Mechanic`'s public interface is now something that any object may profitably use; you don't need a `Trip` to prepare a bike. These objects now communicate in a few well-defined ways; they are less coupled and more easily reusable.

This style of coding places the responsibilities in the correct objects, a great improvement, but continues to require that `Trip` have more context than is necessary. `Trip` still knows that it holds onto an object that can respond to `prepare_bicycle`, and it must *always* have this object.



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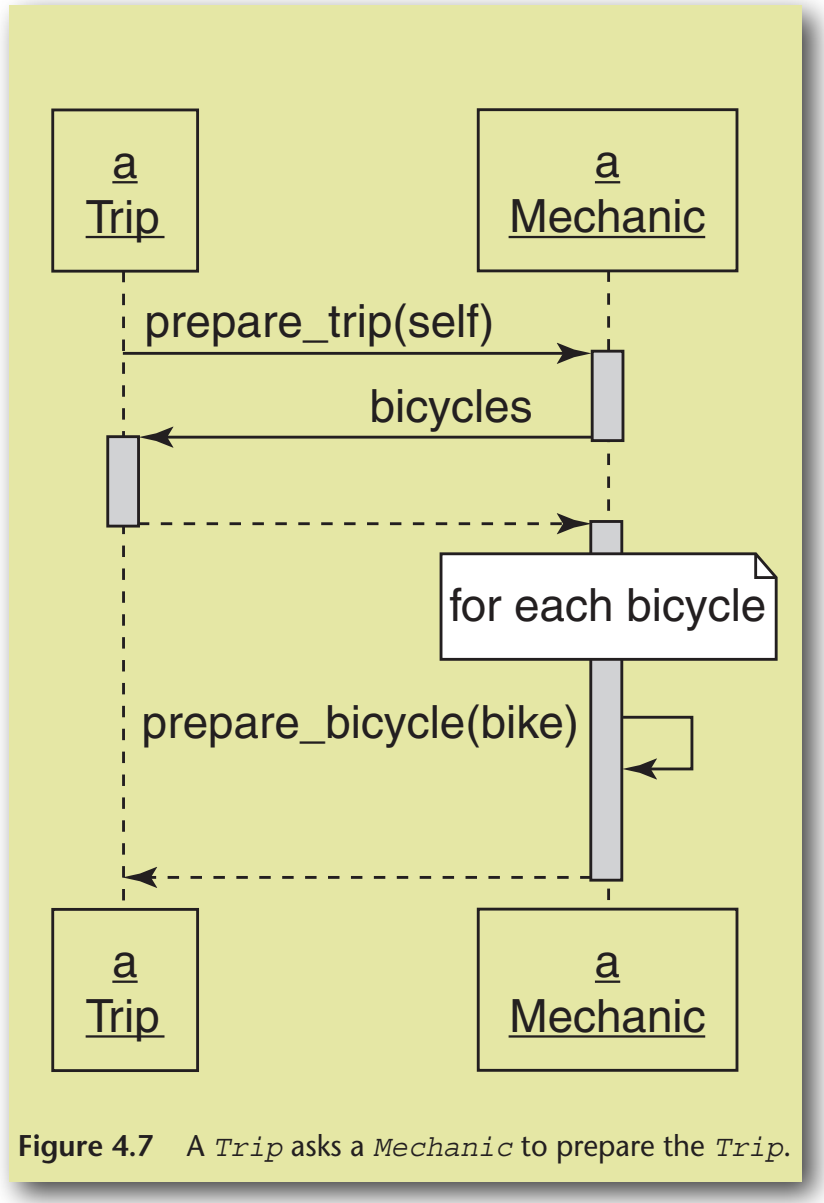

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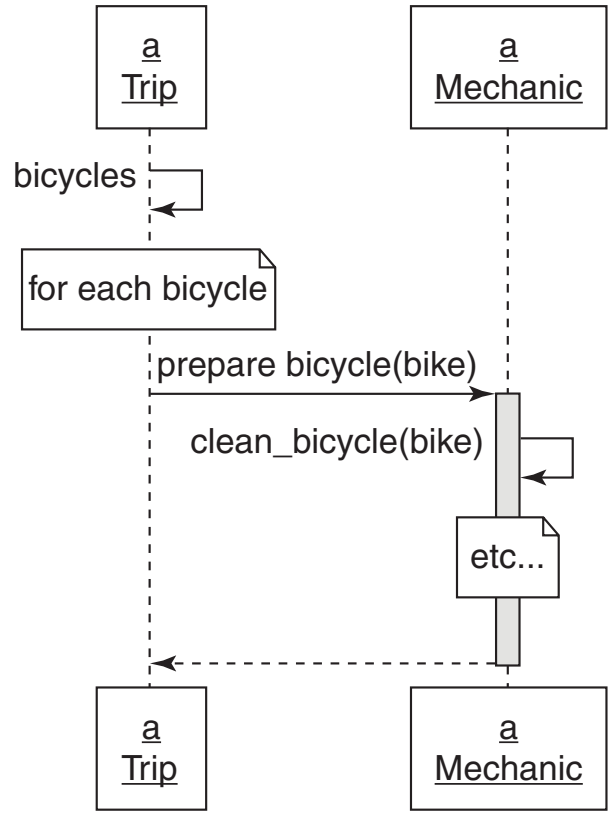

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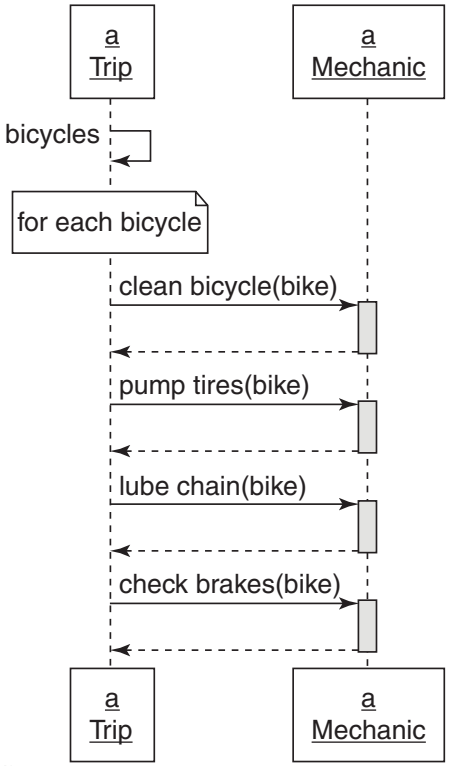

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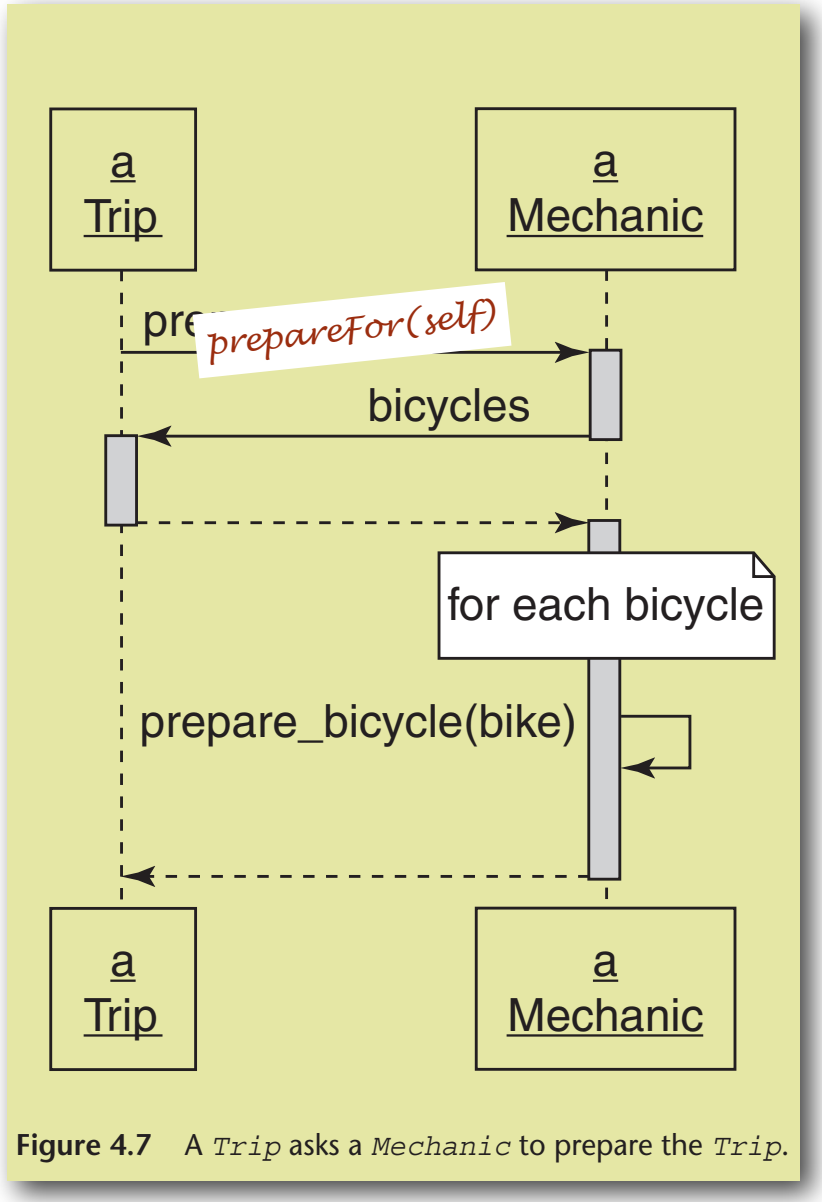

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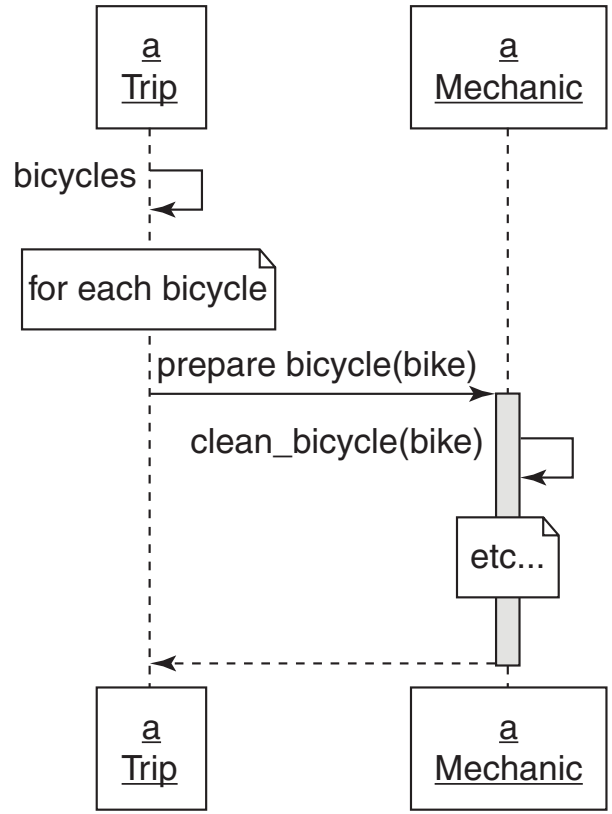

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The **open/closed principle** states that
software entities should be open for extension, but closed for modification

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This blind trust is a keystone of object-oriented design. It allows objects to collaborate without binding themselves to context and is necessary in any application that expects to grow and change.

Forwarding ≠ Delegation

- *Forwarding* a request means asking some other object *assist* to handle the request on your behalf
  - *assist* answers to you, you answer to the original requestor
- *Delegation* means asking another object, *delegate*, to act as *if it were you*
  - *delegate* answers to the original requestor
  - self-request by *delegate* are treated *as if made by you*
- Metz should be arguing to use *forwarding* to avoid train wrecks

Grace note:

- In Grace, methods are by default *public*, and fields are by default *confidential*
- *confidential* means accessible to the object itself, and to the objects that inherit from it.
- you can change the defaults using annotations, *e.g.:*
  - **def** extent **is** *public* = 200@200
    var partner **is** *readable* := nobody
- vars can be readable or writable, as well as fully public
- methods that are not in your interface should be annotated as *confidential*

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    prepareFor(aTrip) → Done
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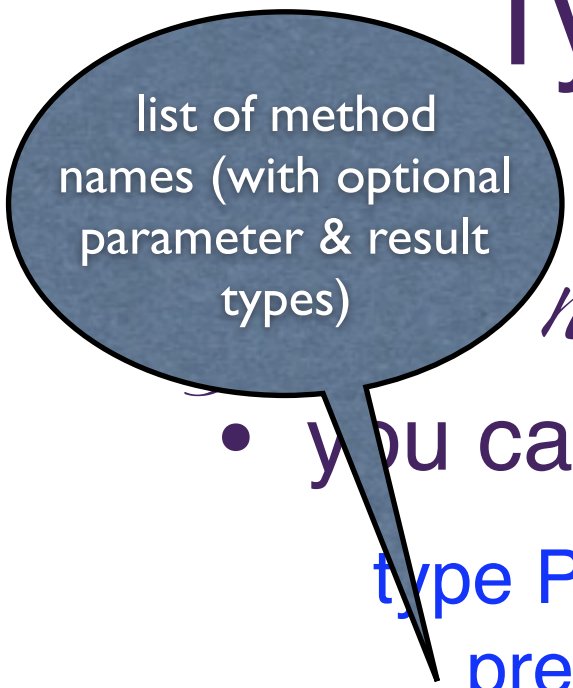

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class mechanic →Preparer { ... }
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    ...
}
```

- and use it to check your class:

```
class mechanic→Preparer{ ... }
```

Types as Interfaces

Grace note:

- you can define a type as an interface

```
type Preparer = interface {
    prepareFor(aTrip) → Done
    ...
}
```

- and use it to check your class:

```
class mechanic→Preparer{ ... }
```

will raise a type error (at runtime) if the new object does not have the right methods

Types as Interfaces

Grace note:

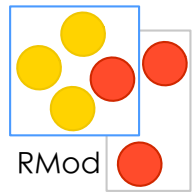
- you can define a type as an interface

```
type Preparer = interface {
    prepareFor(aTrip) → Done
    ...
}
```

- and use it to check your class:

```
class mechanic →Preparer { ... }
```

The Law of Demeter



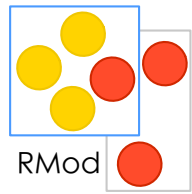
You should send requests only on:

- an argument passed to you
- your own instance variables
- an object you create
- **self, outer**

Avoid global variables

Avoid objects returned from messages sent to others

Correct Requests

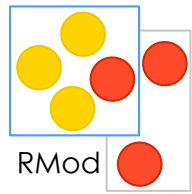



```
method someMethod(aParameter) {
        self.foo
        field.foo
        aParameter.foo
        def myThing := aThing.createNewObject
        myThing.foo
}
```

Talk only to your immediate friends

- Friends of friends are suspect

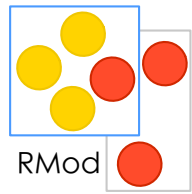
In other words …



- You can play with yourself. this.method(_)
- You can play with your own toys (but you can't take them apart). field.method(_)
- You can play with toys that were given to you. parameter.method(_)
- And you can play with toys you've made yourself.

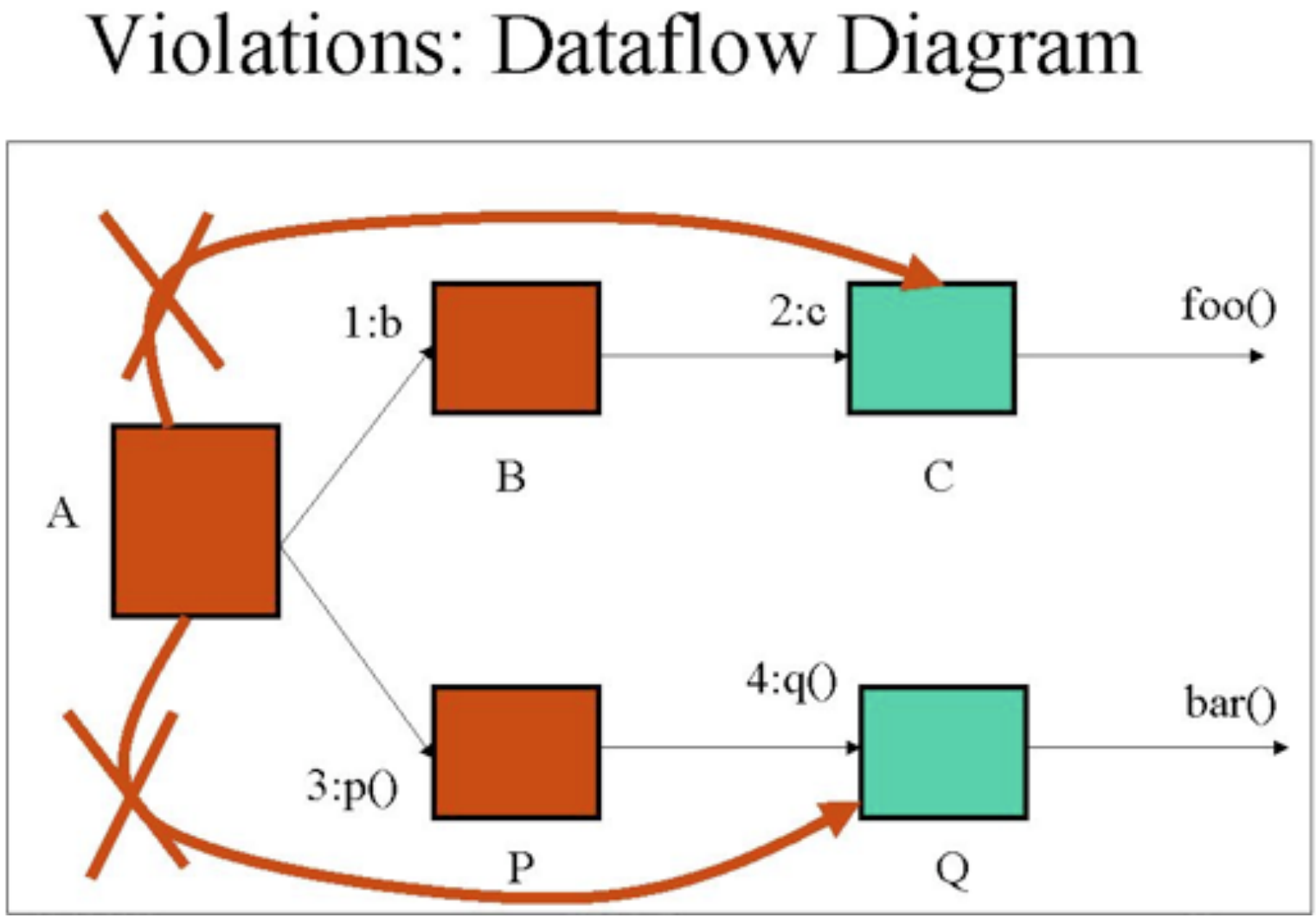
  myA = aFactory.makeA(_); myA.method()

Halt!



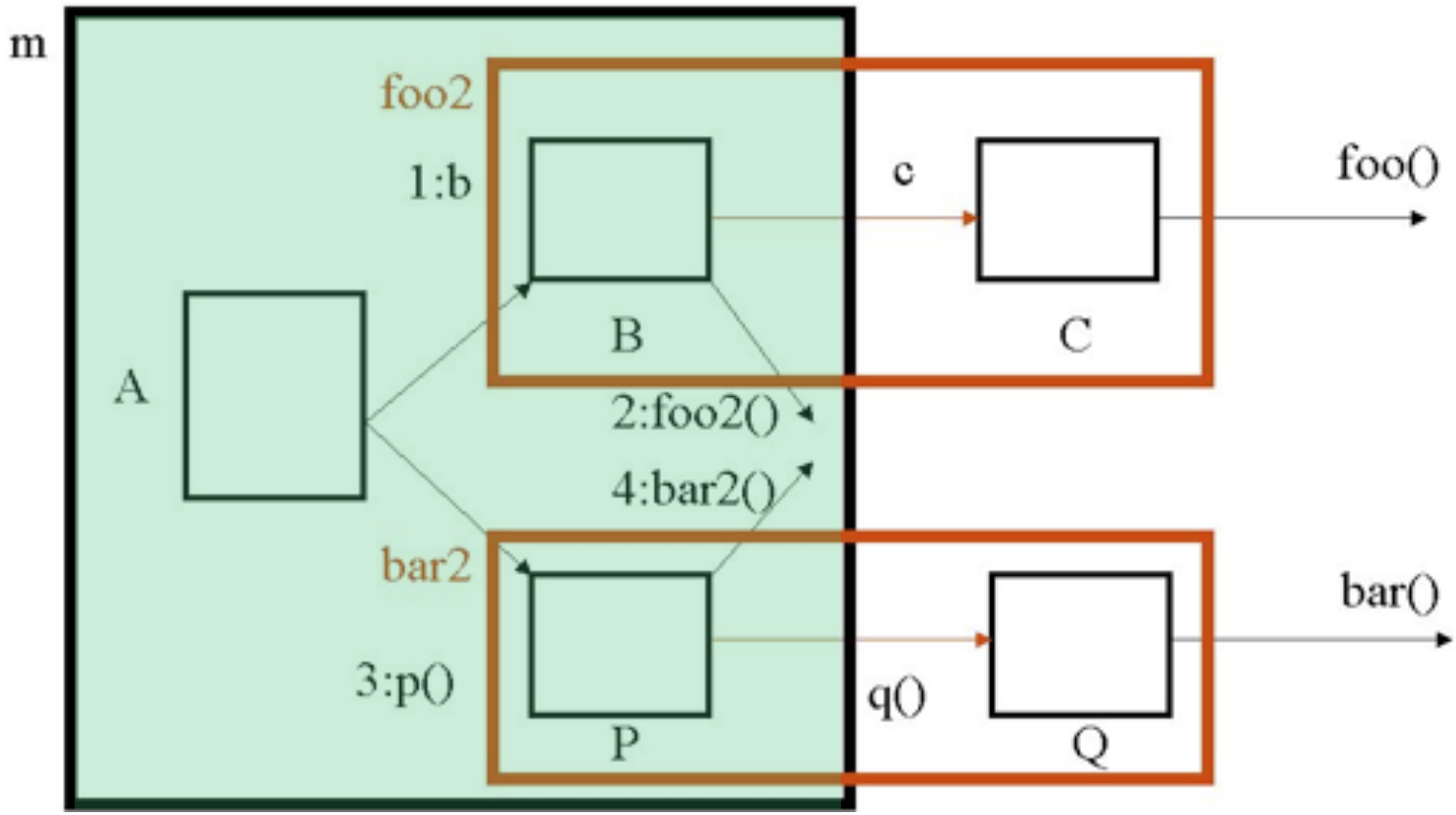

```
class A {public: void m(); P p(); B b; };
class B {public: C c; };
class C {public: void foo(); };
class P {public: Q q(); };
class Q {public: void bar(); };
void A::m() {
    this.b.c.foo(); this.p().q().bar();}
```

Do not skip intermediaries!

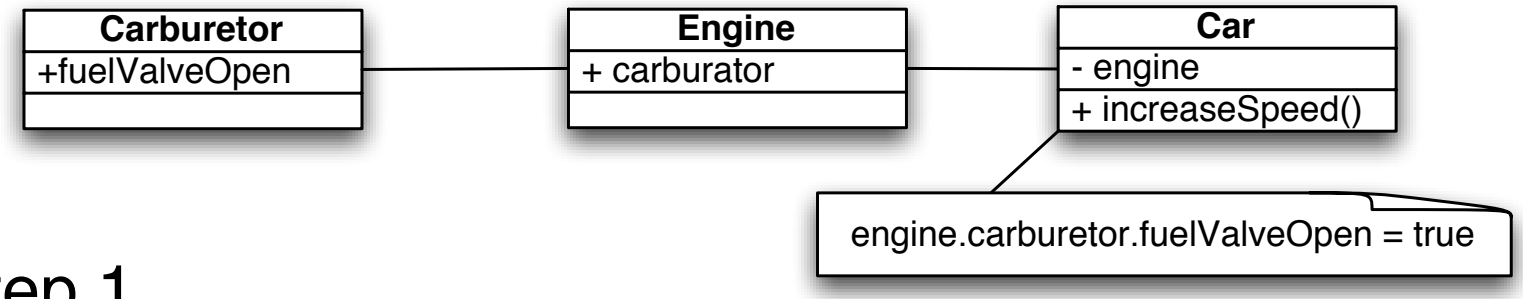


Solution

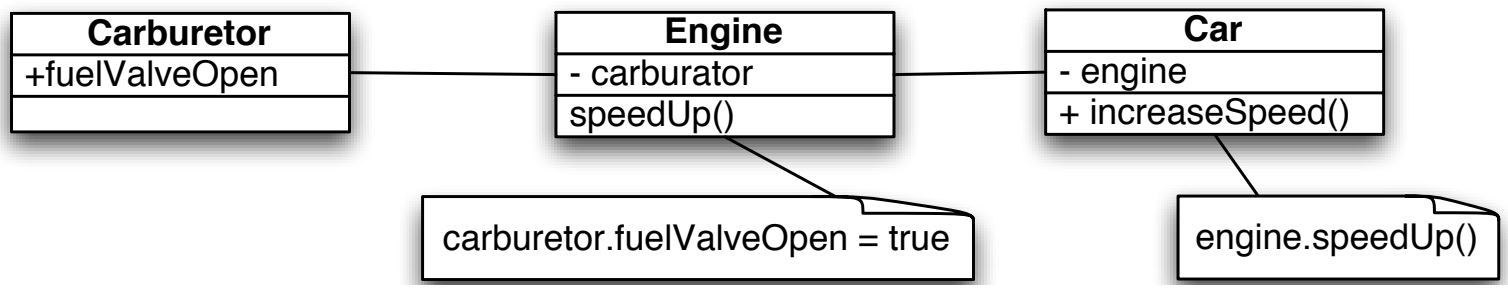
- Follow the Law of Demeter



Transformation



Step 1



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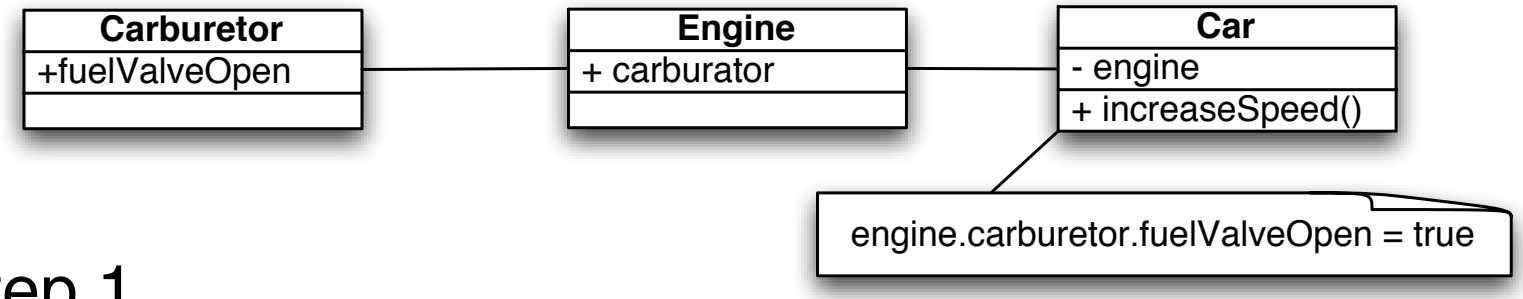
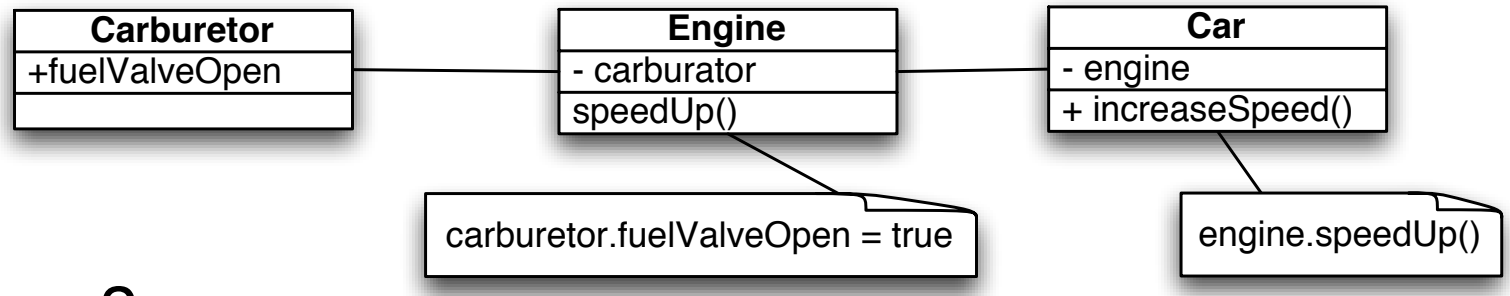
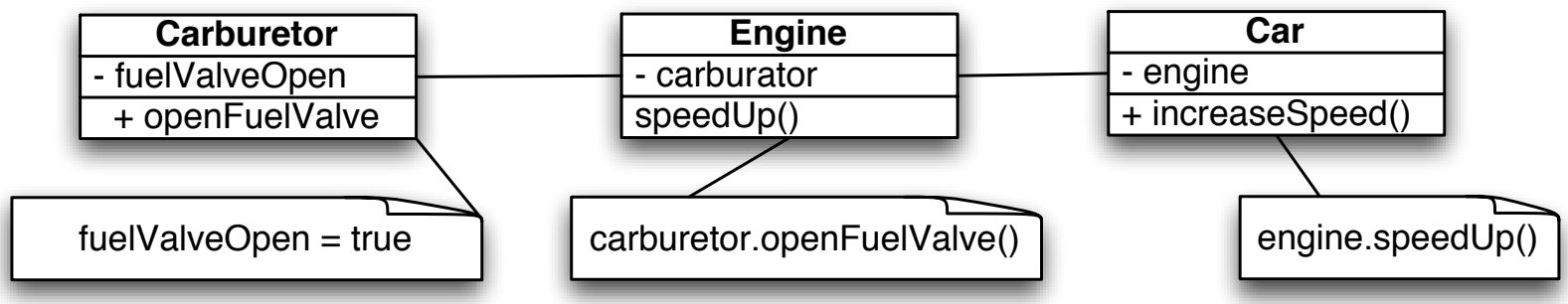


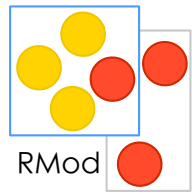
Step 1



Step 2

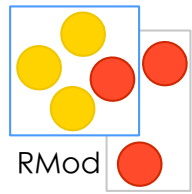


The Dark side of the Law of Demeter




```
class bicycleFleet {
        def bikes = set [ ]
        method do(aBlock) { bikes.do(aBlock) }
        method isEmpty { bikes.isEmpty }
        method map(aBlock) { bikes.map(aBlock) }
        method filter(aBlock) { bikes.filter(aBlock) }
            …
}
```

The Dark side of the Law of Demeter

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        def bikes = set [ ]
        method do(aBlock) { bikes.do(aBlock) }
        method isEmpty { bikes.isEmpty }
        method map(aBlock) { bikes.map(aBlock) }
        method filter(aBlock) { bikes.filter(aBlock) }
              …
}
```
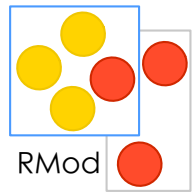

Each object itself has to provide a complete interface

About Accessor methods



In Grace, we don't have to worry about this.

Accessor methods are indistinguishable from direct field access.

Other languages distinguish.

Some gurus say: “Access all instance variables using accessor methods”. Why?

I say:

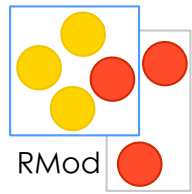
Be consistent inside an object:

do not mix direct access and accessor methods

Initially, make accessors *confidential* or *private*

Make them more *public* as part of designing the interface.

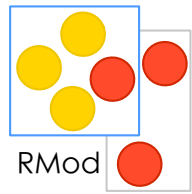
Example




```
def scheduler = object {
        def tasks = priorityQueue
        method suspendedTasks { tasks }
        …
}
```

But now everybody can tweak the task queue!

Accessors

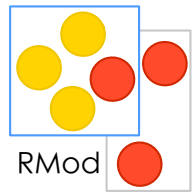


Accessors are good for lazy initialization

```
def suspendedTasks = uninitialized
method tasks {
    if (uninitialized == suspendedTasks) then {
        suspendedTasks := priorityQueue
    }
    suspendedTasks
}
```

But: accessors methods should be confidential by default, at least at the beginning

Provide a Complete Interface




```
class workstation {
    method accept(aPacket) {
        if (aPacket.addressee == self.address) then { … } else { … }
        …
```

- It is the responsibility of an object to offer a complete interface that protects that object from its clients' intrusion.
- Shift the responsibility to the Packet object

```
class packet {
    method isAddressedTo(aNode) { addressee == aNode.address }
    …
}
class workstation {
    method accept(aPacket) {
        if (aPacket.isAddressedTo(self)) then { … } else { … }
        …
```

Who is Demeter Anyway?

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Demeter,
Consort of Zeus,
mother of Persephone

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Karl Liebherr,
Professor of Computer Science at Northeastern University