Construction of Flexible Software

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Contents

- Configuration parameters
- Concepts and contruction principles for flexible, object-oriented product families
- Design Patterns

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Configuration

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Definition

- Configuration parameters are placed in configuration files.
- Configuration parameters correspond to persistent, global (= static) variables.

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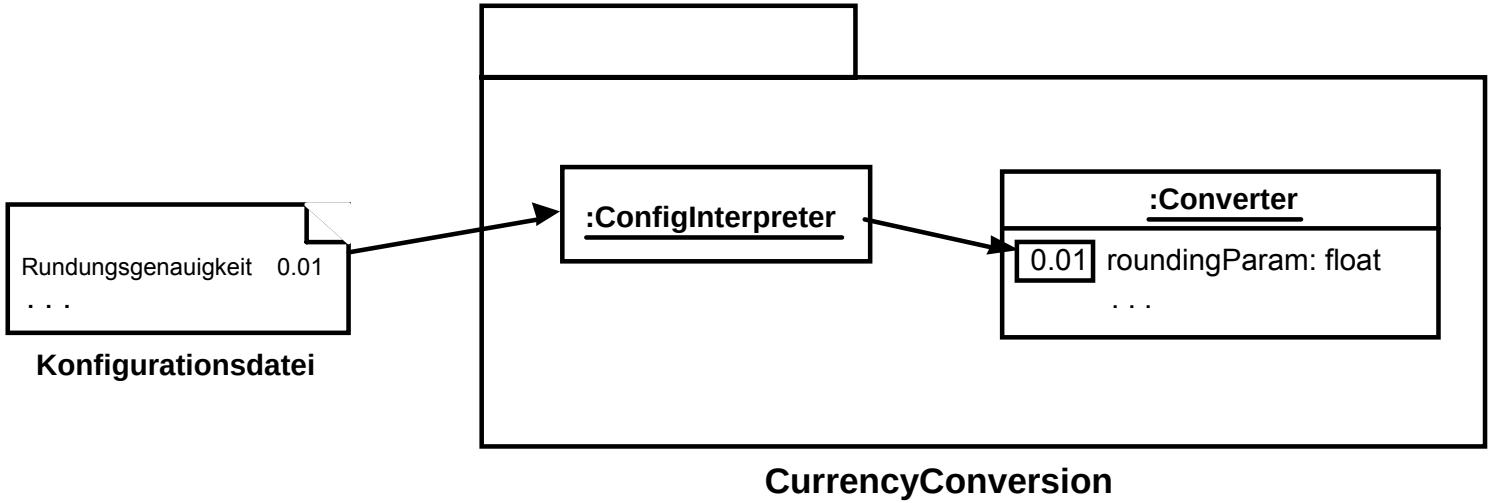
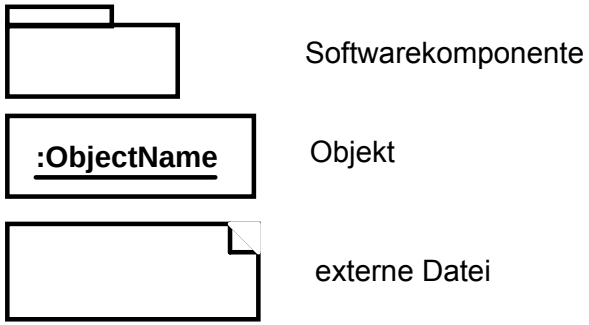
Example



Legende:



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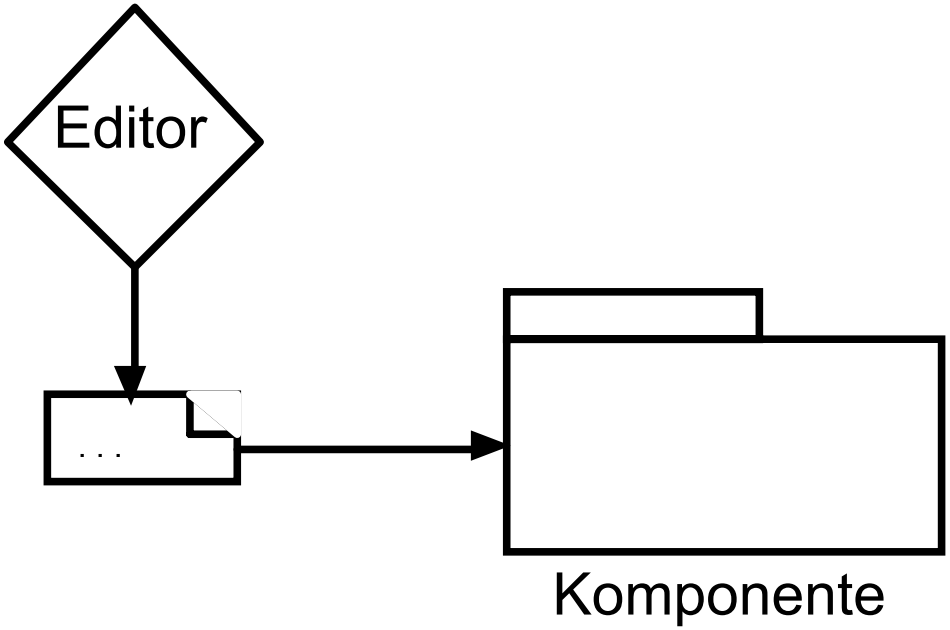
Generating the Configuration File



Example:

GUI Configuration file = Resource file

Visual, interactive construction with help from resource editors

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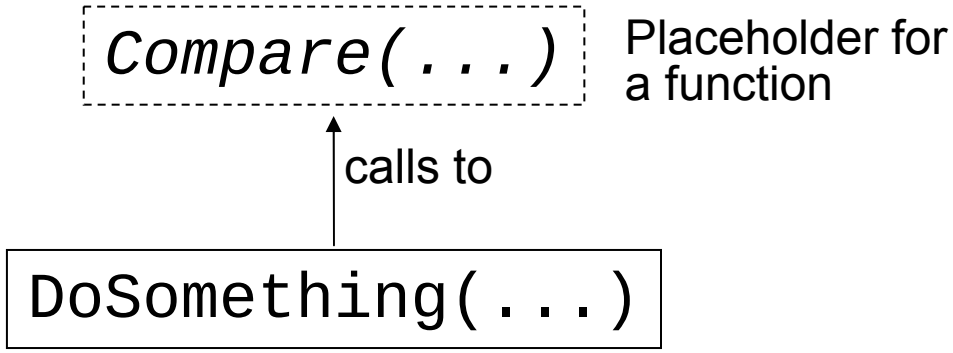
The Callback Style of Programming (I)



DoSomething calls a function which it has received as an argument. This shows the meaning of the callback style of programming:

One can conceptually distinguish whether a function or a procedure is **called directly (call)** or whether a function or a procedure passed as a parameter is **called indirectly (by means of callback).**

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The Callback Style of Programming(II)

```
void DoSomething(int (*Compare)(void*, void*),
                                 void* elem1, void* elem2 )


int StringCompare(void* string1, void* string2) {
        return strcmp(    // C-Bibliotheksfunktion strcmp
                          (char*)string1,
                          (char*)string2
                    );
  }  // StringCompare

DoSomething(StringCompare, “first“, “second“);
```

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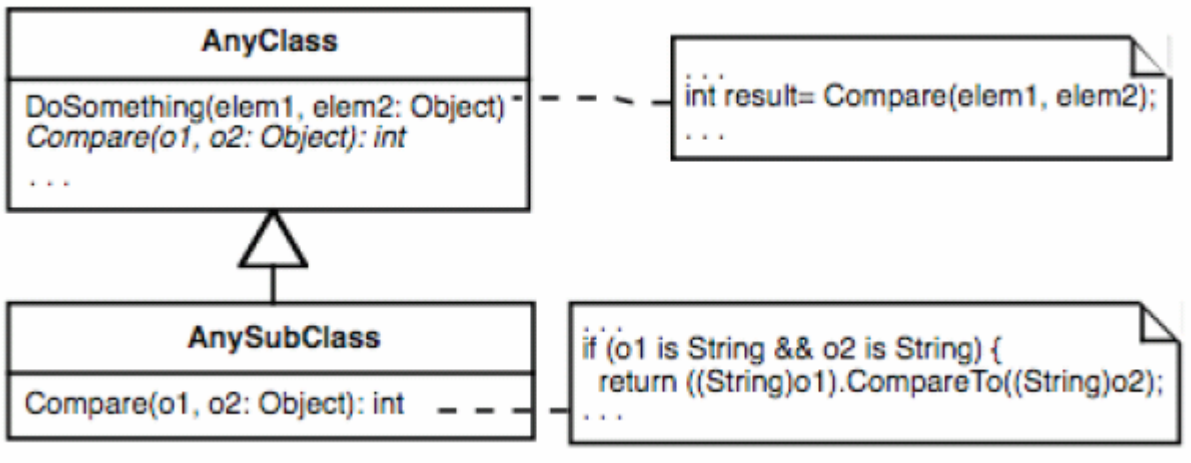
The Callback Style of Programming(III)



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Concepts and Construction Principles for Flexible Object-Oriented Product Families

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Definition

Product Family: A piece of software from which different applications can be formed by the callback style of programming, i.e. its behavior is changeable and/or expandable.

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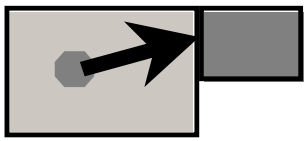
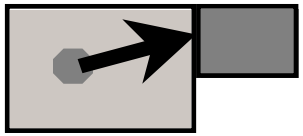
Abstract Coupling



GPS-Komponente

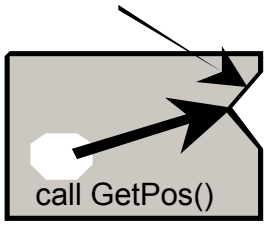
Navigationskomponente

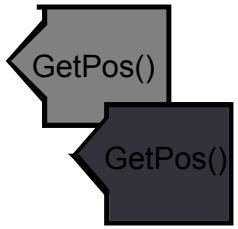


Galileo-Komponente

Navigationskomponente

„Stecker“ PosSystem





GPS- Komponente

Galileo- Komponente

Navigationskomponente

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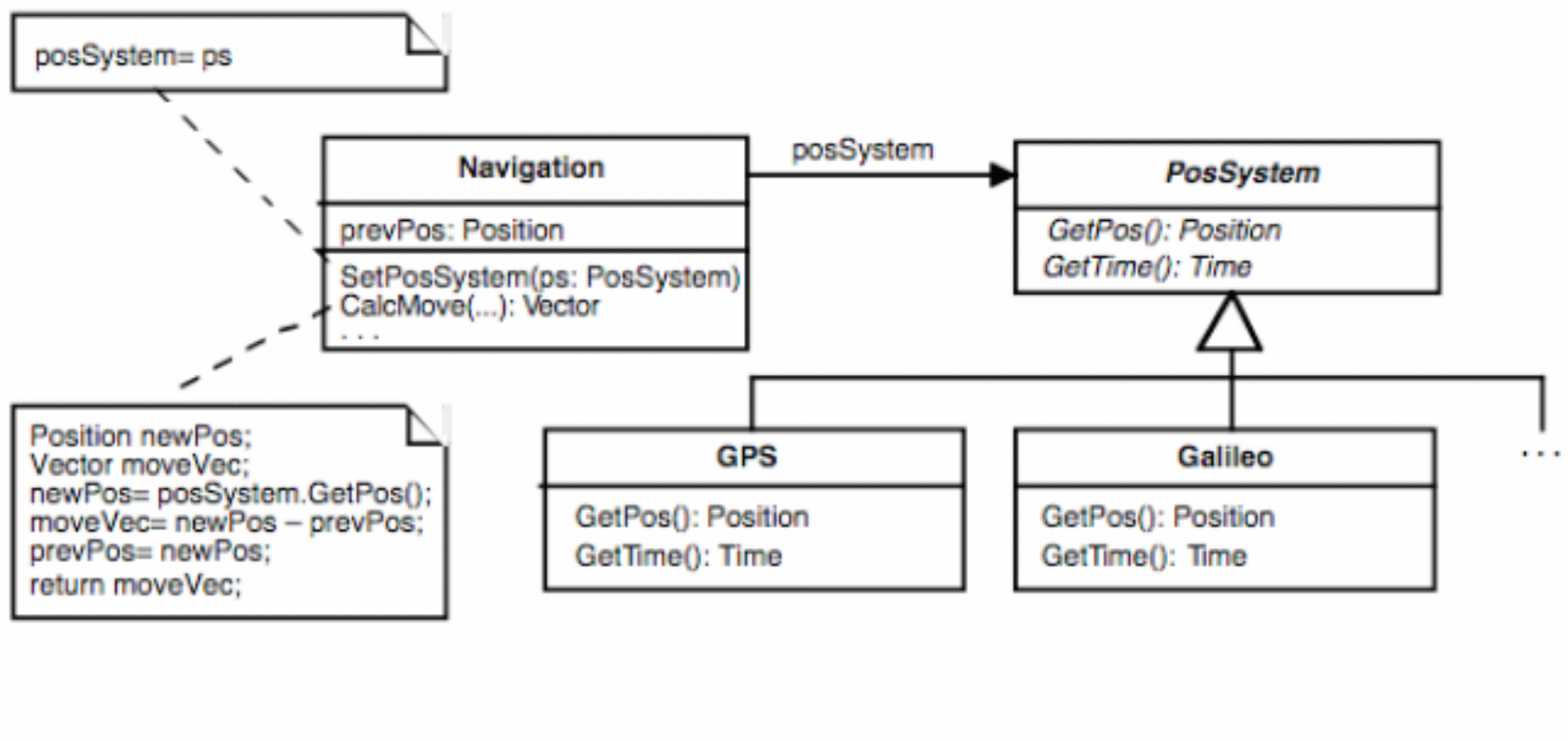
Abstract Coupling by Abstract Classes

Navigation system example:



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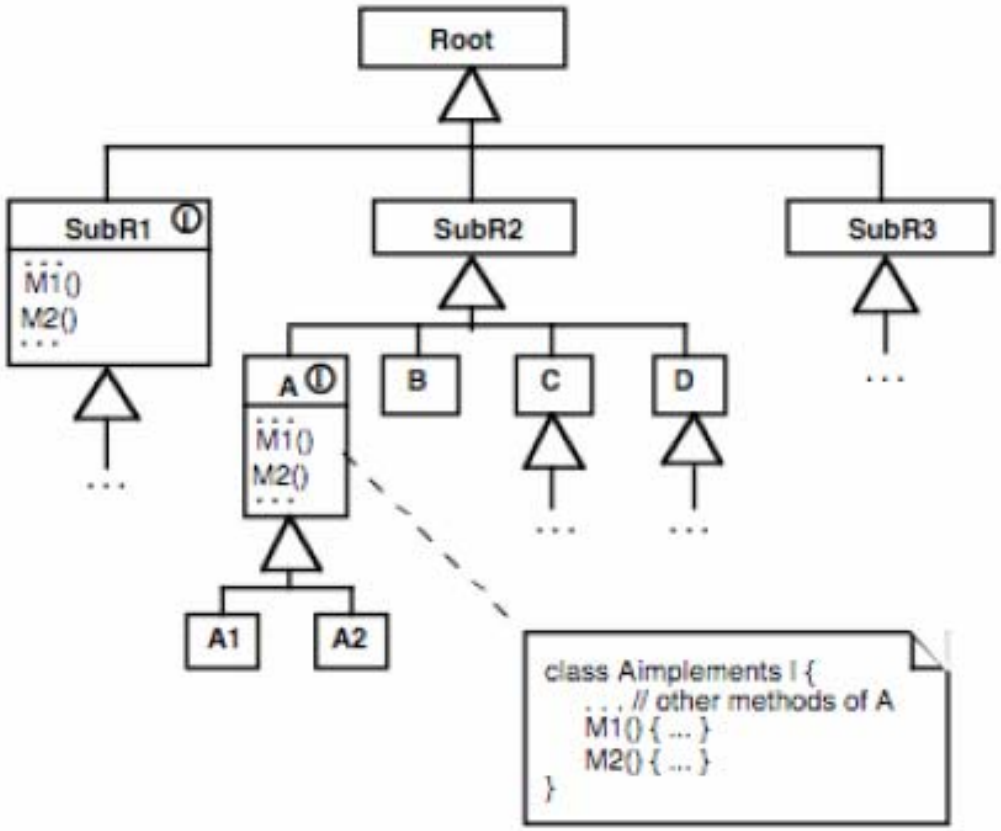
Alternative: Interfaces



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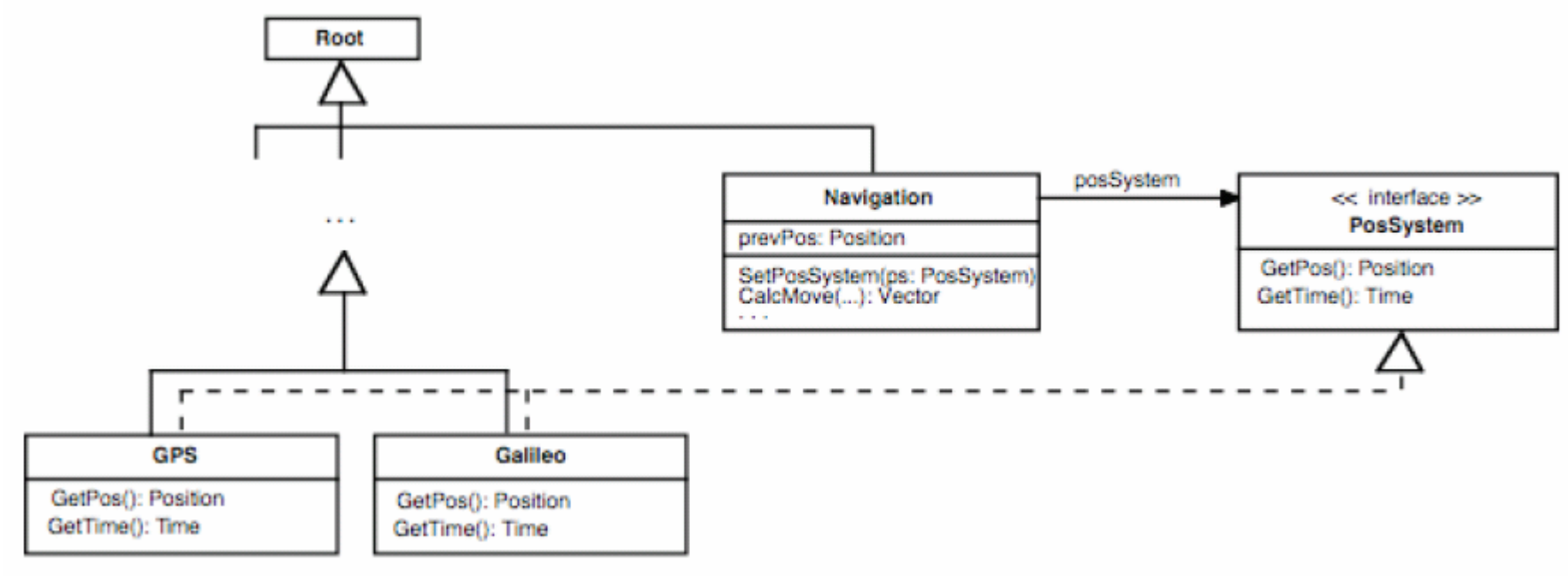
Abstract Coupling by Interfaces

Navigation system example:



Template and Hook Methods

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Definition

If a method is called in another method's implementation, then we call the **calling method the Template method** and the **called method the Hook method**.

The template method addressed here has nothing to do with the C++ language construct `template`.

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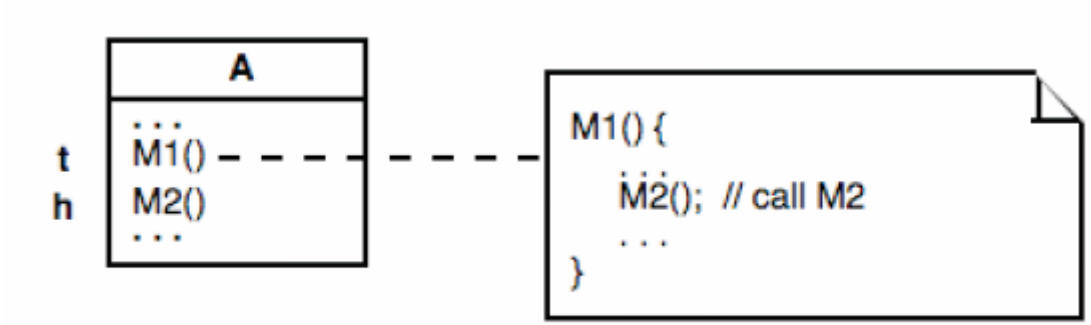
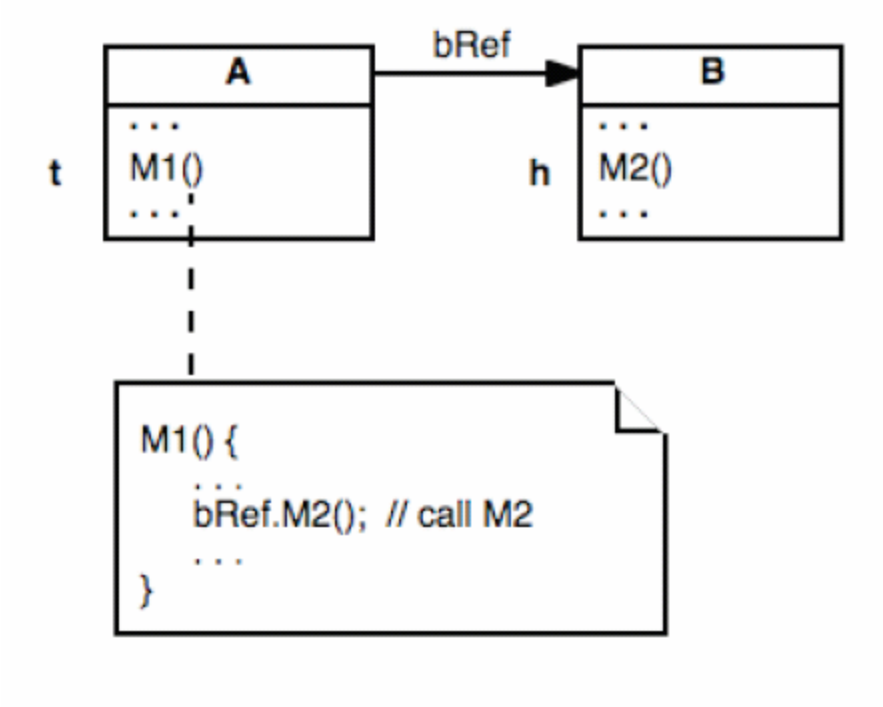
Both Methods in the Same Class



Template and Hook Methods in Different Classes



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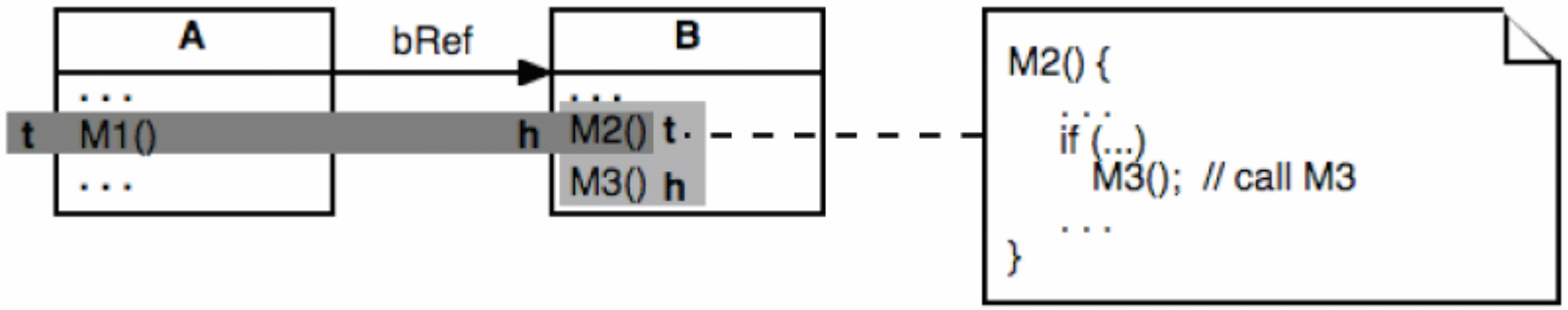
The same method can be both Template and Hook depending on the context



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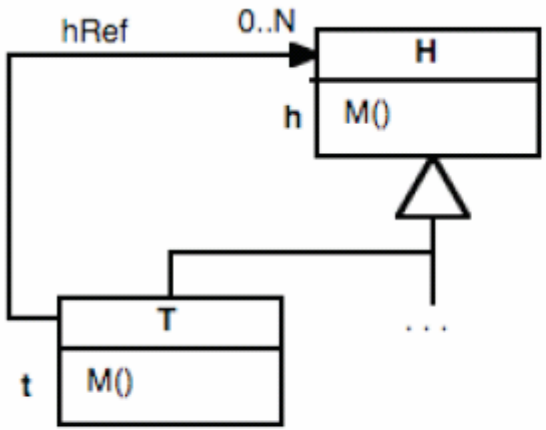
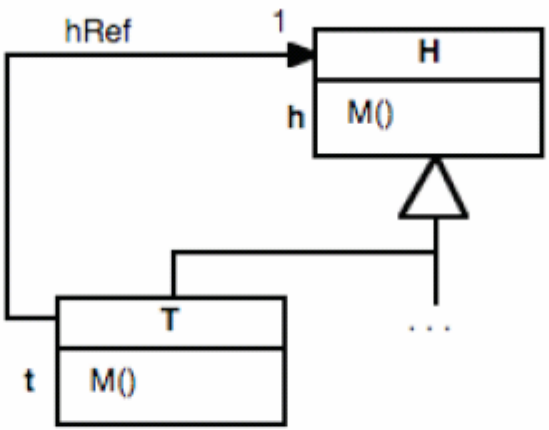
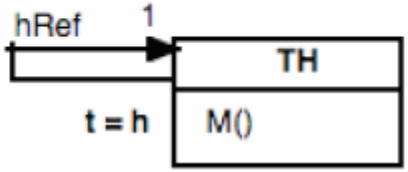
Combinations With Recursiveness



Composite



Decorator



Chain-Of-Responsibility

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Hook Method Construction Principle

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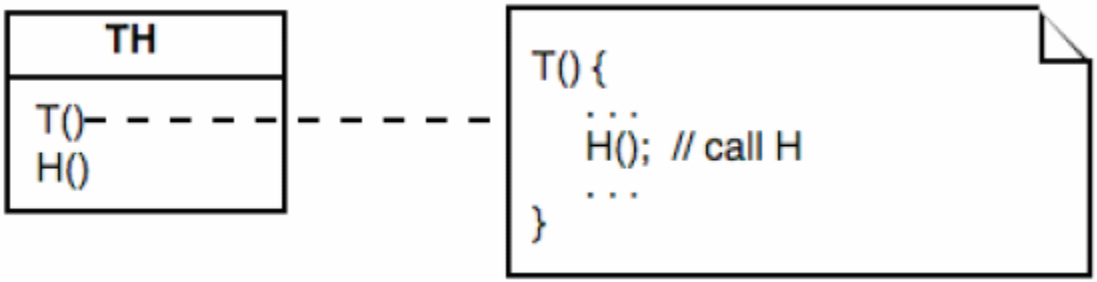
Hook Method: Adaptation of T() by overwriting of H()



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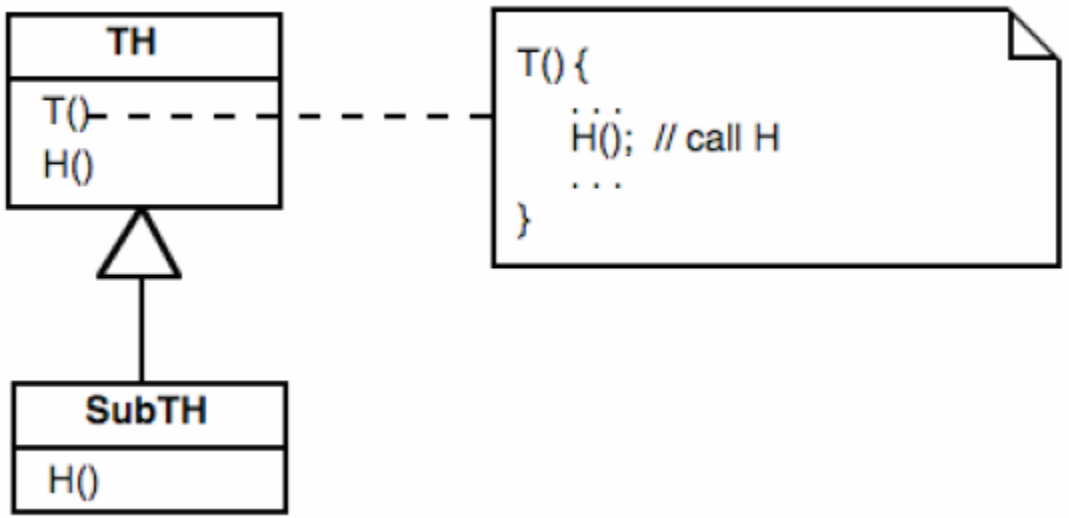
Adaptation by Overwriting the Hook Method H()



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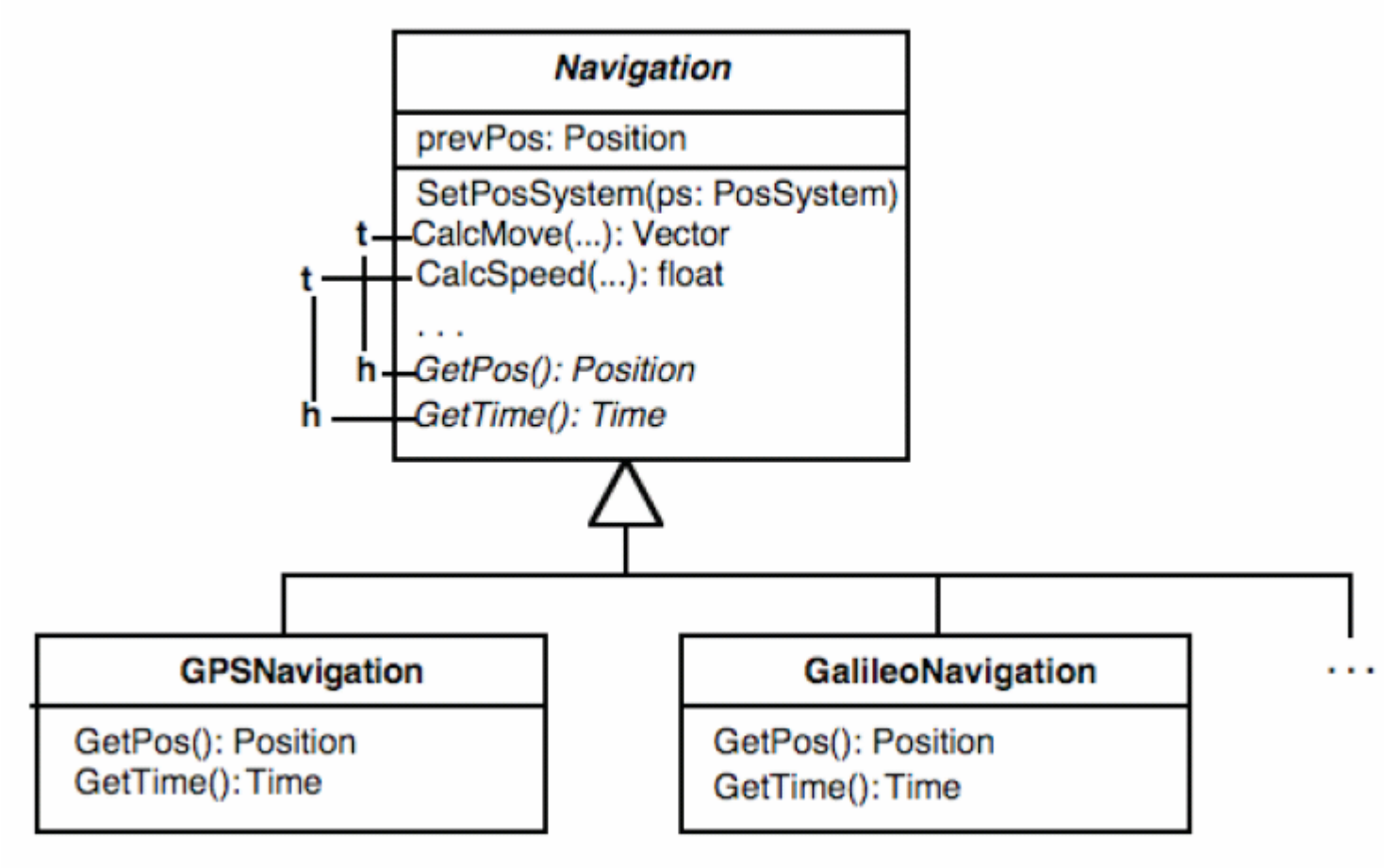
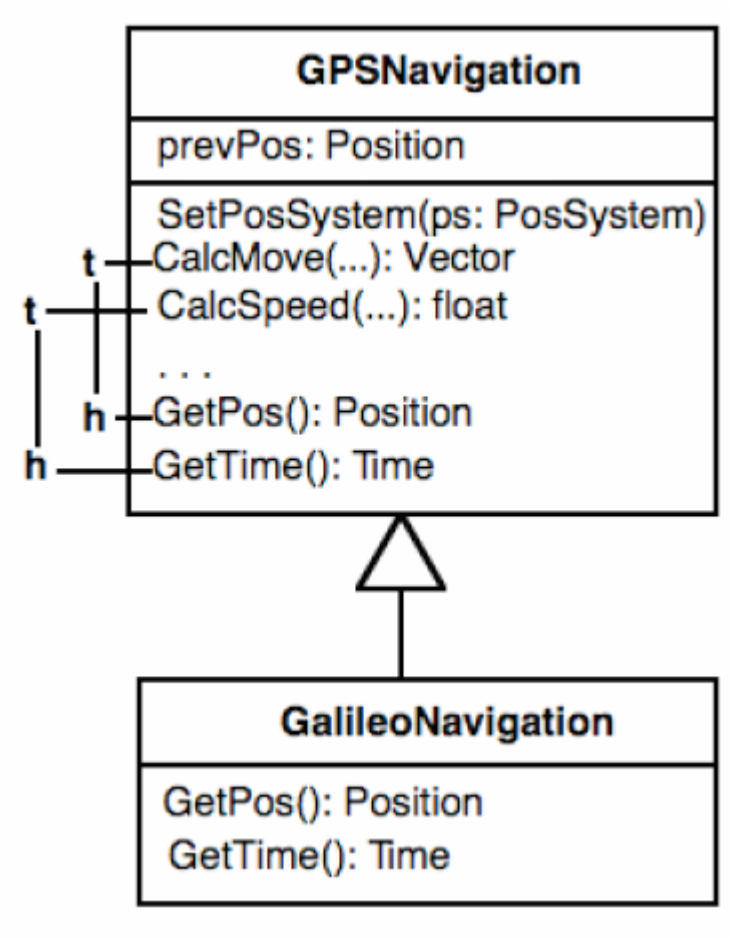
Application Example: Navigation System(I)



Application Example: Navigation System(II)



Problem: Galileo is not a specialization of GPS!

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Summary *Hook Method*

+ Simplicity: For an adaptable behavior, one must plan only a hook method.

- Adaptability requires a subclass formation and the overwriting of the hook method.

  In many cases, the hook method construction principle is sufficient to achieve the flexibility required for adaptation.

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The Hook Object Construction Principle

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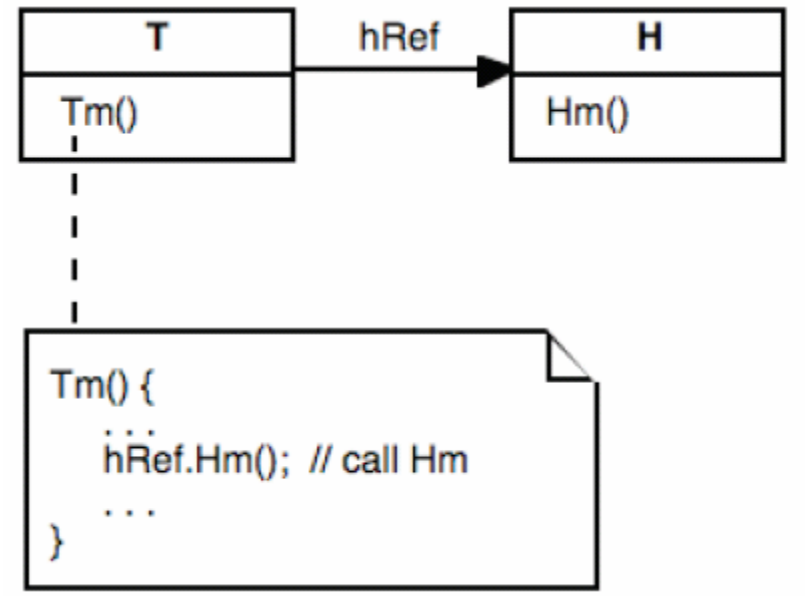
Hook Object: Adaptation of T() by Plugging an H Object In



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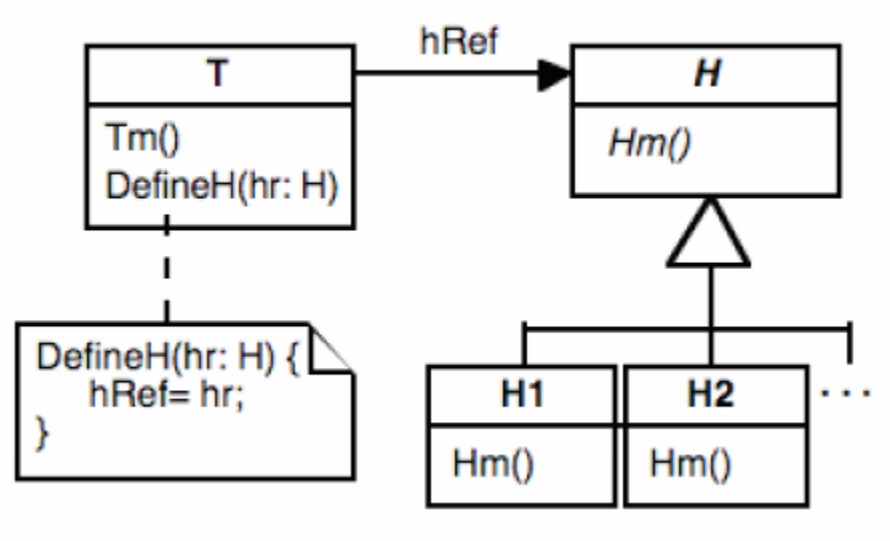
Adaptation by Composition (I)



⇒ Adaptability at runtime

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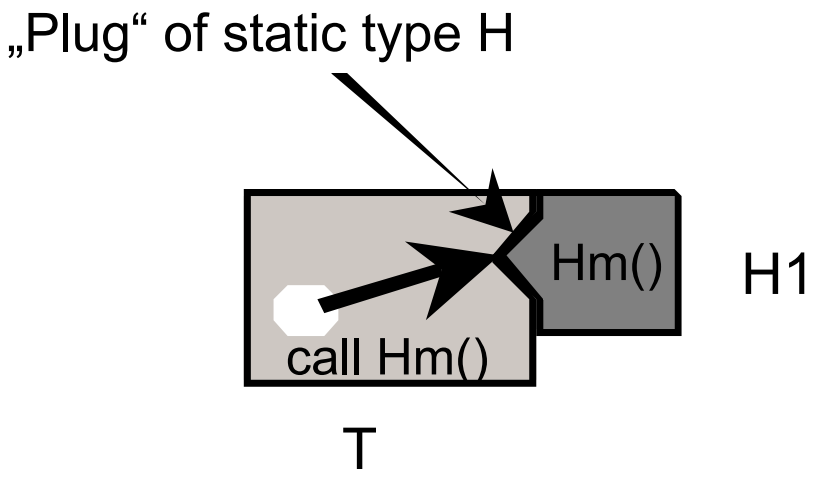
Adaptation by Composition (II)




```
T sampleT= new T();
sampleT.DefineH(new H1());
```

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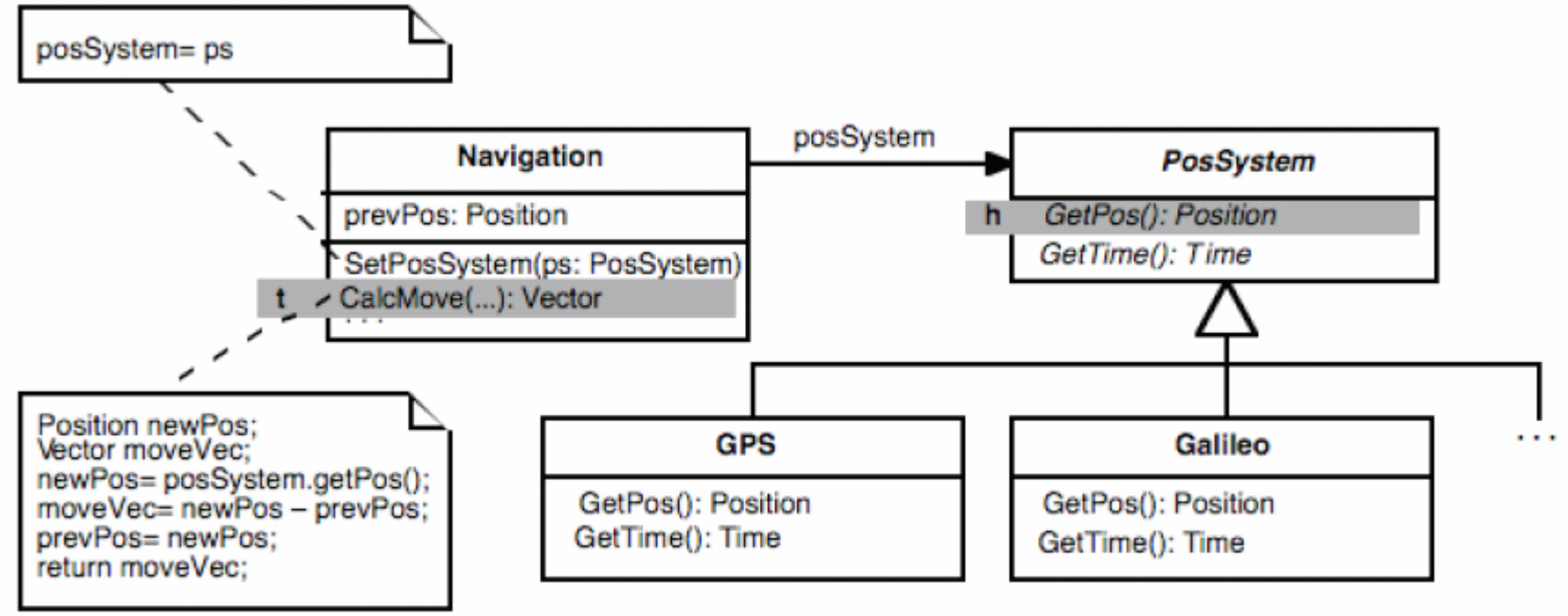
Application Example: Navigation System(I)



Application Example: Navigation System(II)

Composition for achieving a navigation system:

(a) GPS-based

(b) Galileo-based

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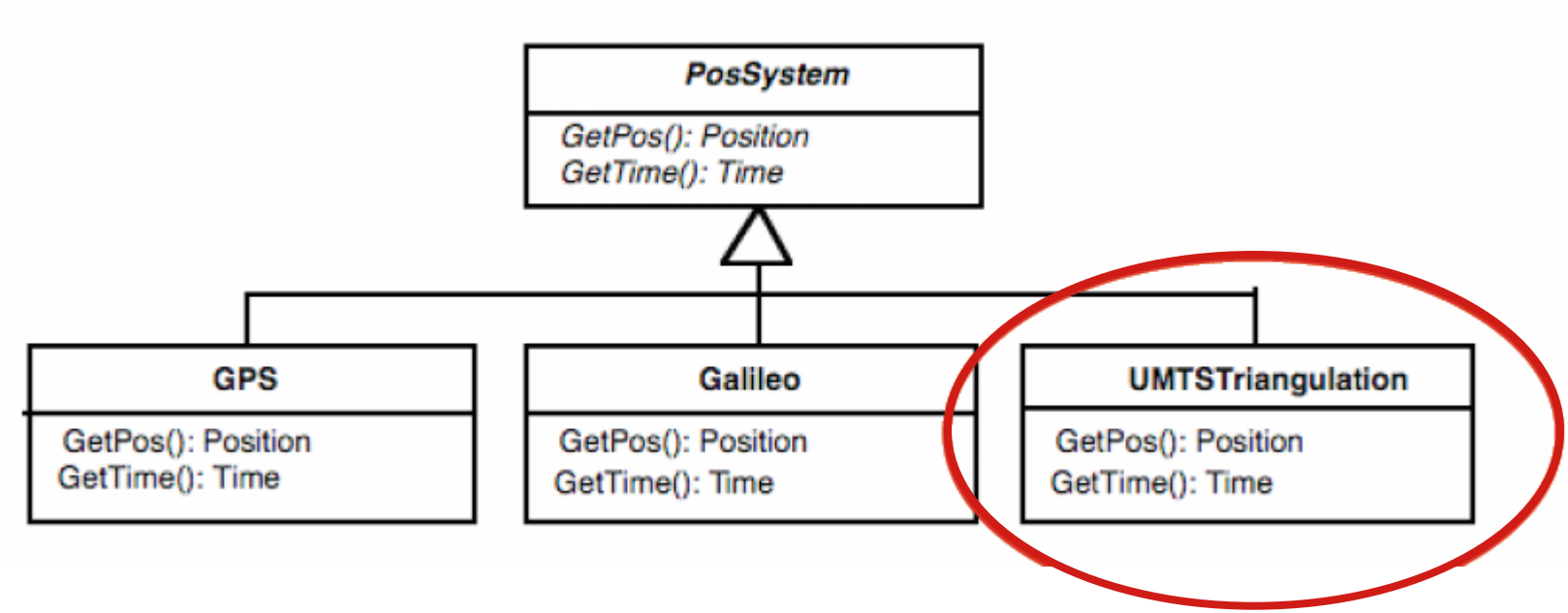
Extension of the Pluggable Components at Runtime?




```
Navigation navigation= new Navigation(...);
String nameOfAddtlClass= “UMTSTriangulation“;
Object anObj= new nameOfAddtlClass;  // not possible
                                     // correct solution follows
navigation.SetPosSystem((PosSystem)anObj);
```

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By Reflection in .NET/C#


```
Navigation navigation= new Navigation(...);
. . .
String nameOfAddtlClass= “UMTSTriangulation“;
Type typeOfAddtlClass= Type.GetType(nameOfAddtlClass);
Object anObj;
PosSystem posSys;

if (typeOfAddtlClass != null) {
   anObj= Activator.CreateInstance(typeOfAddtlClass);
    if (anObj != null && anObj is PosSystem)
        posSystem= (PosSystem) anObj;
    else  ...  // error handling
}
navigation.SetPosSystem(posSys);
```

Summary *Hook Object*

+ Simple configuration, also at runtime

- Higher complexity of design and implementation than in the hook method principle

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