A

Eiffel: The Essentials

This appendix addresses people who are familiar with the object-oriented approach but do not know Eiffel very well. It introduces all the concepts needed to understand the core of this thesis.

However, it is not an exhaustive presentation of the Eiffel language. The reference manual of the current version of Eiffel is the book by Meyer *Eiffel: The Language*. The next version of the language is defined in the third edition of this book, which is currently available as a draft. [Meyer 1992]. [Meyer 200?b].

A.1 SETTING UP THE VOCABULARY

First, Eiffel uses vocabulary that sometimes differs from the one used in other object-oriented languages like Java or C#. This section sets up the vocabulary with references to the terminology used in these other languages you may be familiar with.

Structure of an Eiffel program

The basic unit of an Eiffel program is the **class**. There is no notion of module or assembly like in .NET, no notion of package like in Java (no **import**-like keyword).

Classes are grouped into **clusters**, which are often associated with a file directory. Indeed, an Eiffel class is stored in a file (with the extension .e); therefore it is natural to associate a cluster with a directory. But this is not compulsory. It is a logical separation, not necessary a physical one. Clusters may contain subclusters, like a file directory may contain subdirectories.

An Eiffel **system** is a set of classes (typically a set of clusters that contain classes) that can be assembled to produce an executable. It is close to what is usually called a “program”.

Eiffel also introduces a notion of **universe**. It is a superset of the system. It corresponds to all the classes present in the clusters defined in an Eiffel system, even if these classes are not needed for the program execution.

Eiffel uses a notion of **root class**, which is the class that is instantiated first using its creation procedure (the constructor) known as the **root creation procedure**. An Eiffel system corresponds to the classes needed by the root class directly or indirectly (the classes that are reachable from the root creation procedure). The universe contains all classes in all the clusters specified in the system.

The definition of what an Eiffel system contains is done in an **Ace file**, which is a configuration file written in a language called LACE (*Language for Assembly Classes in Eiffel*).

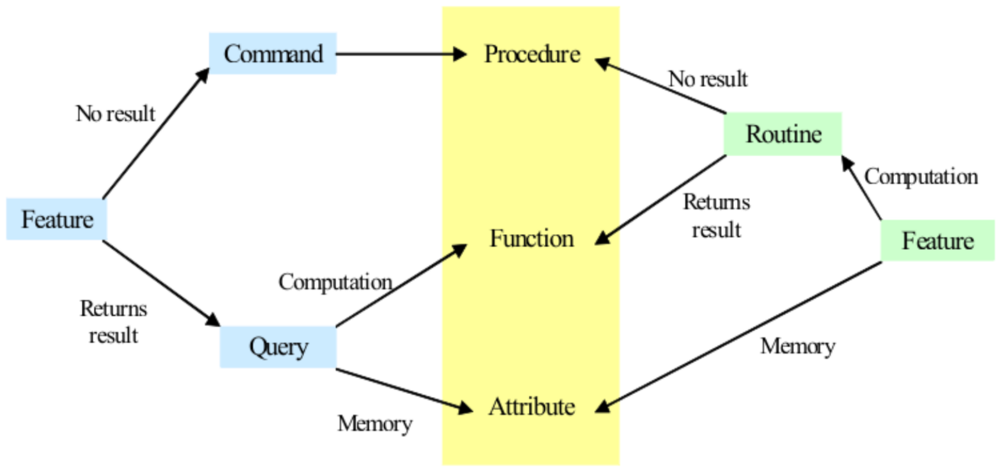
Classes

A class is a representation of an Abstract Data Type (ADT). Every **object** is an instance of a class. The object creation uses a so-called **creation procedure**, which is similar to the notion of "constructor" in languages such as Java or C#.

A class is characterized by a set of **features** (operations), which may be either **attributes** or **routines**. (In Java/C# terminology, features tend to be called "members", attributes are called "fields" and routines are called "methods".) Eiffel further distinguishes between routines that return a result (**functions**) and routines that do not return a result (**procedures**). This is a classification by implementation: routines vs. attributes, namely computation vs. memory.

There is another classification: by role. Features can be either **commands** (if they do not return a result) or **queries** (if they do return a result). Then, queries can be either functions if they involve some computation or attributes if the value is stored in memory.

The following picture shows the different feature categories:



Feature categories (by role and by implementation)

Design principles

Eiffel is not only a programming language but also an object-oriented method to build high-quality software. As a method, it brings some design principles:

- As mentioned above, Eiffel distinguishes between "commands" and "queries". Even if not enforced by any compiler, the Eiffel method strongly encourages following the **Command/Query Separation principle**: A feature should not both change the object's state and return a result about this object. In other words, a function should be side-effect-free. As Meyer likes to present it: "*Asking a question should not change the answer*."

  [Meyer 1997], *p 751.*

- Another important principle, which is **Information Hiding**: The supplier of a module (typically a class) must select the subset of the module's properties that will be available officially to its client (the "public part"); the remaining properties build the "secret part". The Eiffel language provides the ability to enforce this principle by allowing to define fine-grained levels of availability of a class to its clients.

  [Meyer 1997], *p 51-53.*

- Another principle enforced by the Eiffel method and language is the principle of **Uniform Access**, which says that all features offered by a class should be available through a uniform notation, which does not betray whether features are implemented through storage (attributes) or through computation (routines). Indeed, in Eiffel, one cannot know when writing *x*.*f* whether *f* is a routine or an attribute; the syntax is the same.

  [Meyer 1997], *p 57.*