Interfaces

Interfaces

- **interface**: A list of methods that a class promises to implement.
  - Interfaces give you an is-a relationship **without** code sharing.
    - Only method **stubs** in the interface
    - Allows object with no common ancestor to act same way
    - Object **can-act-as** any interface it **implements**
  - Analogous to non-programming idea of roles or certifications
    - "I'm certified as a CPA accountant. The certification assures you that I know how to do taxes, perform audits, and do management consulting.“
    - “I can have many certifications, thus allowing me to do many things. I am both a CPA **and** a certified massage therapist”

English/Spanish Interpreter

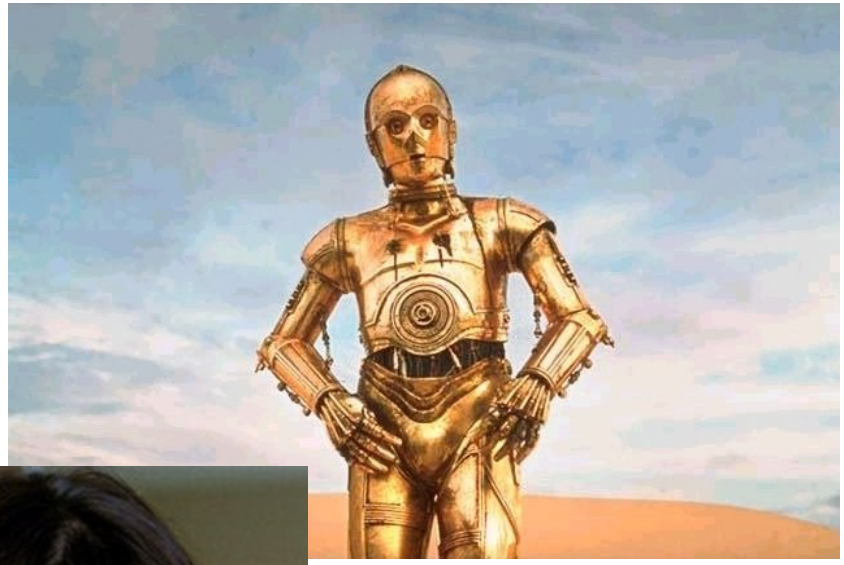
- To qualify, one needs to be able to:
  - Convert English to Spanish
    - public String englishToSpanish (String english)
  - Convert Spanish to English
    public String spanishToEnglish (String spanish)

```
public interface EnglishSpanishInterpreter {

  public String englishToSpanish(String english);

  public String spanishToEnglist(String spanish);
}
```

Sample English/Spanish Interpreters



Using an Interface

```
public class PenelopeCruz implements
   EnglishSpanishInterpreter;

public class Chihuahua implements
   EnglishSpanishInterpreter;

public class C3PO extends Robot implements
   EnglishSpanishInterpreter;

EnglishSpanishInterpreter esi = any object that
   implements EnglishSpanishInterpreter

     esi.englistToSpanish("Hello World");
```

When you declare a variable of an interface type, you are saying that you are **only** interested in the methods defined for that interface.

Implementing an interface

- A class can declare that it ***implements*** an interface.
  - This means the class contains an implementation for each of the method stubs in that interface.

    (Otherwise, the class will fail to compile. The method stubs are called "abstract methods")

```
public class <name> implements <interface name> {
        ...
}
```

Requirements

- If we write a class that claims to be a `EnglishSpanishInterpreter` but doesn't implement the `englishToSpanish` and `spanishToEnlish` methods, it will not compile.
  - Example:

```
public class Banana implements
EnglishSpanishInterpreter {
    //without implementing methods
}
```

  - The compiler error message:

```
Banana.java:1: Banana is not abstract and does
not override abstract method englishToSpanish()
in EnglishSpanishInterpreter
```

^

Comments about Interfaces

- The term interface refers to the set of public methods through which we can interact with objects of a class.
- Interfaces are used to define a contract for how you interact with an object, independent of the underlying implementation.
- Separate behavior (interface) from the implementation

Commonly used Java interfaces

- The Java class library contains classes and interfaces
- `Comparable` – allows us to order the elements of an arbitrary class
- `Serializable` (in `java.io`) – for classes whose objects are able to be saved to files.
- `List, Set, Map, Iterator` (in `java.util`) – describe data structures for storing collections of objects

Comparable

```
public interface Comparable<E> {
    public int compareTo(E other);
}
```

- A class can implement the `Comparable` interface to define a natural ordering for its objects.

- A call of `a.compareTo(b)` should return:

  a value < 0 if `a` comes "before" `b` in the ordering,

  a value > 0 if `a` comes "after" `b` in the ordering,

  or 0 if `a` and `b` are considered "equal" in the ordering.

`compareTo` tricks

- delegation trick - If your object's fields are comparable (such as strings), you can use their `compareTo` results:

```
// sort by employee name
public int compareTo(StaffMember other) {
    return name.compareTo(other.getName());
}
```

Comparable and sorting

- The Arrays class in java.util has a (static) method sort that sorts the elements of an array if they implement Comparable

```
StaffMember [] staff = new StaffMember[4];
staff[0] = new Executive(…);
staff[1] = new Employee(…)
staff[2] = new Hourly(…);
staff[3] = new Volunteer(…);
Arrays.sort(staff);
```

ArrayList

- The ArrayList declaration:

```
public class ArrayList<E> extends
AbstractList<E> implements List<E>,
RandomAccess, Cloneable, Serializable
```

- The `List` interface includes:

Method	
`E get(int index)`	Returns the element at the specified position
`int indexOf(Object o)`	Returns the index of the first occurrence of the specified element
`E remove(int index)`	Removes the element at the specified position
`E set(int index, E element)`	Replaces the element at the specified position