USING COMPOSITION: WHOLE-PART BY EMBEDDING

The whole sends messages to (i.e., calls functions in) its parts

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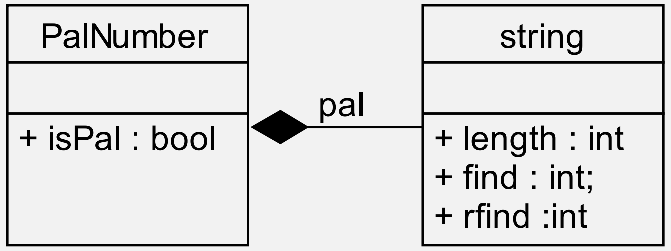
THE GORILLA AND ITS LIVER

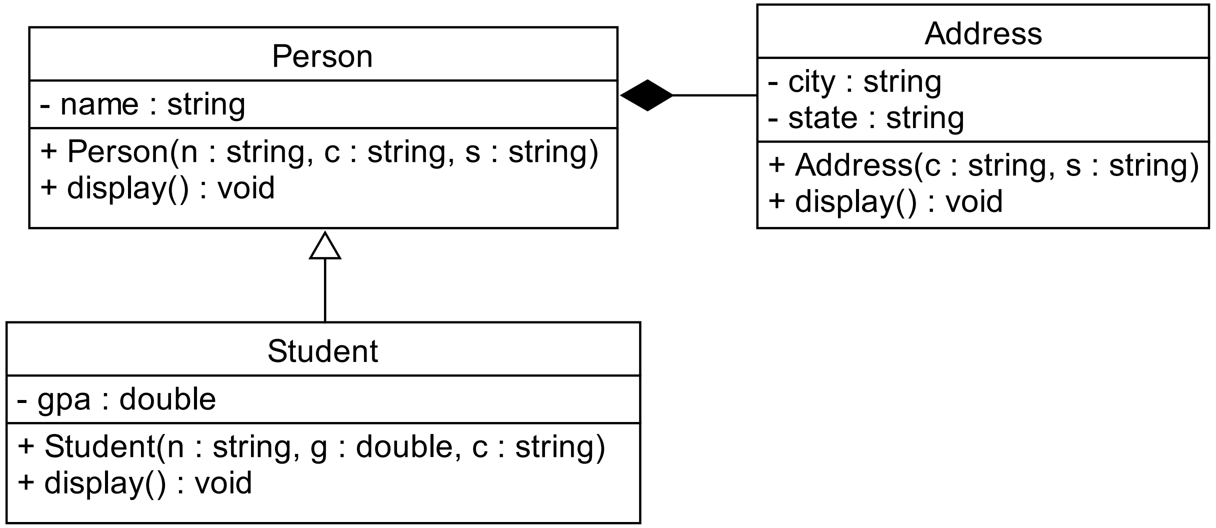
- In 1990, I attended a C++ conference
- One session was an open discussion about maintaining encapsulation and sharing object data
  - Extract the object's data to use it?
  - Maintain encapsulation by letting the object use its data for the program?
- "A gorilla has a liver and is responsible for it. Cutting out the liver to use it somewhere is messy and annoys the hell out of the gorilla."
- Conclusion: keep the gorilla happy and let it use its liver.

USING SIMPLE COMPOSITION

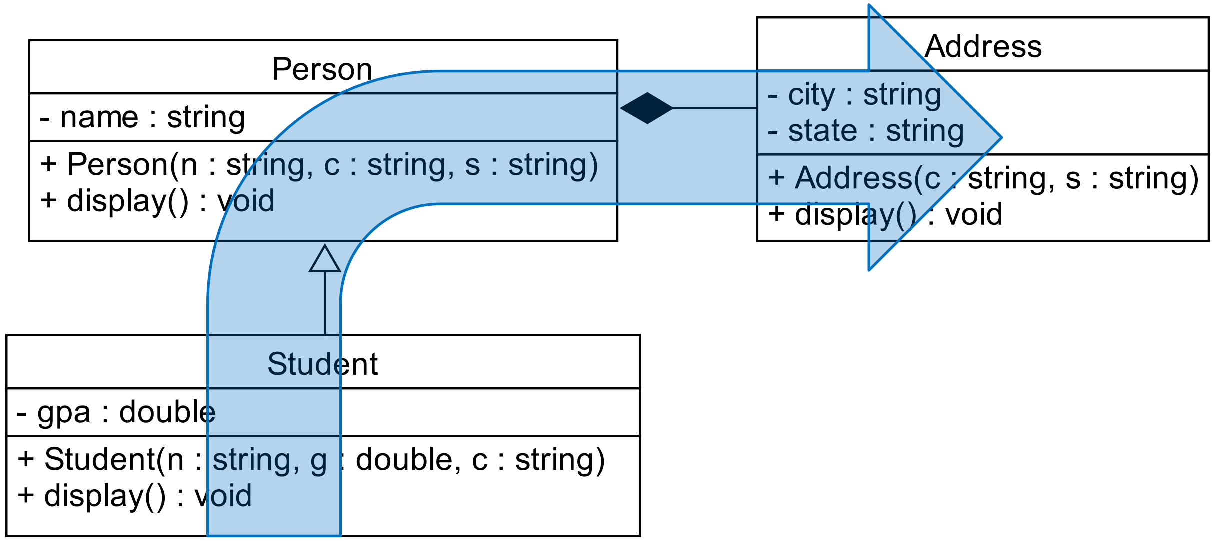


```
class string
{
  public:
     int length() { ... }
     int find() { ... }
     int rfind() { ... }
};

class PalNumber
{
  private:
     string pal;
  public:
     bool isPal()
     {
          pal.length() ...
          pal.find() ...
          pal.rfind() ...
     }
};
```

INHERITANCE & COMPOSITION (1)



INHERITANCE & COMPOSITION (I)

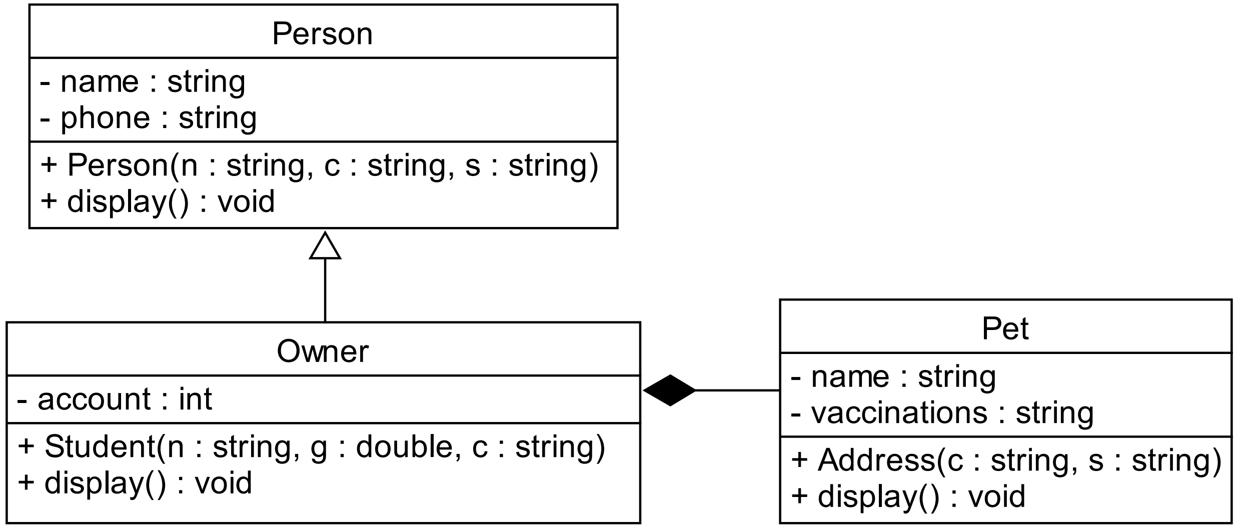


USING COMPOSITION WITH INHERITANCE (1)

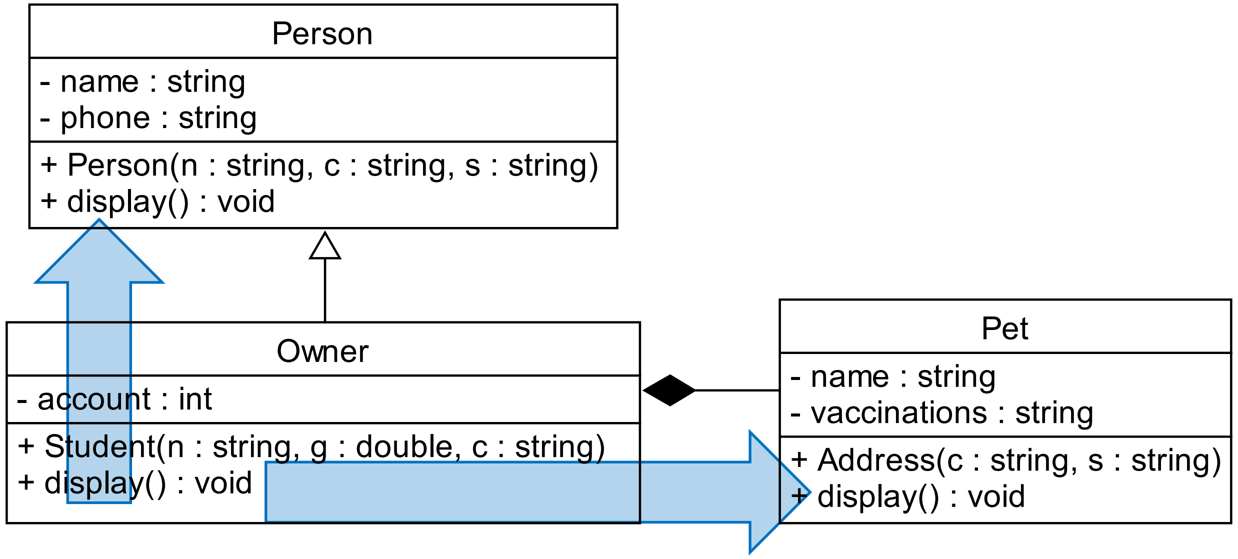
```
class Address
{
  public:
     void display()
     {
         cout << city << ", " << endl;
     }
};

class Person
{
  private:
     Address addr;
  public:
     void display()
     {
         cout << name << end;
         addr.display();
     }
};
```

```
class Student : public Person
{
  public:
     void display()
     {
         Person::display();
         cout << gpa << endl;
     }
}
```

INHERITANCE & COMPOSITION (2)



INHERITANCE & COMPOSITION (2)



USING COMPOSITION WITH INHERITANCE (I)

```
class Pet
{
  public:
     void display()
     {
          cout << name << " vaccinated on “
               << vaccinations << endl;
     }
};

class Person
{
  public:
     void display()
     {
          cout << name << endl;
          cout << phone << endl;
     }
};
```

```
class Owner : public Person
{
  private:
     Pet my_pet;
  public:
     void display()
     {
          Person::display();
          cout << account << endl;
          my_pet.display();
     }
};
```