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Programming in the future tense,

or Accept that things will change

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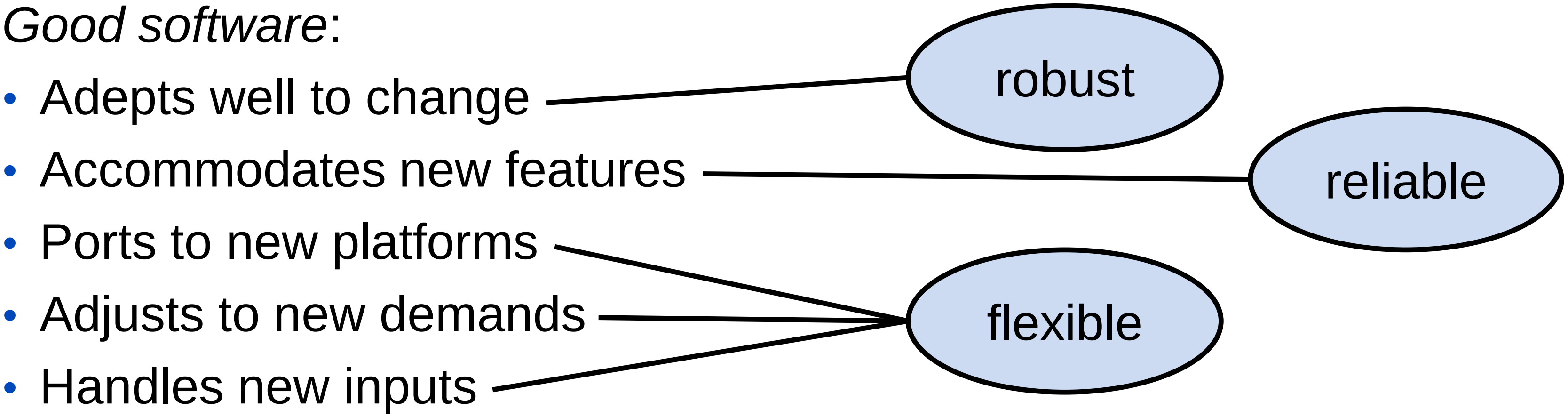
Programming in the future tense

Object-oriented programming

→ Support for incremental changes

→ add new functionality and new properties

Good software:



- Adepts well to change
- Accommodates new features
- Ports to new platforms
- Adjusts to new demands
- Handles new inputs

robust

reliable

flexible

Good software does not come about by accident,

Good software is written by **Programming in the future tense!**

Why?

What could happen…

- New classes are added to the hierarchies
- New overloading will occur
- Derived classes may be tomorrow‘s base classes
- Functions are called in new context

Why?

What ~~could~~ will happen!

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Additional problem:

“It is to remember that the programmers who modify code [fix bugs] are typically ***NOT*** *the code‘s original developers!”*

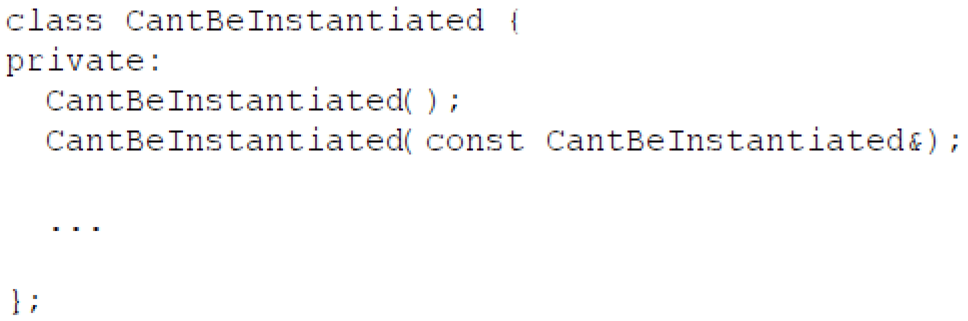
- Scott Meyers, More Effective C++, Addison-Wesley, 2011

HOW TO…

- One way to do this is to express design constraints in C++ (in addition to comments and documentation):

- A class is designed to never have derived classes

→ use C++ to prevent derivation



```
class CantBeInstantiated {
private:
   CantBeInstantiated( );
   CantBeInstantiated( const CantBeInstantiated&);

   ...

};
```

or even better, use the **final** keyword of C++ 11

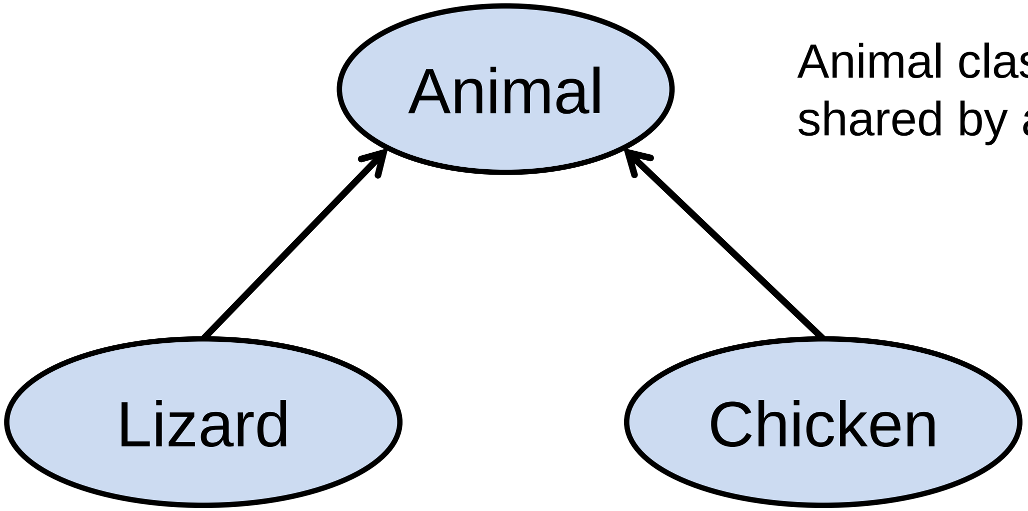
HOW TO…

- If copy and assignment make no sense for a class

→ prevent those operations by declaring the copy constructor and assignment operator private

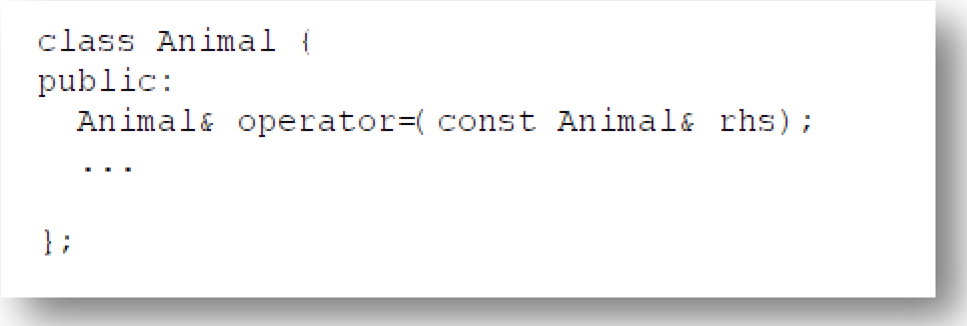
→ Prevent partial assignments

Chicken / Lizard example



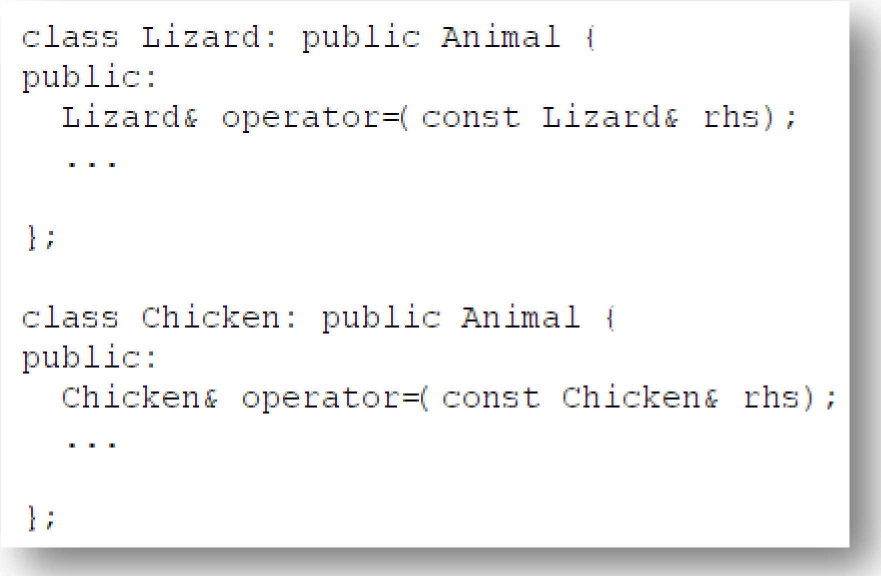
Animal class embodies all features shared by all creatures

Specialize Animal in ways appropriate for Chickens and Lizards



```
class Animal {
public:
  Animal& operator=( const Animal& rhs);
  ...

};
```



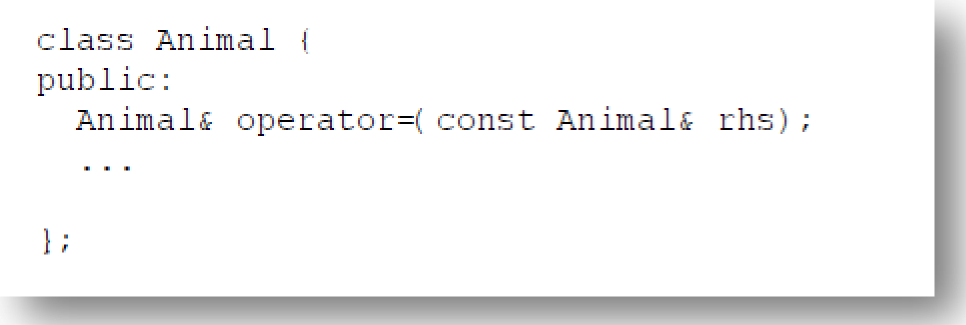
```
class Lizard: public Animal {
public:
  Lizard& operator=( const Lizard& rhs);
  ...

};

class Chicken: public Animal {
public:
  Chicken& operator=( const Chicken& rhs);
  ...

};
```

Chicken / Lizard example



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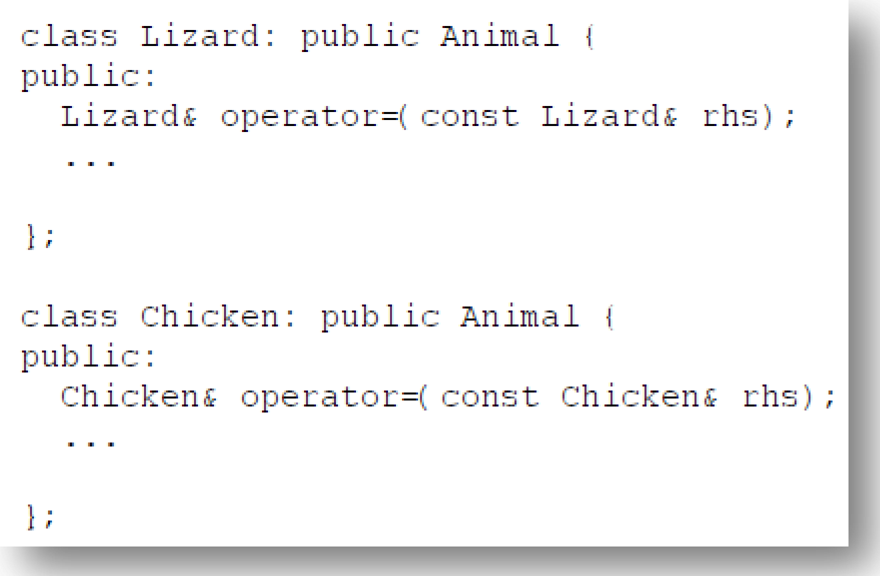
class Animal {
public:
  Animal& operator=( const Animal& rhs);
  ...

};
```



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class Lizard: public Animal {
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  Lizard& operator=( const Lizard& rhs);
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};

class Chicken: public Animal {
public:
  Chicken& operator=( const Chicken& rhs);
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};
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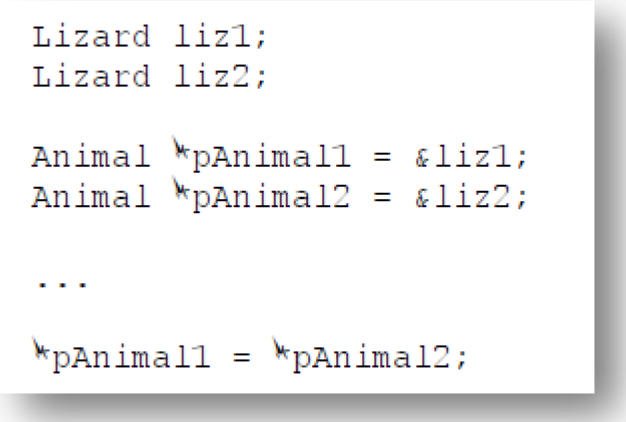

```
Lizard liz1;
Lizard liz2;

Animal *pAnimal1 = &liz1;
Animal *pAnimal2 = &liz2;

...

*pAnimal1 = *pAnimal2;
```

Only the Animal part liz1 will be modified!
→ **Partial assignment**

HOW TO…

- Avoid „demand-paged“ virtual functions (only make functions virtual when somebody comes along and demands it)

→ Make it virtual if it makes sense

→ If it does not make sense that's ok but don‘t change it later just because it would be convenient for someone

- Handle assignments and copy construction in every class

→ Even if „nobody ever does those things“

Recognize that anything somebody CAN do, they WILL do.

Examples

Most frequent (simple) MITK examples:

- Assigning objects to themselves
- Use objects before giving them values
- Give objects values and never use them
- Give objects huge, tiny or null values

A friendly reminder:

If it will compile, somebody will do it.

Summary

- Present-tense thinking is ok
  - You can’t wait for the latest language features
  - It has to run on the current hardware
  - It has to offer acceptable performance NOW

- Provide complete classes, even if some parts aren‘t currently used.
- Design your interfaces to facilitate common operations and prevent common errors → Make the classes hard to use incorrectly!
- If there is no great penalty for generalizing your code, generalize it.

Be a renegade and program in future tense!