

A top-down view of a white ceramic bowl with a dark rim, filled with spaghetti topped with a meat sauce and a generous amount of shredded cheese. The bowl is placed on a light-colored, speckled countertop. The text is overlaid on the bowl.

Onions and Spaghetti

Programming Lessons Learnt the Hard Way

Sara Falamaki

CSIRO Networking Technologies Lab

MSC Malaysia Open Source Developers Conference 2009

Onions and Spaghetti

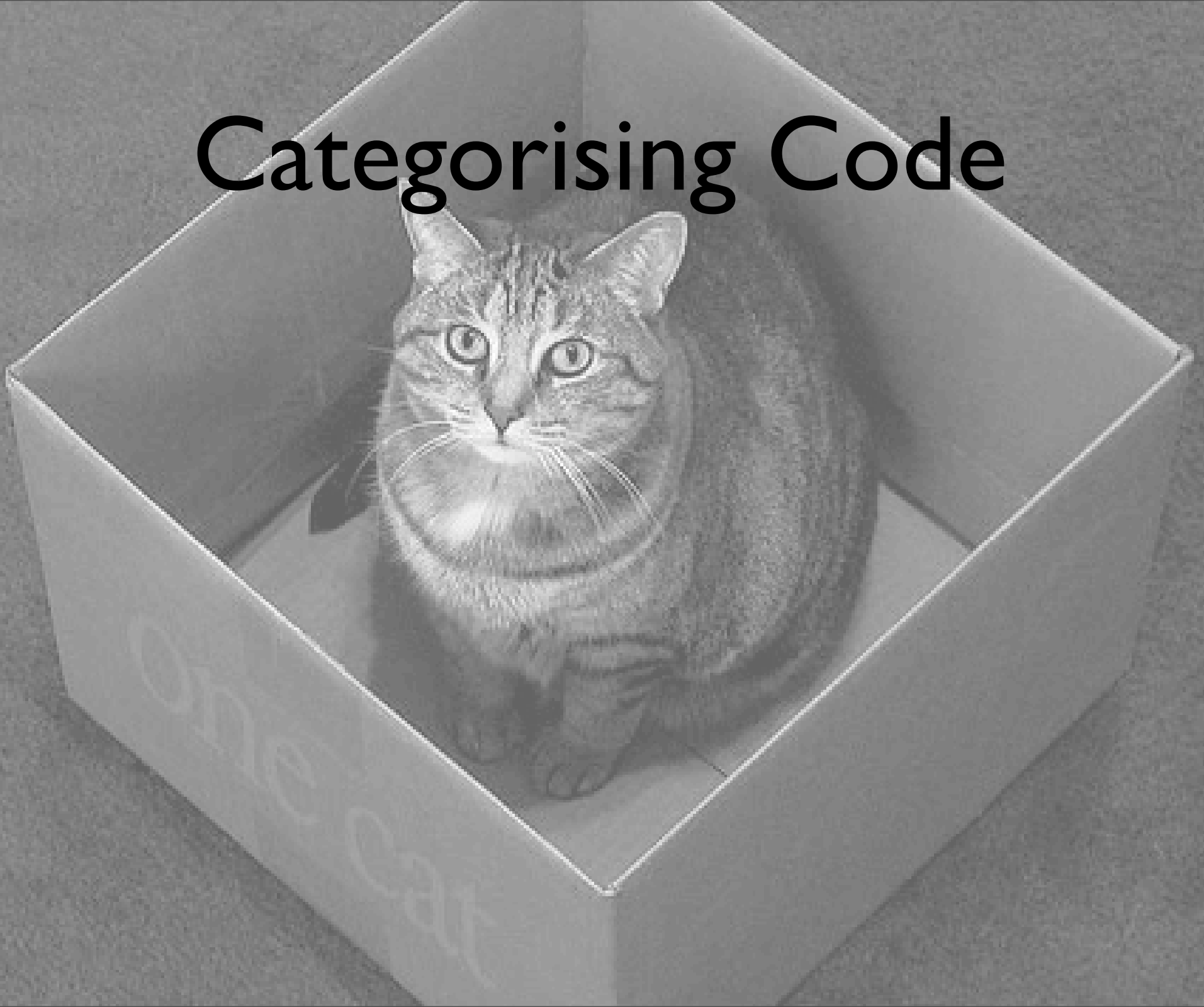


Onions and Spaghetti



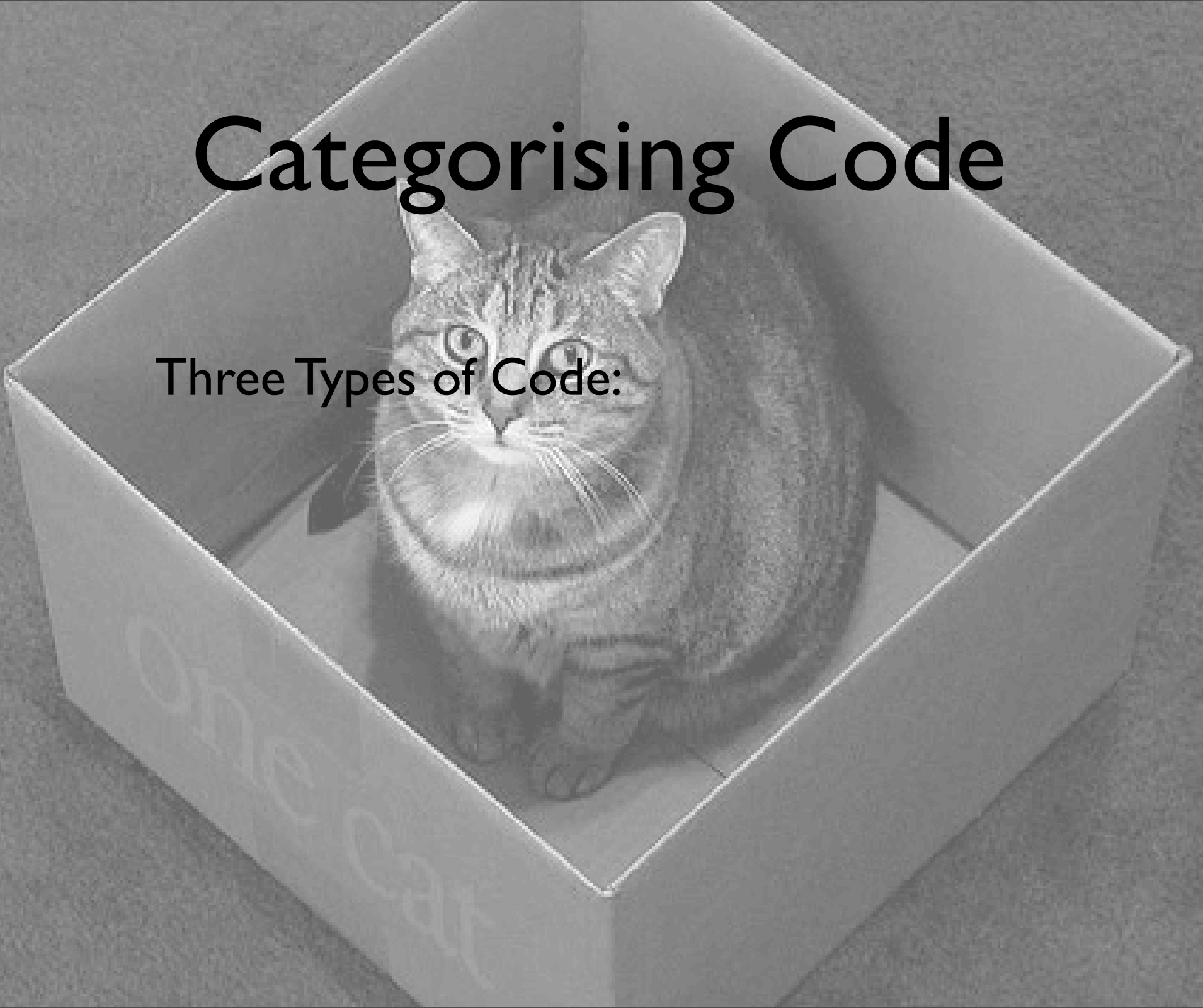
- **Categorising Code**
- **Handling Errors and Exceptions**
- **Global Variables Are Considered Evil**
- **Unspaghettifying Your Objects**
- **Controlling Data Flow**
- **Encapsulation**
- **Threads are Hard!**

Categorising Code



Categorising Code

Three Types of Code:



Categorising Code



Three Types of Code:

1. *Model*: Your data structures and algorithms.

Categorising Code

A kitten is sitting inside a cardboard box. The box is open, and the kitten is looking out. The words "open cat" are printed on the side of the box. The kitten is a tabby cat with white paws and chest.

Three Types of Code:

1. *Model*: Your data structures and algorithms.
2. *View*: The interfaces to the outside world.

Categorising Code

A photograph of a ginger and white tabby cat sitting inside a cardboard box. The cat is looking directly at the camera with wide, curious eyes. The box is open, and the cat is positioned in the center. The background is a plain, light-colored surface.

Three Types of Code:

1. *Model*: Your data structures and algorithms.
2. *View*: The interfaces to the outside world.
3. *Controller*: Code that ties the Model to the View.

Categorising Code

A photograph of a ginger and white tabby cat sitting inside an open cardboard box. The cat is looking directly at the camera with wide, curious eyes. The box is made of brown cardboard and has some faint, embossed patterns on its side. The background is a plain, light-colored surface.

Three Types of Code:

1. *Model*: Your data structures and algorithms.
2. *View*: The interfaces to the outside world.
3. *Controller*: Code that ties the Model to the View.

Don't mix them!

Handling Exceptions



Handling Exceptions

Handling Exceptions

- Almost universally handled badly

Handling Exceptions

- Almost universally handled badly
- Only catch it if you can do something about it

Handling Exceptions

- Almost universally handled badly
- Only catch it if you can do something about it
- If you can't deal with it, let it bubble up and fail. **Fail-Fast** code is good!

Handling Exceptions

Handling Exceptions

- Don't hot potato exceptions. Try to deal with each exception only once.

Handling Exceptions

- Don't hot potato exceptions. Try to deal with each exception only once.



Handling Exceptions

Handling Exceptions

- Exceptions can really complicate your program state when you catch them.

Handling Exceptions

- Exceptions can really complicate your program state when you catch them.
- If you intend to roll back state, make your try statements as small as possible.

Handling Exceptions

```
bool
Checker::isAvailable(){
    try{
        QueryResult result;
        checkQuery = "SELECT * FROM Devices WHERE available";
        _db.query(checkQuery, result);
        if(result.size()==0){
            rescheduleTimer(20);
            return false;
        }
        else{
            rescheduleTimer(100);
            propagateResults(result);
            return true;
        }
    }
    catch(Exception &e){
        cerr << "isAvailable: query failed!";
        return false;
    }
}
```

Handling Exceptions

bool

```
Checker::isAvailable(){
    QueryResult result;
    checkQuery = "SELECT * FROM Devices WHERE available";
    try{
        _db.query(checkQuery, result);
    }
    catch(DBTimeoutException &e){
        cerr << "isAvailable: query failed! " << e.what();
        rescheduleTimer(20);
        return false;
    }
    if(result.size()==0){
        rescheduleTimer(20);
        return false;
    }
    else{
        rescheduleTimer(100);
        propagateResults(result);
        return true;
    }
}
```

Global Variables are Considered Evil



**Global Variables are
Considered Evil**



Global Variables are Considered Evil

- We all learn this in first year, but seem to forget it too frequently.

Global Variables are Considered Evil

- We all learn this in first year, but seem to forget it too frequently.
- Global variables masquerading as member variables are also Evil!

Why Are Global Variables Evil?



Why Are Global Variables Evil?

- They make tracking the program's state hard.

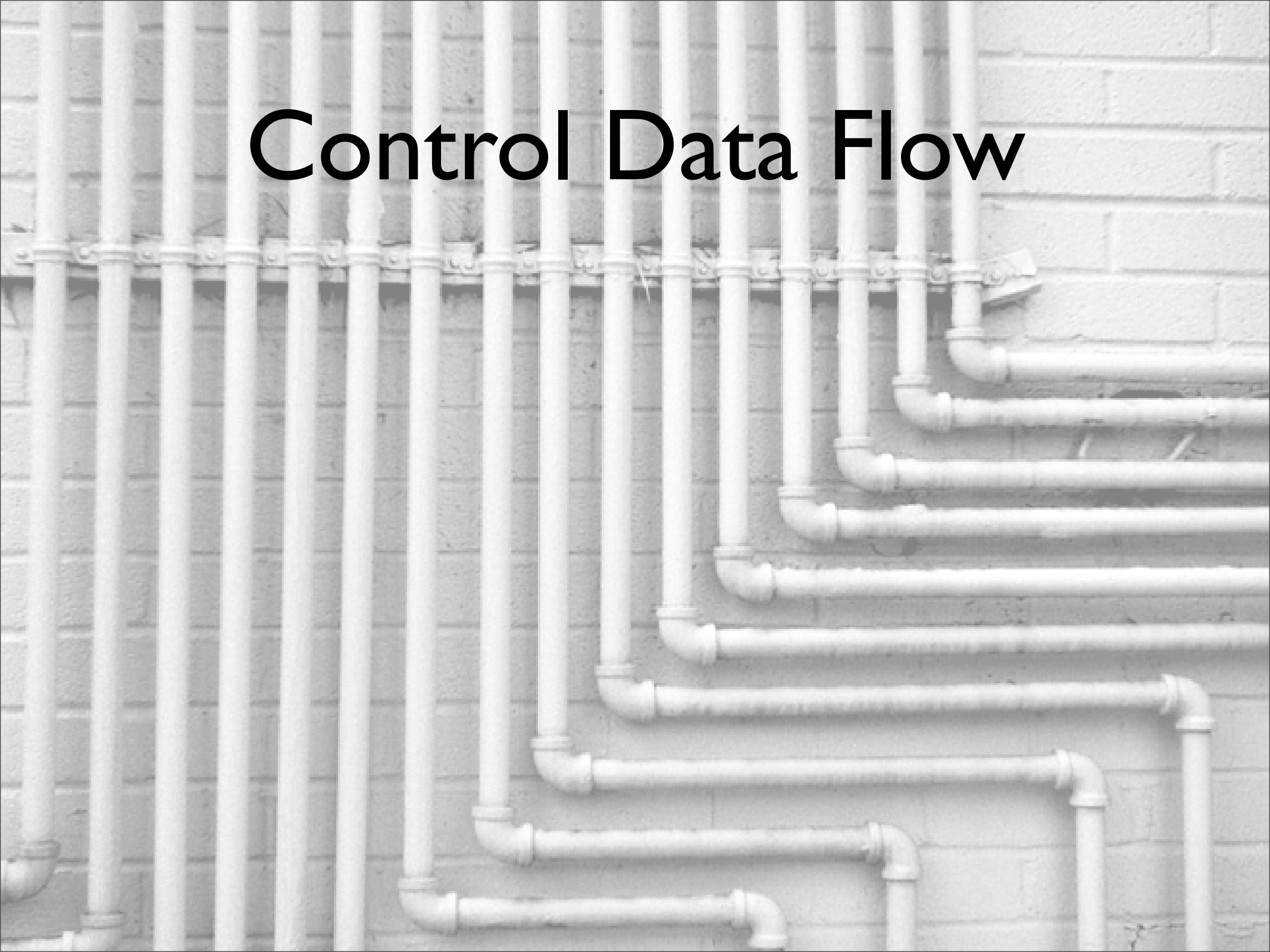
Why Are Global Variables Evil?

- They make tracking the program's state hard.
- They make using multiple threads more dangerous and difficult.

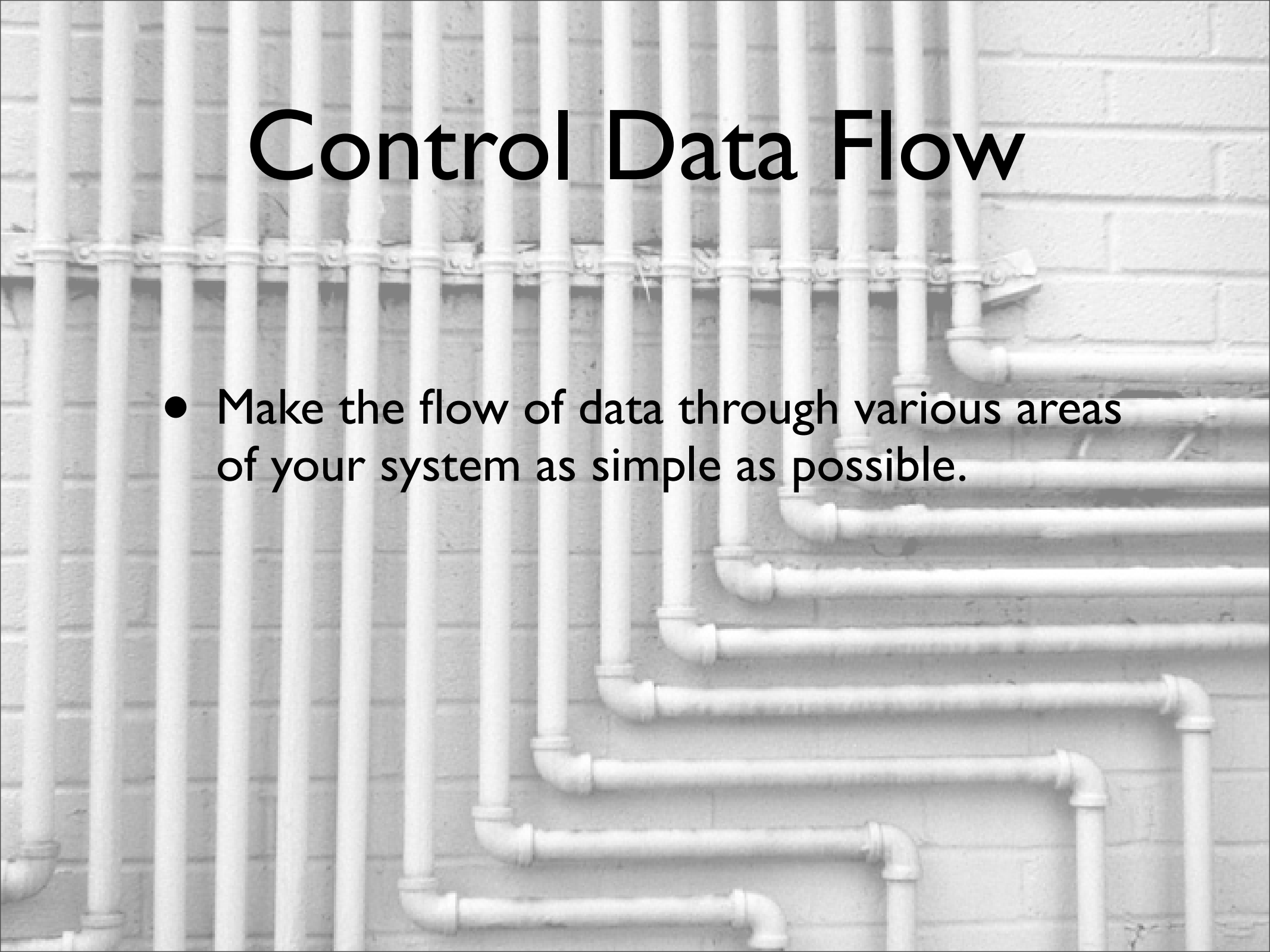
Why Are Global Variables Evil?

- They make tracking the program's state hard.
- They make using multiple threads more dangerous and difficult.
- They make testing really really hard.

Control Data Flow

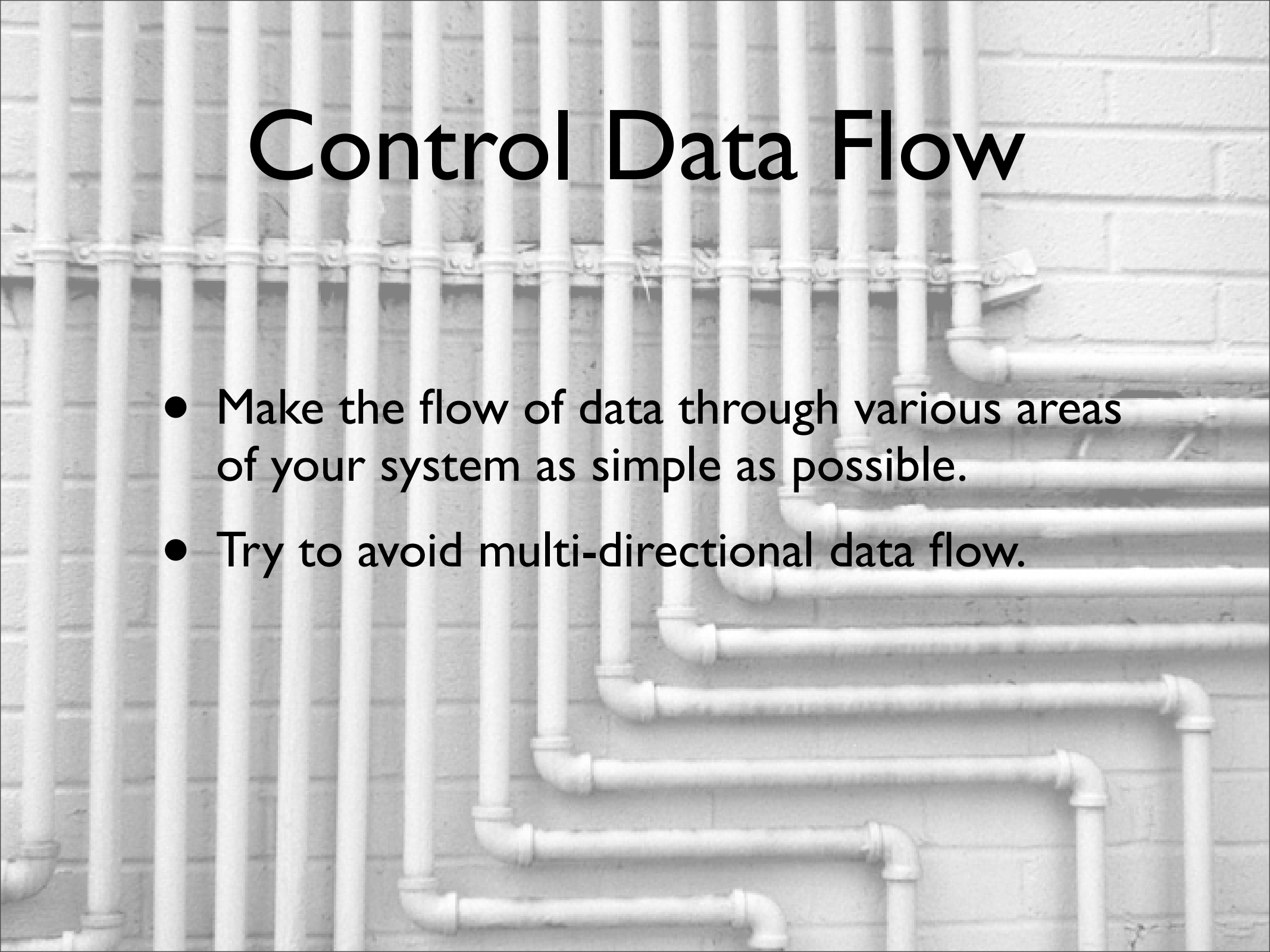


Control Data Flow



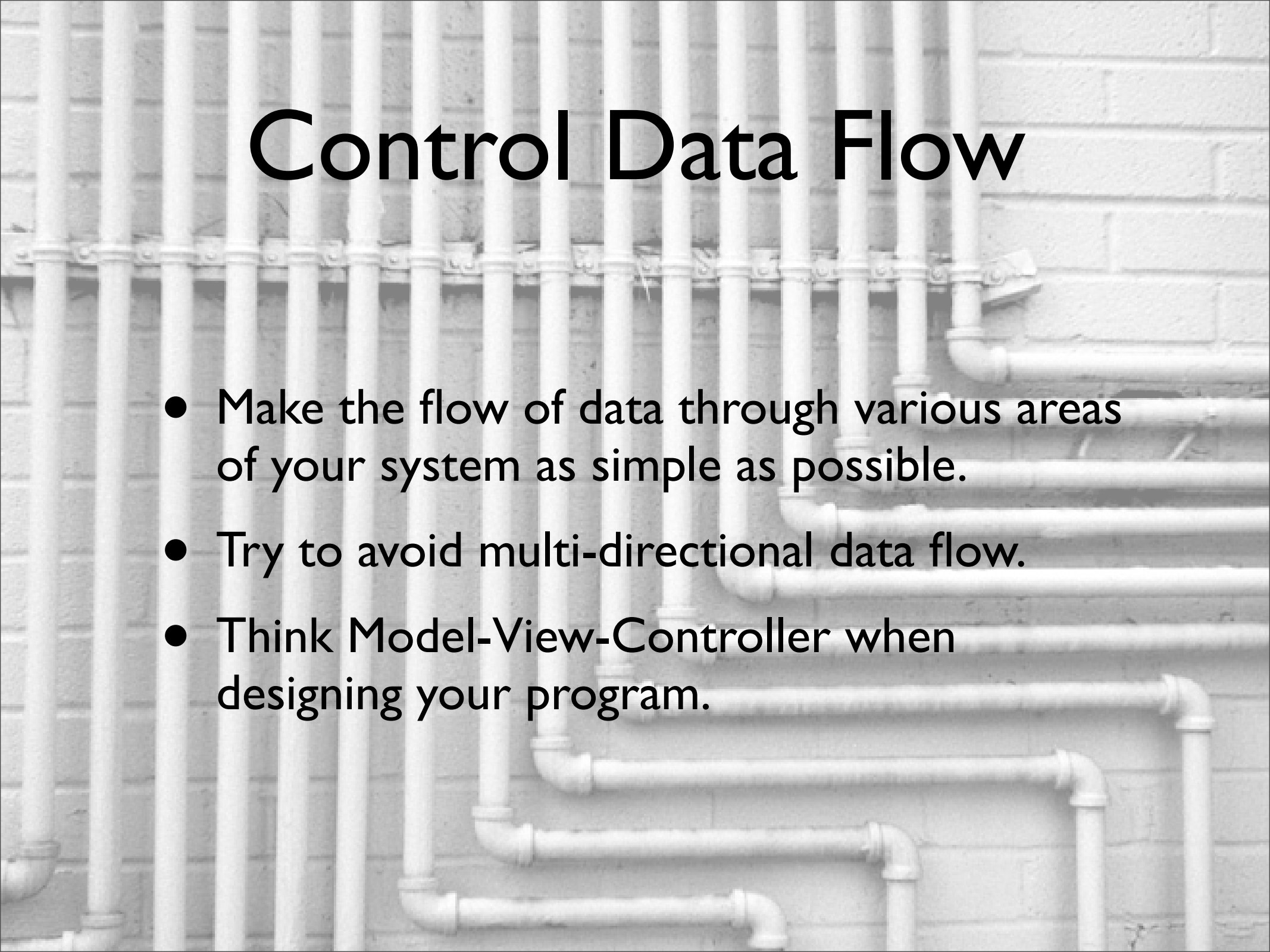
- Make the flow of data through various areas of your system as simple as possible.

Control Data Flow

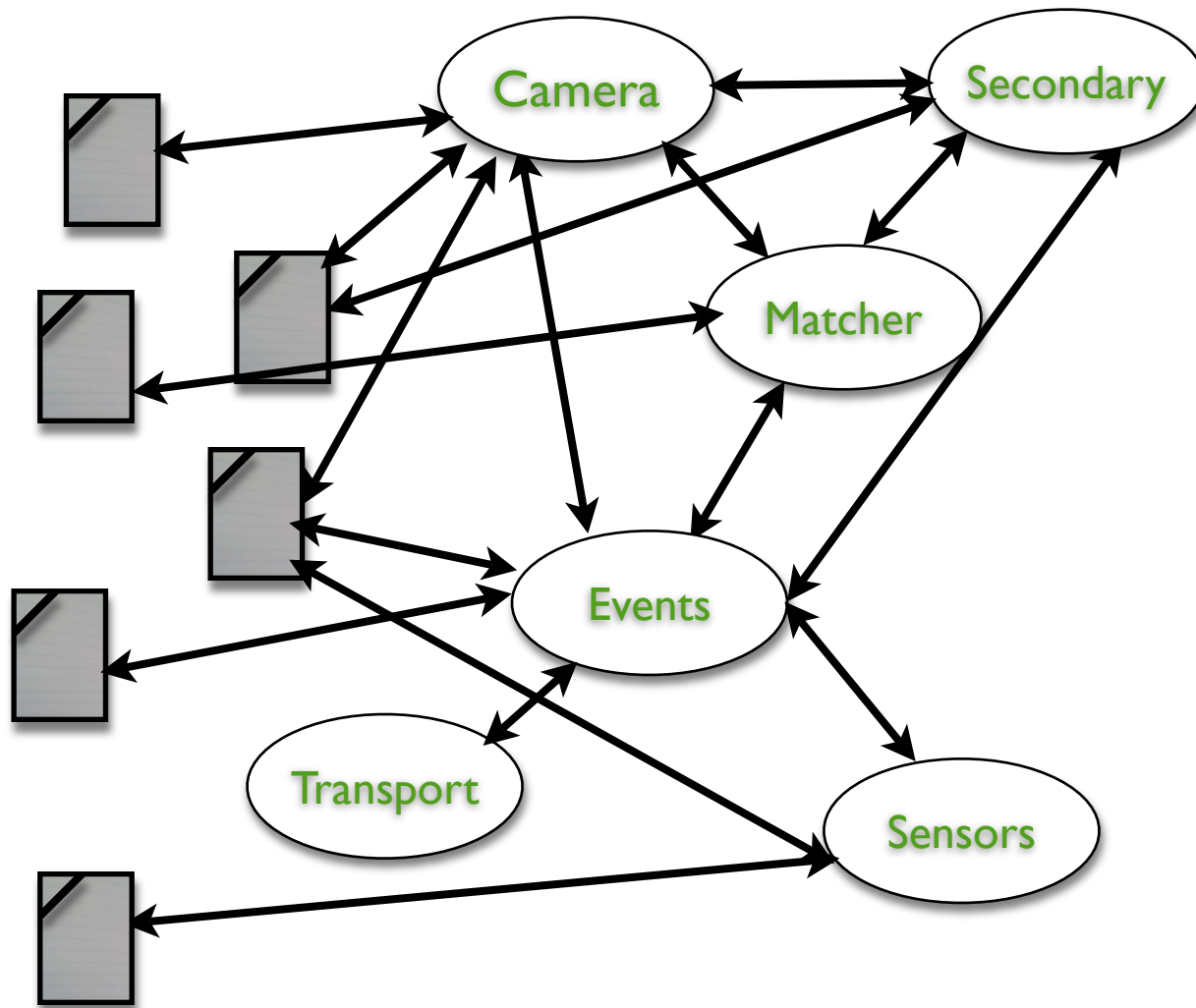


- Make the flow of data through various areas of your system as simple as possible.
- Try to avoid multi-directional data flow.

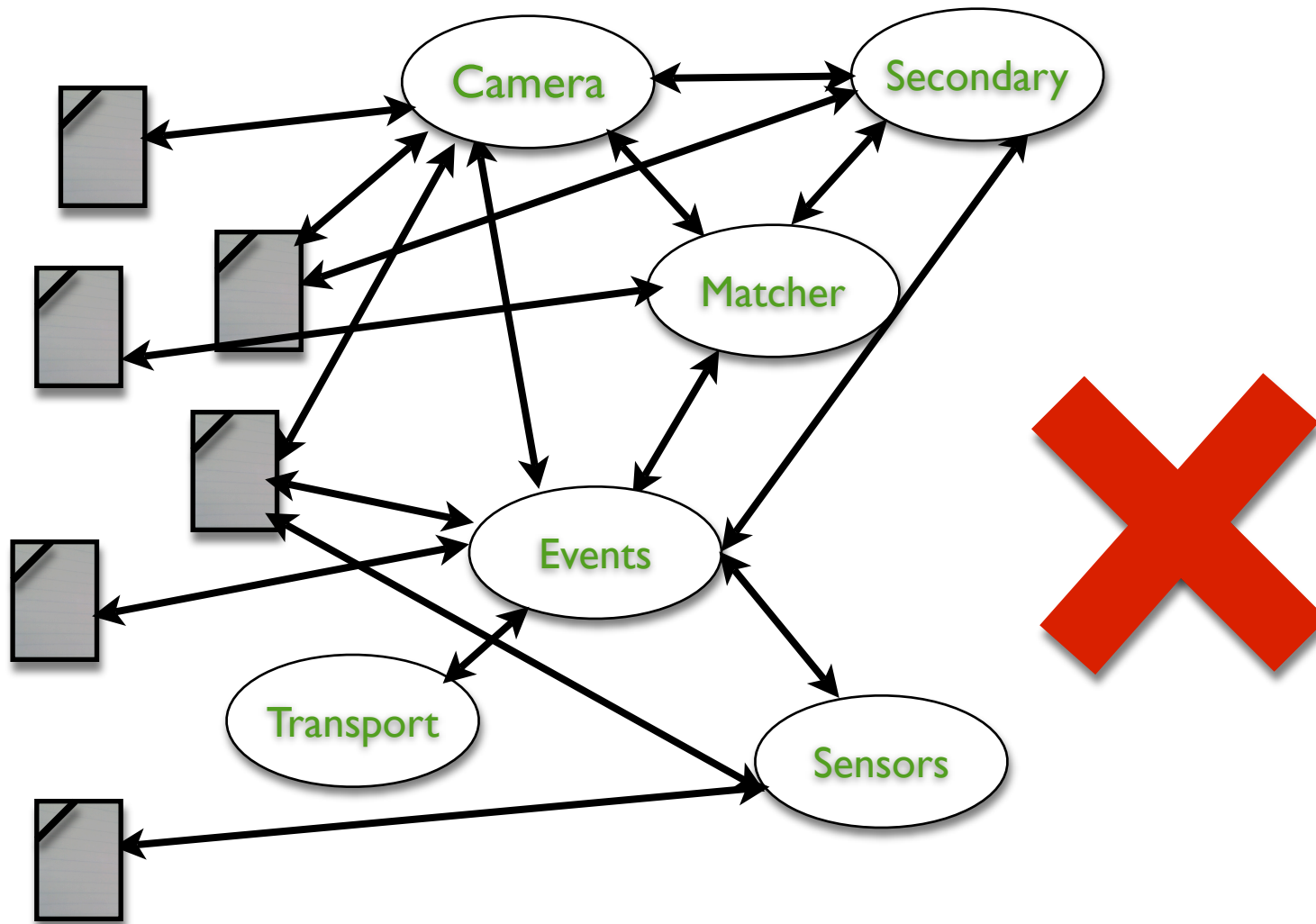
Control Data Flow



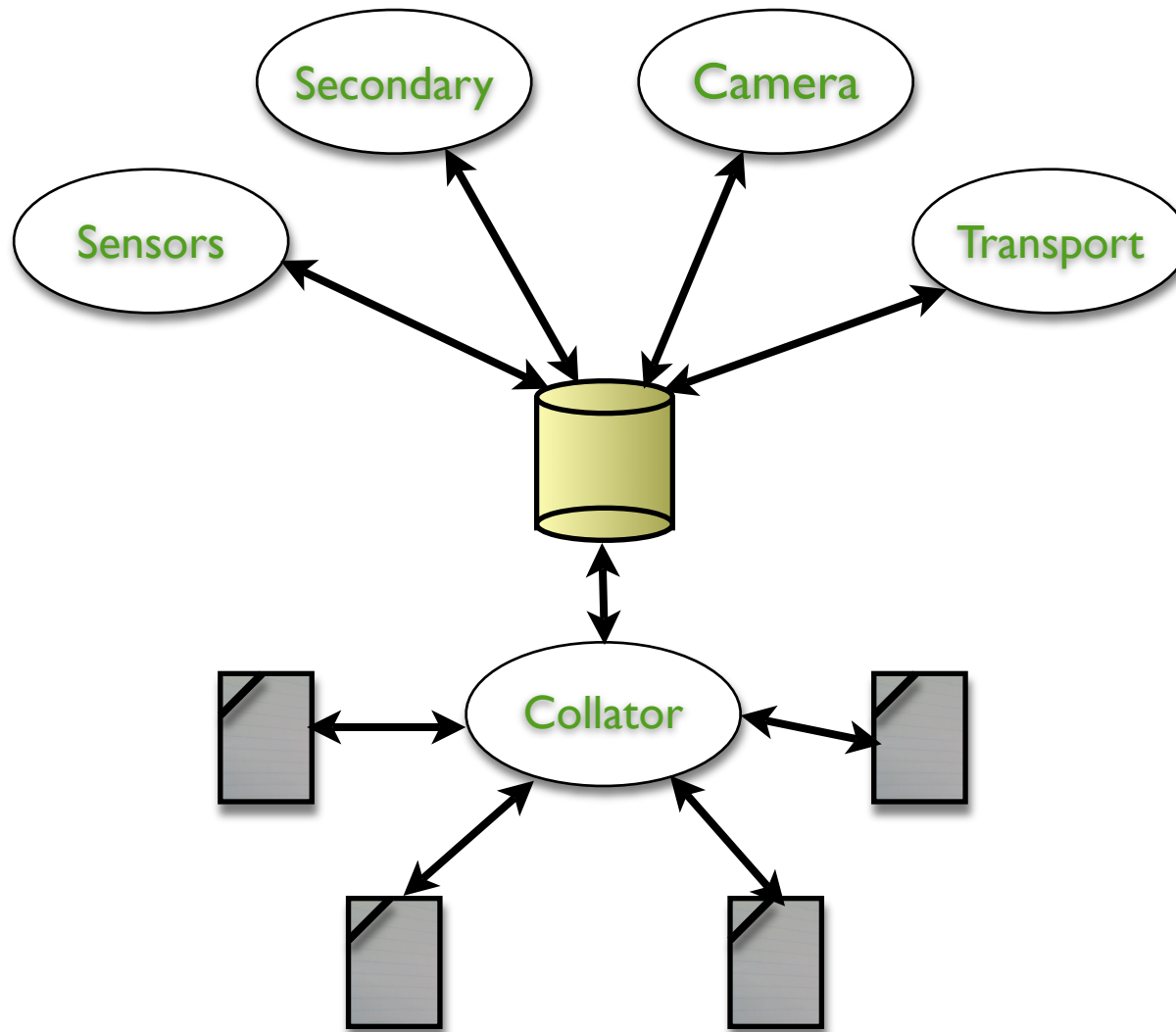
- Make the flow of data through various areas of your system as simple as possible.
- Try to avoid multi-directional data flow.
- Think Model-View-Controller when designing your program.



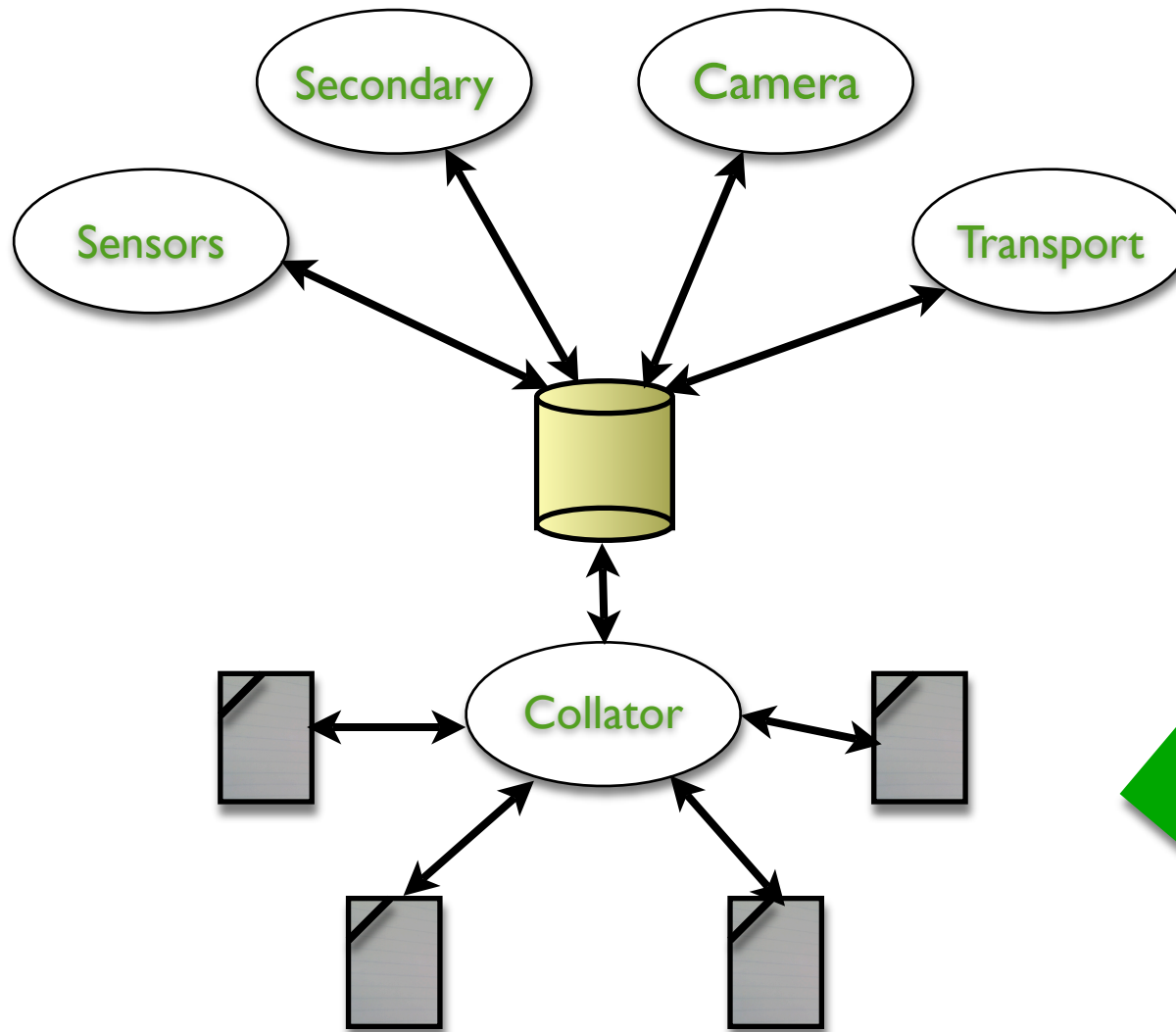
Original Design



Original Design



New Design



New Design

Unspaghettifying Your Objects

Unspaghettifying Your Objects

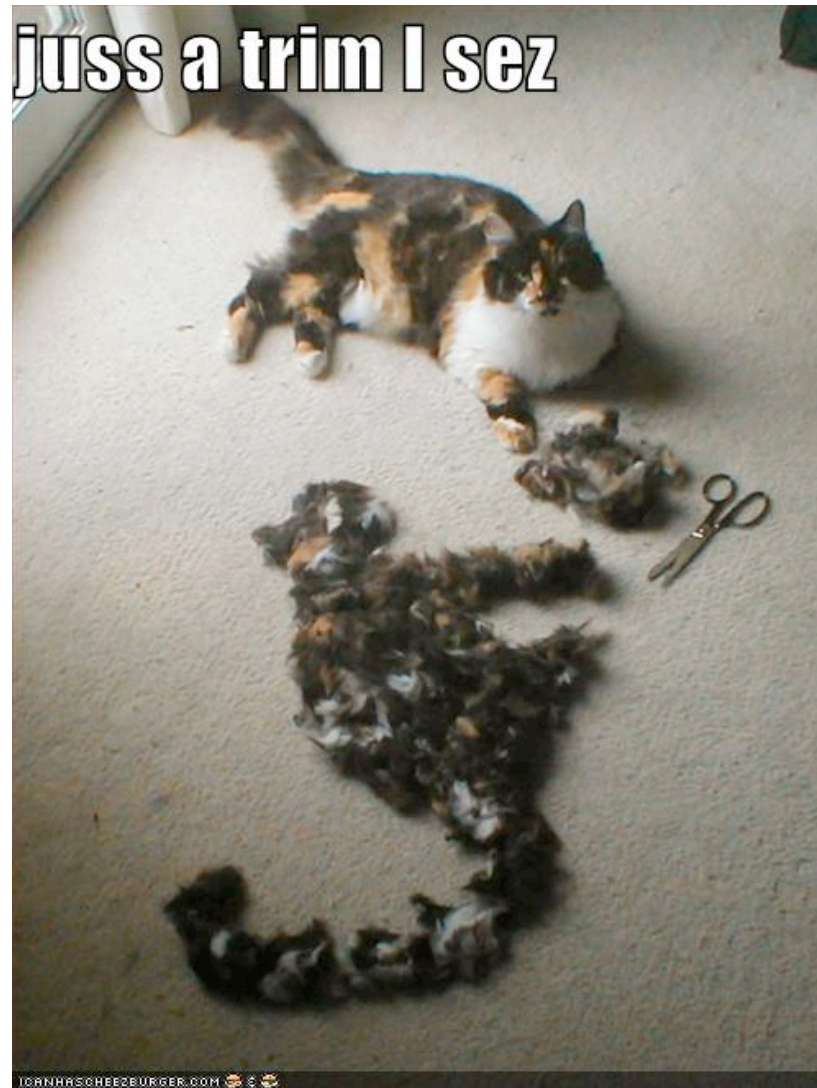
- Don't use an object as a namespace and its members as global variables
- Don't be afraid of having a library of static functions that do computation.

Unspaghettifying Your Objects

Keep your *object* graphs well trimmed

- Separate your logic from your object construction
- Avoid constructing *new* objects in your object - Use **Dependency Injection**

Unspaghettifying Your Objects



Unspaghettifying Your Objects

Unspaghettifying Your Objects

- Keep your *inheritance* graphs well trimmed - Don't write Onion Code!

Unspaghettifying Your Objects

- Keep your *inheritance* graphs well trimmed - Don't write Onion Code!
- Keep your *call* graphs well trimmed. Don't have long chains of function calls.

Encapsulation



Encapsulation



Encapsulation

The image shows two halves of a sliced red onion, cut lengthwise, revealing the characteristic concentric layers of the vegetable. The layers are a mix of light purple and white, creating a pattern that visually represents the concept of encapsulation in programming. The onion halves are positioned on either side of the center, with their cut surfaces facing each other. The background is a plain, light-colored surface.

- Encapsulation is Good

Encapsulation

The background of the slide features two sliced red onions, cut in half and placed side-by-side. The onions are sliced into thin, concentric rings, showing a vibrant purple-red color. The slices are arranged in a way that they appear to be part of a larger onion, with the cut surfaces facing each other. The background is a light, neutral color, possibly a white cutting board or a light-colored surface.

- Encapsulation is Good
- Excessive Encapsulation is Evil

Encapsulation

The background of the slide features two halves of a sliced red onion, showing their concentric rings. The onion is cut in half, and the two halves are positioned symmetrically, facing each other. The text is overlaid on the left half of the onion.

- Encapsulation is Good
- Excessive Encapsulation is Evil
- Excessive Encapsulation is Evil

Encapsulation

- Encapsulation is Good
- Excessive Encapsulation is Evil
- Excessive Encapsulation is Evil
- Don't encapsulate the encapsulated. Don't write Onion Code!

Encapsulation

```
class Door{
    public:
        Door():_handle(Handle()){}

        void open(){
            if(!_handle.locked()){
                _opened = true;
            }
        }

        void close(){
            _opened = false;
        }
    protected:
        bool _opened;
        Handle _handle;
}
```

Encapsulation

```
class RedDoor:public Door{
    public:
        RedDoor():_colour("red"){
    protected:
        string _colour;
}

class RedDoorWithAluminiumHandle: public RedDoor{
    RedDoorWithAluminiumHandle():_colour("red"),_handle(Handle("
aluminium")){}
}

RedDoorWithAluminiumHandle
makeRedDoorWithAluminiumHandle(){
    return RedDoorWithAluminiumHandle();
}
```

Encapsulation

```
class Door{
    public:
        Door(string colour, Handle handle):
            _colour(colour), _handle(handle){}
        void open(){
            if(!_handle.locked()){
                _opened = true;
            }
        }
        void close(){
            _opened = false;
        }
    private:
        string _colour;
        Handle _handle;
}

Door
makeRedDoorWithAluminiumHandle(){
    handle = Handle("aluminium");
    return Door("red", handle);
}
```

Encapsulation



Encapsulation

The background of the slide features two halves of a sliced red onion, showing the characteristic concentric rings of the vegetable. The onion is cut in half, and the two halves are positioned symmetrically, facing each other. The rings are a mix of light purple and white, creating a visually appealing pattern. The lighting is soft, highlighting the texture of the onion's layers.

- Encapsulate logical parts of your code, don't encapsulate basic computation or IO.

Encapsulation

- Encapsulate logical parts of your code, don't encapsulate basic computation or IO.
- Don't be afraid to use public member variables directly

Encapsulation

- Encapsulate logical parts of your code, don't encapsulate basic computation or IO.
- Don't be afraid to use public member variables directly
- Make your encapsulated objects general enough to use in different modules

Encapsulation

- Encapsulate logical parts of your code, don't encapsulate basic computation or IO.
- Don't be afraid to use public member variables directly
- Make your encapsulated objects general enough to use in different modules
- Composition or Inheritance?

Threads are Hard

"To offer another analogy, a folk definition of insanity is to do the same thing over and over again and expect the results to be different. By this definition, we in fact require that programmers of multithreaded systems be insane. Were they sane, they could not understand their programs."

-Edward A. Lee

Well see, it all started

with a loose thread

and just went downhill from there



Threads are Hard



Threads are Hard

- If it can be done in one thread, do it in one thread.
- Keep the multithreaded minority of your code separate from the single threaded majority.
- Use message passing rather than shared memory.

Summary

Summary

- Minimise your state.

Summary

- Minimise your state.
- Make your code as simple as possible but no simpler.

Summary

- Minimise your state.
- Make your code as simple as possible but no simpler.
- Control your data flow.

Simplicity is prerequisite for reliability

- Edsger W. Dijkstra

Questions?

More Information

Details of this talk and a copy of the slides
are available at:

[http://sara.falamaki.id.au/moin/Writing/
ProgrammingTips](http://sara.falamaki.id.au/moin/Writing/ProgrammingTips)

Photo Credits

<http://www.flickr.com/photos/23232902@N05/2542353761/> (exception)

<http://mine.icanhascheezburger.com/view.aspx?ciid=3900660> (trim)

<http://mine.icanhascheezburger.com/view.aspx?ciid=4027009> (hot potato)

<http://www.flickr.com/photos/vox/2208835201/sizes/o/> (pipes)

<http://icanhascheezburger.com/2008/11/05/funny-pictures-see-it-all-started-with-a-loose-thread-and-just-went-downhill-from-there/> (threads)

<http://www.flickr.com/photos/Designedlykristi/122619504/sizes/o/>

<http://icanhascheezburger.com/2007/06/02/im-in-ur-quantum-box/>