



University of  
Sheffield



COM3529 Software Testing and Analysis

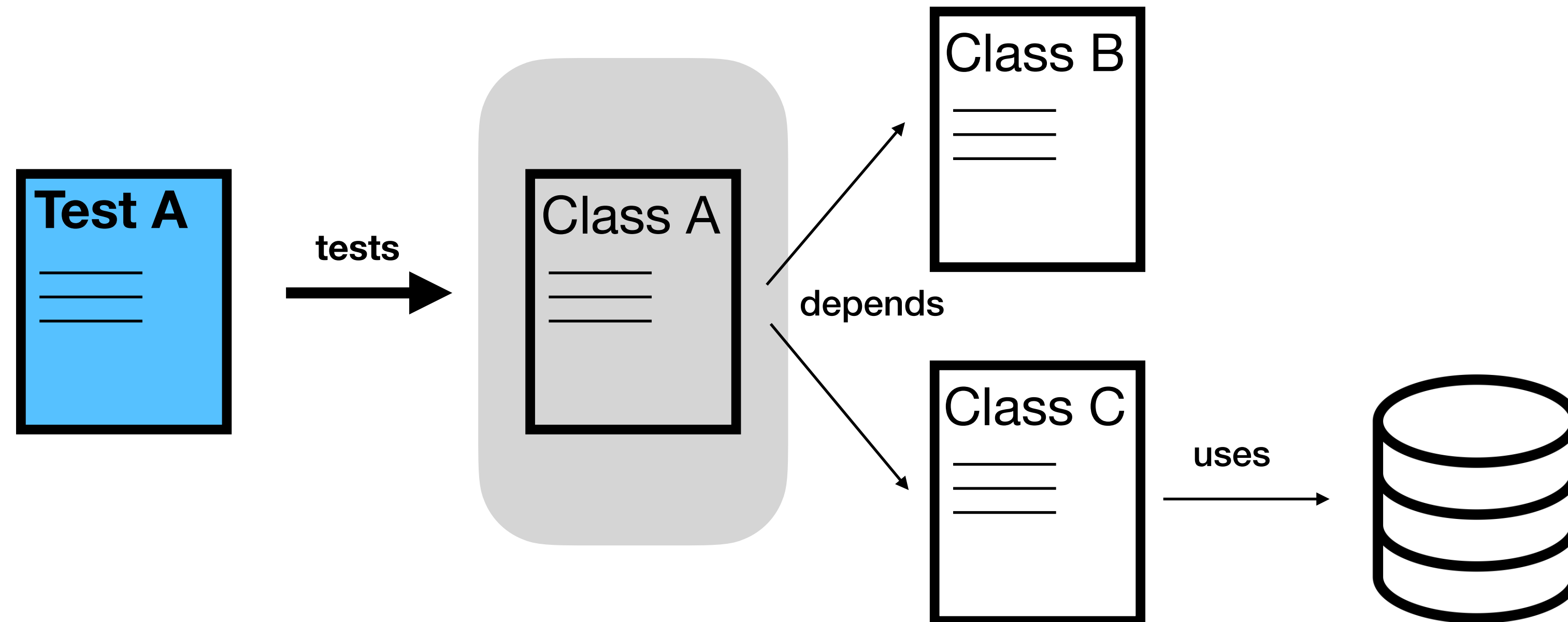
# Test Scope

Professor Phil McMinn

# Unit Testing

A unit is an individual component of a system, such as a class or an individual method.

Testing units in isolation is called **unit testing**.



# Unit Testing

A unit is an individual component of a system, such as a class or an individual method.

Testing units in isolation is called **unit testing**.

- **Fast**
- **Easy to control**
- **Easy to write**
- **Lack reality**
- **Cannot catch all bugs**  
(e.g. interactions with other components or services)

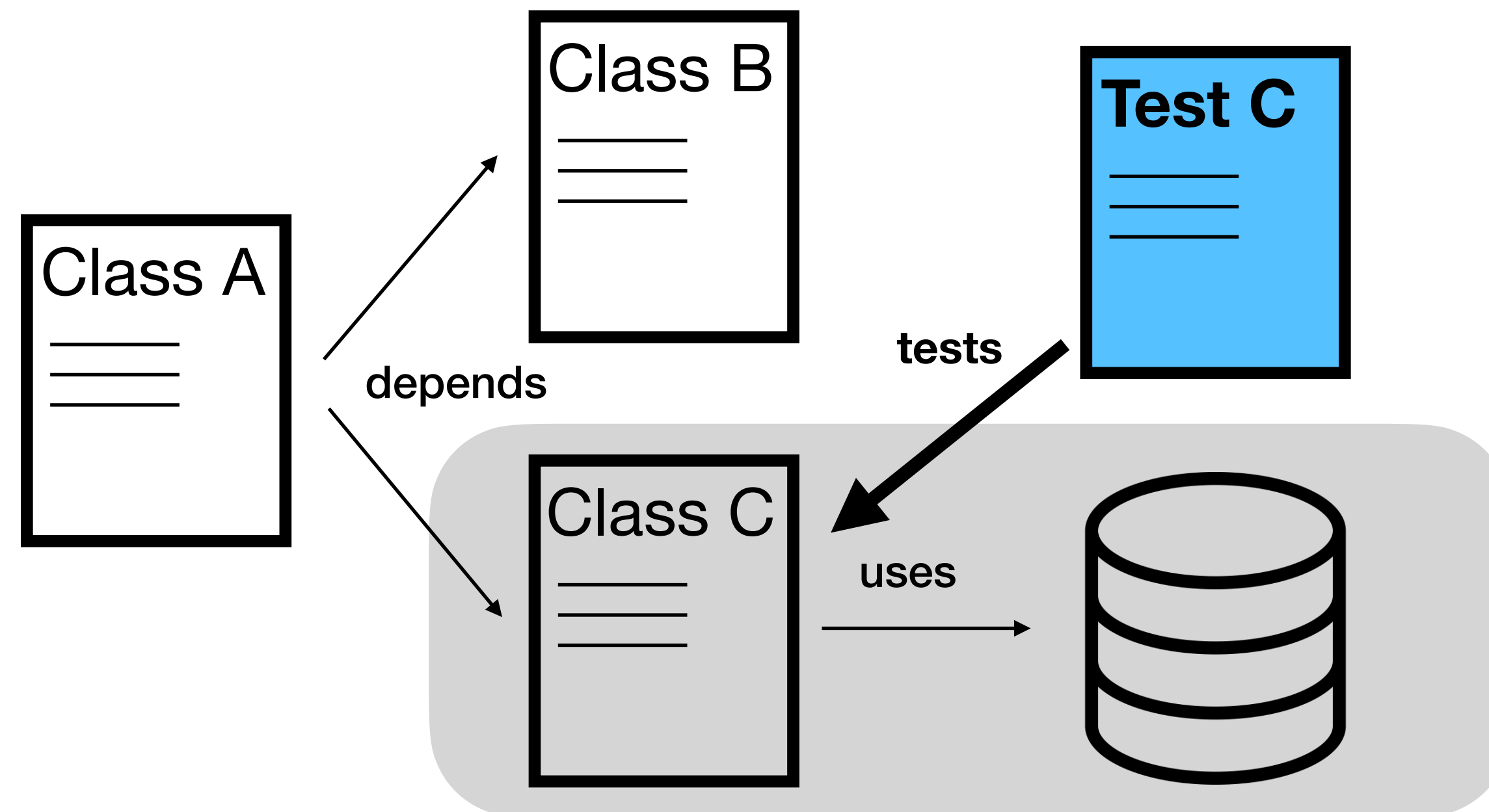
**Unit tests are a very useful type of test but are often insufficient on their own.**

# Integration Tests

Testing in isolation is not enough. Sometimes code goes “beyond” the system’s borders and uses other (often external) components – for example, a database.

**Integration tests test the integration between our code and that of external parties.**

**Example:** Testing methods that access a database via SQL queries. Do our methods obtain the right data from the database?



# Integration Tests

Testing in isolation is not enough. Sometimes code goes “beyond” the system’s borders and uses other (often external) components – for example, a database.

**Integration tests test the integration between our code and that of external parties.**

**Example:** Testing methods that access a database via SQL queries. Do our methods obtain the right data from the database?

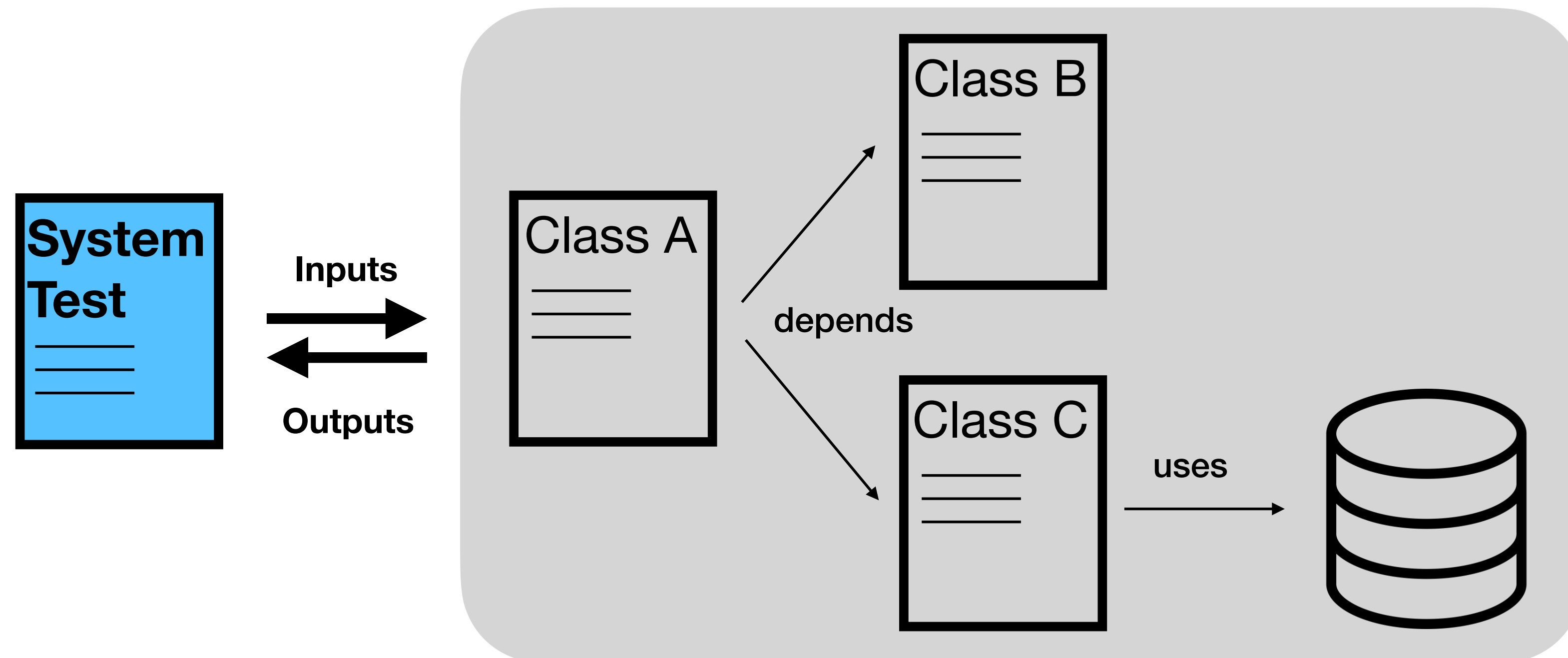
- **Can capture integration bugs**
- **Less complex than writing a system test that goes through the entire system, including components we do not care about**
- **Hard to write**, for example:
  - Need to use an isolated instance of the database
  - Put it into a state expected by the test
  - Reset the state afterwards

# System Tests

To get a more realistic view of the software we should also perform more realistic tests with it – with all its database, front-end, and other components.

We do not care about how the system works from the inside.

**We care that given certain inputs, certain outputs are provided by the system.**



# System Tests

To get a more realistic view of the software we should also perform more realistic tests with it – with all its database, front-end, and other components.

We do not care about how the system works from the inside.

**We care that given certain inputs, certain outputs are provided by the system.**

- **Realistic**

(when the tests perform similarly to the end user, the more confident we can be that the system will work correctly for all end users)

- **Slow!**

- **Hard to write**

(lots of external services to account for)

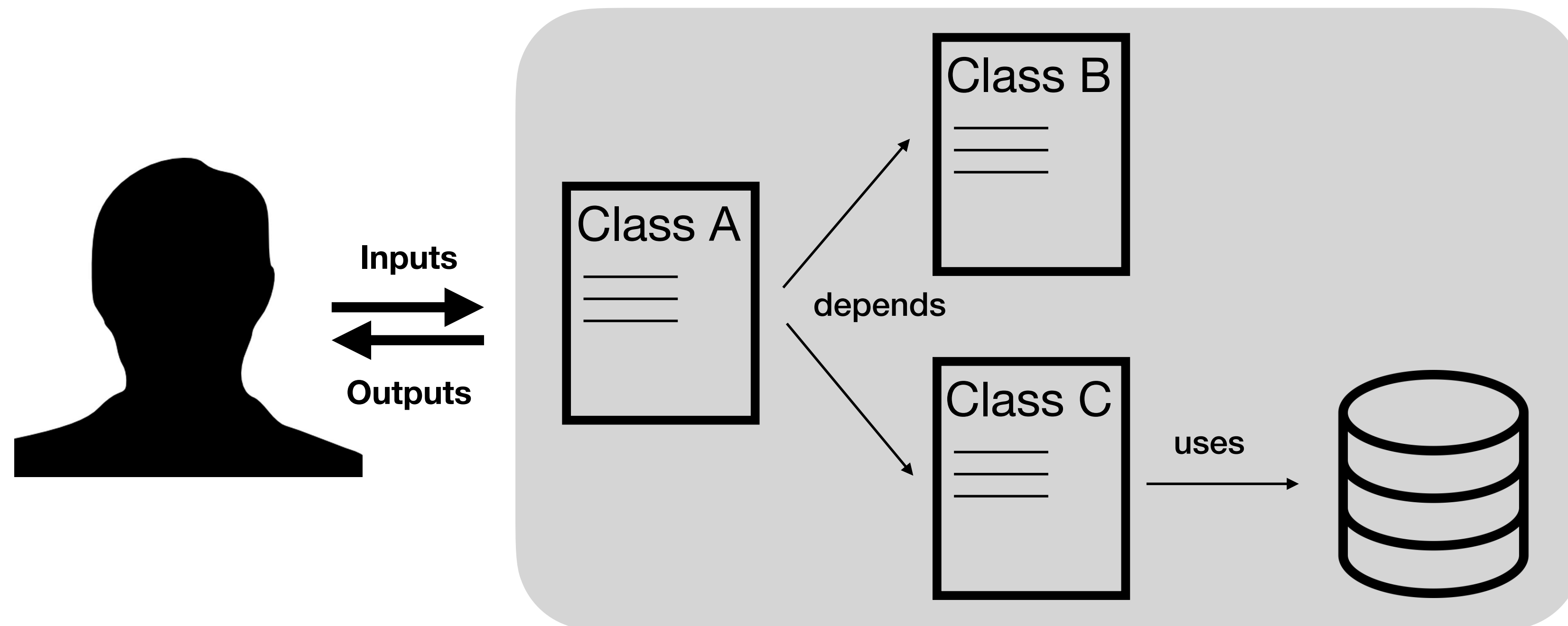
- **Prone to Flakiness**

# Manual Tests

Not everything can be tested easily in an automated fashion, particularly where there are qualitative judgements (e.g., the quality of a search engine's results).

Furthermore, we may need to explore real system behaviour to know what automated tests to write.

**Manual tests are system tests performed manually by a human.**





# Manual Tests

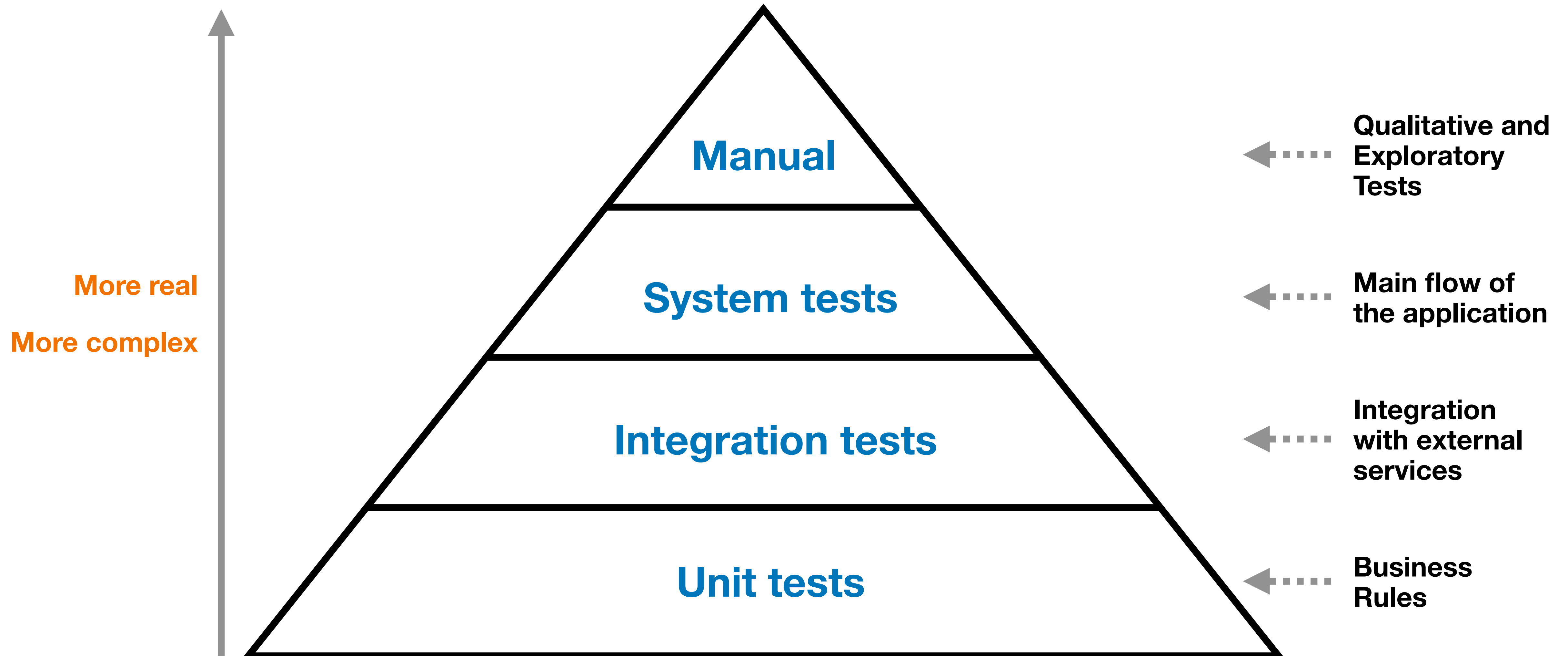
Not everything can be tested easily in an automated fashion, particularly where there are qualitative judgements (e.g., the quality of a search engine's results).

Furthermore, we may need to explore real system behaviour to know what automated tests to write.

**Manual tests are system tests performed manually by a human.**

- **Real**  
(The tester is acting as an end-user, actually using the system)
- **Time-consuming**
- **Difficult to reproduce**
- **Tedious**

# The Test Triangle



*What Test am I?*



I test a web application. I load up the web page, automatically fill out forms, click buttons, and check the resulting web page.

**Am I a ...**

**unit, integration, system or a manual test?**

**SYSTEM**

I am an automated test that checks the results of a method.

**Am I a ...**

**unit, integration, system or a manual test?**

**UNIT**

I am essentially a series of inputs that a human inputs into a terminal. I don't check the answers, I leave that to my human. I don't really "exist" in any tangible form, but some humans write me into documents so that they know how to reproduce me.

**Am I a ...**

**unit, integration, system or a manual test?**

**MANUAL**

I am an automated test that interacts directly with code that uses a database.

Am I a ...

**unit, integration, system or a manual test?**

**INTEGRATION ... OR UNIT**