UML Case Study – 1
Use Cases

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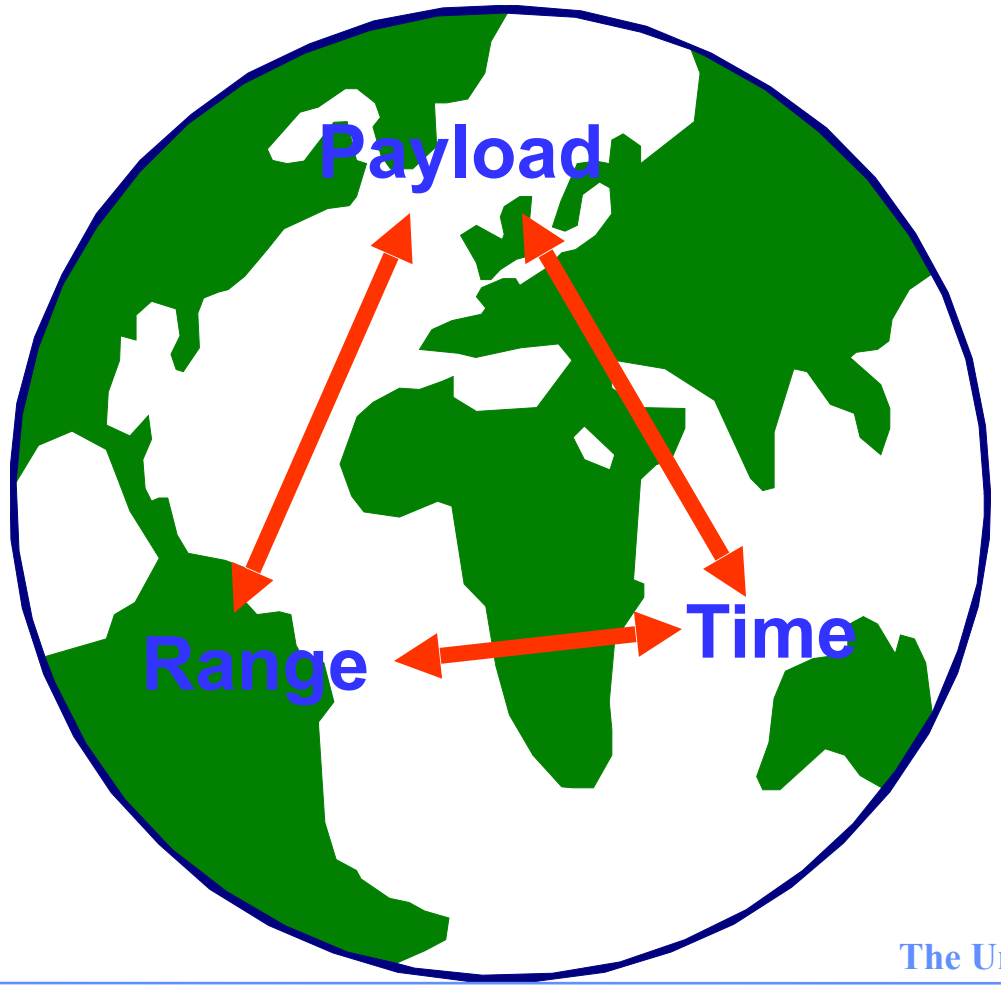
Objectives

- To use demonstrate the use of UML in describing an application domain
  - Commercial Aviation Flight Planning
- To discuss the use of Object Oriented methods
  - In particular, how Delphi is typically used
- To increase understanding of UML
  - As a communication tool

The Flight Planning Problem



But there are lots of constraints…

- **Hard constraints**
  - **Maximum Gross Weight of the aircraft**
  - **Minimum distance between origin and destination**
  - **Aircraft minimum and maximum speeds**
- **Legal Constraints**
  - **Extra fuel in case of delays, bad weather etc.**
  - **Noise limits**
- **Operational Constraints**
  - **Overall maximisation of "profit"**
  - **Total revenues – Total Costs**

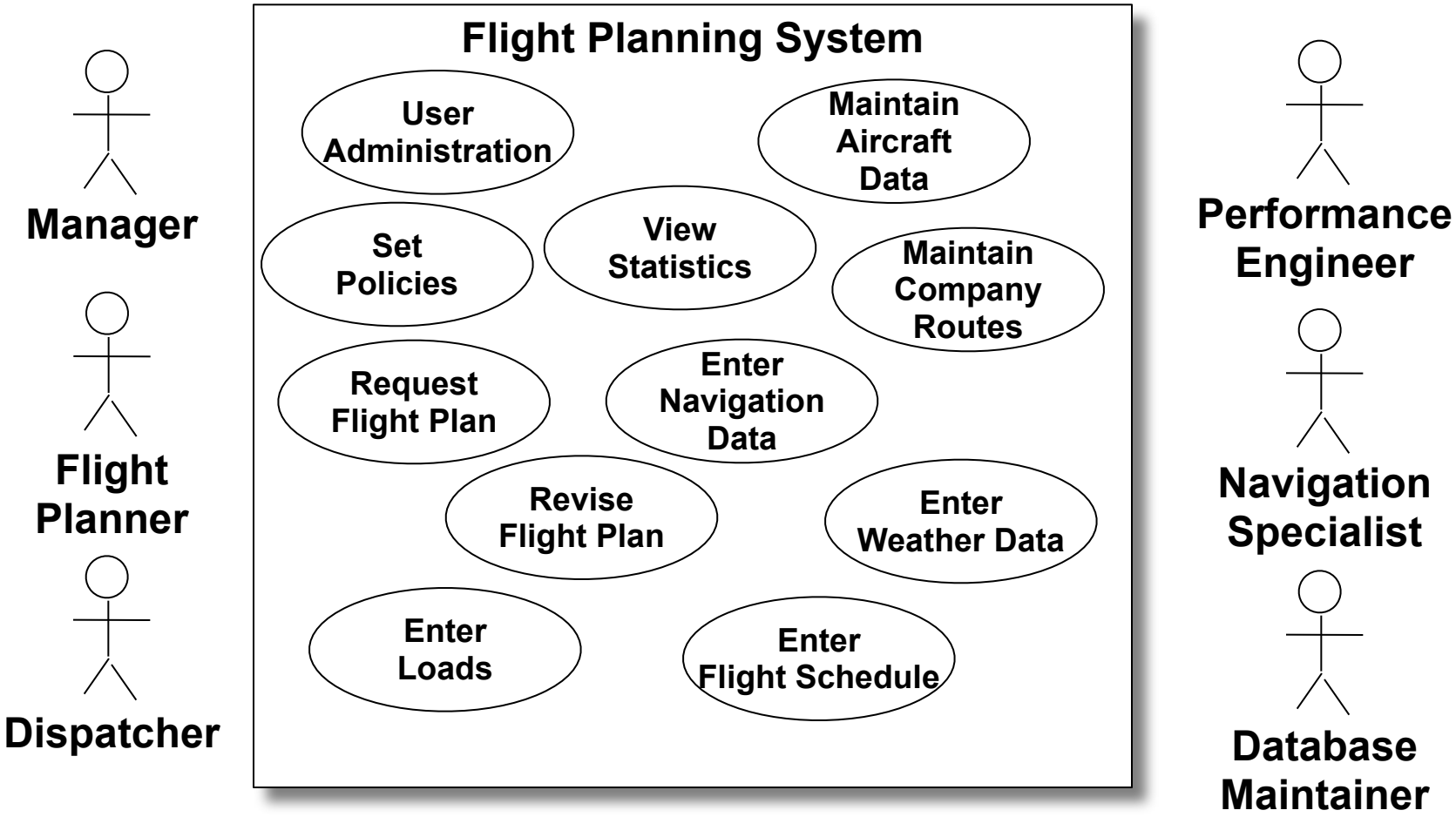
Two Uses of Use Cases

- High Level View
  - For communication between interested parties
  - To assist in object identification / modularisation
- Detailed View
  - As part of detailed requirements
  - Shows "fit" to business process
  - Can be used in acceptance testing

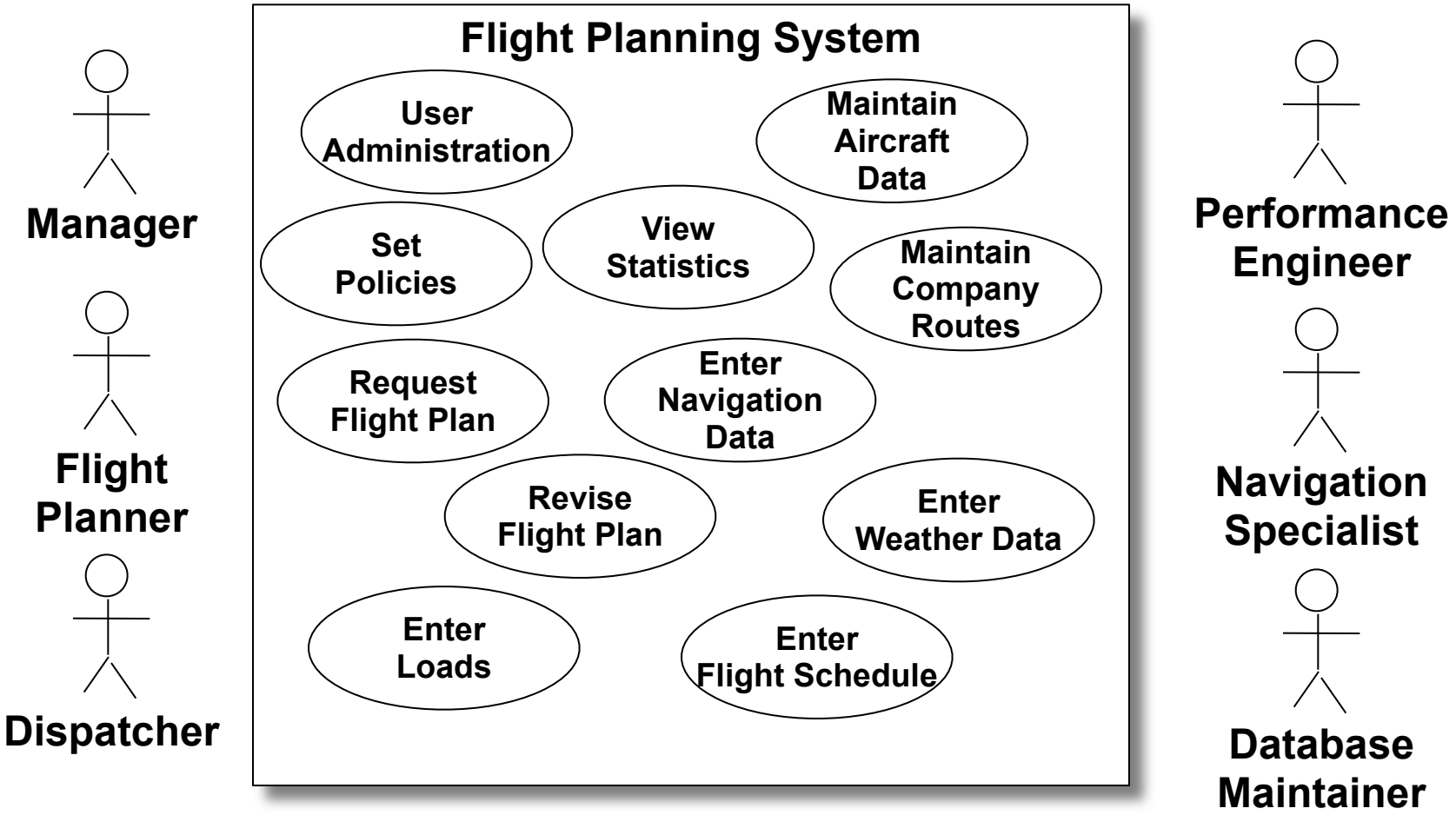
Use Cases in UML

- High Level View
  - UML Use Case Diagrams
  - May not add much value to a narrative / list base approach
- Detailed View
  - Can use activity or sequence diagrams
  - More often use a "procedural" description

Flight Planning Use Cases



Flight Planning Use Cases



Detail – Request Flight Plan

Purpose

To create flight plan

Preconditions

Loads entered
Weather entered

Main Flow

- Enter flight no.
- Examine synoptic weather chart
-Enter special conditions
- Start calculation
- Request printout

Post Conditions

- Statistics updated

Other Detailed Features

- **May include "actors", which may be different for different steps**
  - **Like a "swimlane" activity diagram**
- **May include sub-flows**
  - **Choices in main flow**
- **May number steps for reference purposes**
  - **Sub-flows numbered hierarchically**
- **May include other detailed use cases**
  - **Possibly overriding the default actor**

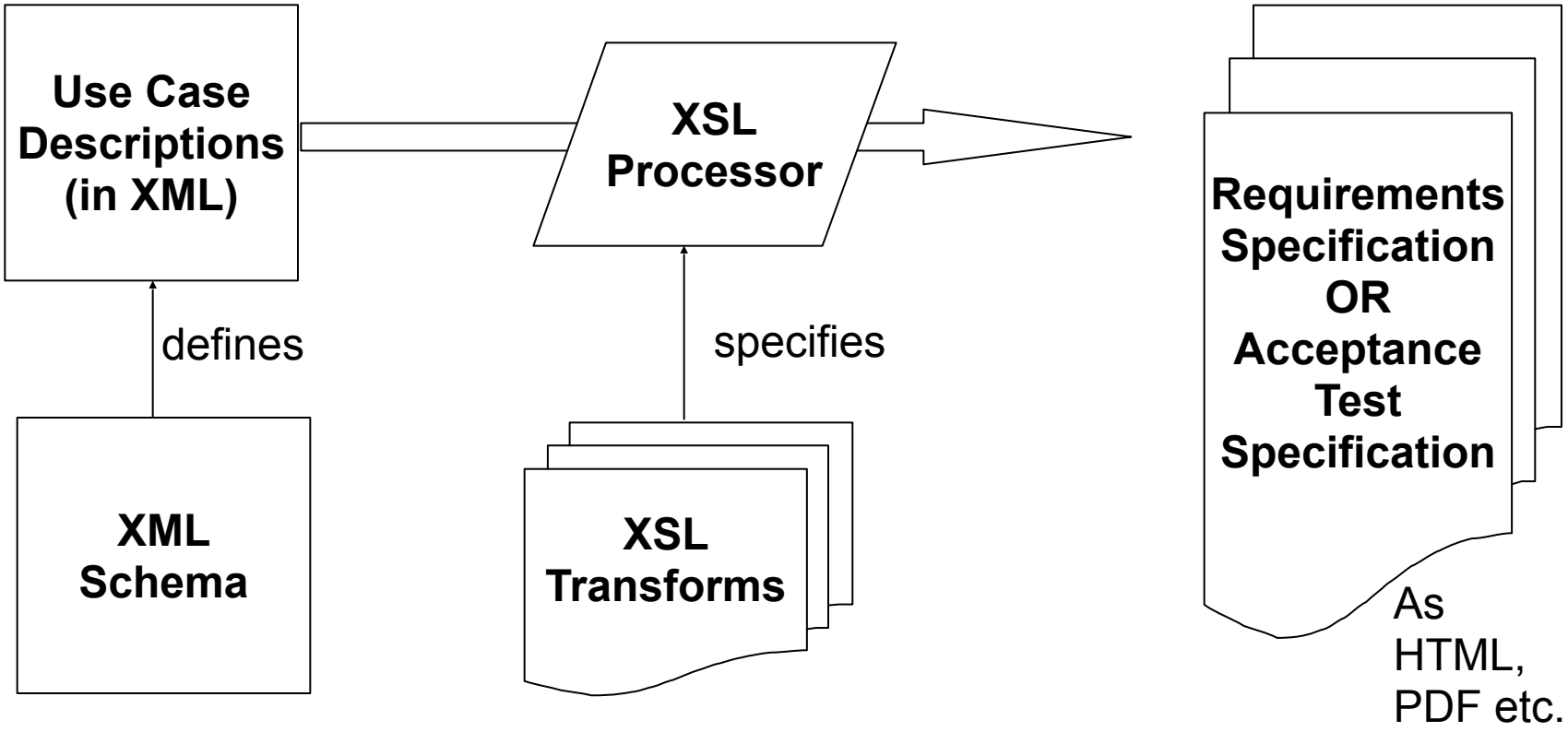
Extending the Use Case

- **Introduce a richer variety of "steps"**
  - **Optional steps**
  - **Choose one or more of…**
- **Each "step" may include specific user actions**
  - **E.g. Select menu item "calculate"**
- **May also include system responses**
  - **E.g. Form 27a is displayed showing calculation progress**
- **Use Cases may be grouped in "Scenarios"**
  - **Sets of related activities**
  - **Common preconditions e.g. data preparation**
- **May need "summary" view for some purposes**

Problems with Use Cases

- **Getting the granularity right can be tricky….**
  - **Too small = too many use cases**
  - **Too large = unwieldy use case**
- **Beware of recursion in cross references**
  - **Especially if generating documents / test cases automatically**
- **Sub-flows & options cause exponential increase in number of "paths" through the use cases**
  - **Can make testing very lengthy**
  - **May need to indicate "important" paths**

Formal Use Case Specification



Example Formal Use Case

```
<usecase><title>Enter actual arrival times</title>
   <usecase id="MCS-UC-072" actor="Flight Dispatcher">
    <purpose><para>To ensure that Operations Control has an
  accurate and up to date view of flight leg movements. </para>
  </purpose>
    <precond><para>None.</para></precond>
    <sequence>
         <step><drs> The Flight Dispatcher enters the actual
             on blocks time for the flight leg.</drs>
           <uat>Enter the actual on blocks time and select
               <button>Update</button>. <expected-result>Actual
               on blocks time is displayed on FS00.
                </expected-result>
           </uat>
         </step>
         <step>
               . . . Further steps . . .
```

Example Requirements Specification

3.2.8 - Enter actual arrival times

3.2.8.1 - Purpose

To ensure that Operations Control has an accurate and up to date view of flight leg movements.

3.2.8.2 - Pre-Conditions

None.

3.2.8.3 - Main Flow

1. The use case begins when the Flight Dispatcher is informed of the arrival of a flight leg. It is not a requirement for the flight to be assigned to an aircraft tail or aircraft pattern. Typically, an automatically generated ACARS (or equivalent) message is received by the system. This step only occurs where is no automatically generated ACARS (or equivalent) message received.
2. The Flight Dispatcher displays the flight leg details (User Interface FS00) .
3. The Flight Dispatcher enters the actual on blocks time for the flight leg.
4. The system calculates the delay time and cascades the delay to subsequent flight legs, only if the delay propagation rules are met (Business Rules MCSBR002) .
5. The Flight Dispatcher saves the changes.

Example Acceptance Test Specification

Enter actual arrival times - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites Media

Address C:\Documents and Settings\Any Authorised User\My Documents\Transfer\MCS-BS-003a-MCS-UC-056-MCS-UC-072.html Go Links

MCS-UC-072 - Enter actual arrival times

This use case is part of scenario (MCS-BS-003a)Flight is arriving late. Passenger connection constraint is violated

Test Actions

No.	Chs.	Seq.	Trace	Chs.	Seq.	Action	Result?	P/F
1	One		Flight Dispatcher MCS-UC-072/3			Enter the actual on blocks time **{onBlocksTime}** and select **[[Update]]**.	Actual on blocks time **{onBlocksTime}** is displayed on FS00.	P/F
2						Select **[[Close]]**.	FS00 is closed and the on blocks time **{onBlocksTime}** is displayed on FS00.	P/F
3			Flight Dispatcher MCS-UC-072/3a			Enter the actual touchdown time **{touchdownTime}** and select **[[Update]]**.	Actual touchdown time **{touchdownTime}** is displayed on FS00.	P/F
4						Select **[[Close]]**.	FS00 is closed and the touchdown time **{touchdownTime}** is displayed on FS00.	P/F
5			Flight Dispatcher MCS-UC-072/4				The delay time is calculated for **{flightNo}** and the delay cascaded to subsequent flight legs only if the data propagation rules are met See MCS-BR-002.	P/F
6			Flight Dispatcher MCS-UC-				Aircraft hours and cycles are adjusted to reflect this arrival information See MCS-BR-072.	P/F

Done My Computer

start Transfer Microsoft PowerPoint ... Enter actual arrival ti... 09:48

Use Cases - Conclusions

- **High Level Use Cases are useful for**
  - **Communication / system understanding**
  - **Object Identification**
- **Detailed Use Cases are useful for**
  - **System Specification**
  - **Understanding how systems fit with business processes**
- **Biggest problem often “granularity”**