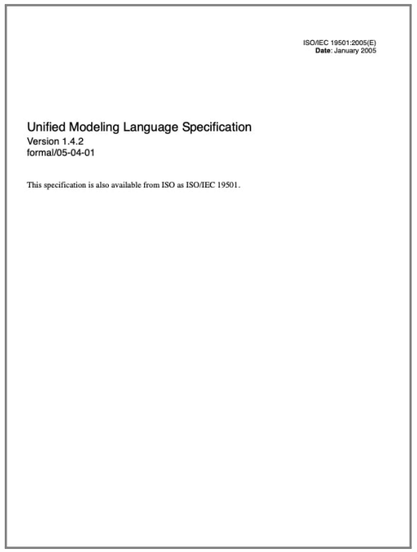
UML

and XMI, OCL, MOF, etc.

Yegor Bugayenko

Lecture #8 out of 16
80 minutes

The slidedeck was presented by the author in this YouTube Video


ISO/IEC 19501:2005(E)
Date: January 2005

Unified Modeling Language Specification
Version 1.4.2
formal/05-04-01

This specification is also available from ISO as ISO/IEC 19501.

“The primary audience for this detailed description consists of the OMG, other standards organizations, tool builders, metamodelers, methodologists, and expert modelers. The authors assume familiarity with metamodeling and advanced object modeling. Readers looking for an introduction to the UML or object modeling should consider another source.”

— International Stardardization Organization ISO. ISO/IEC 19501:2005: Information Technology — Open Distributed Processing — Unified Modeling Language (UML) Version 1.4.2, 2005

Class Diagram

Some Other Diagrams

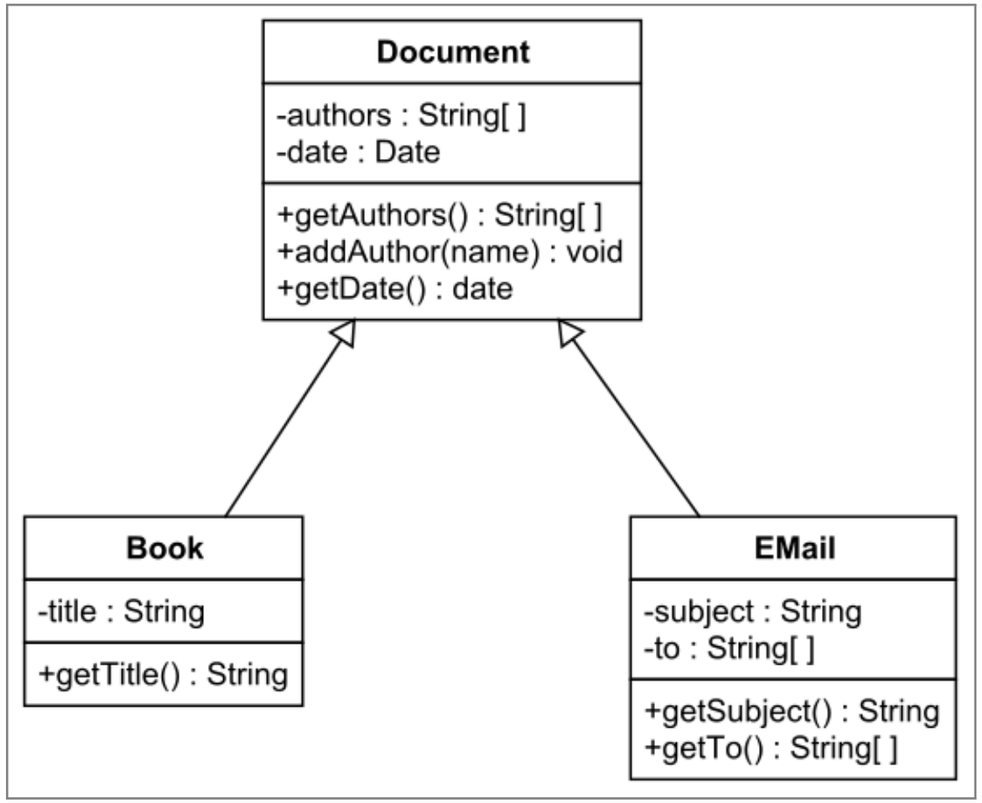
MDA: MOF, XMI, OCL, QVT, fUML, ...

Books, Venues, Call-to-Action

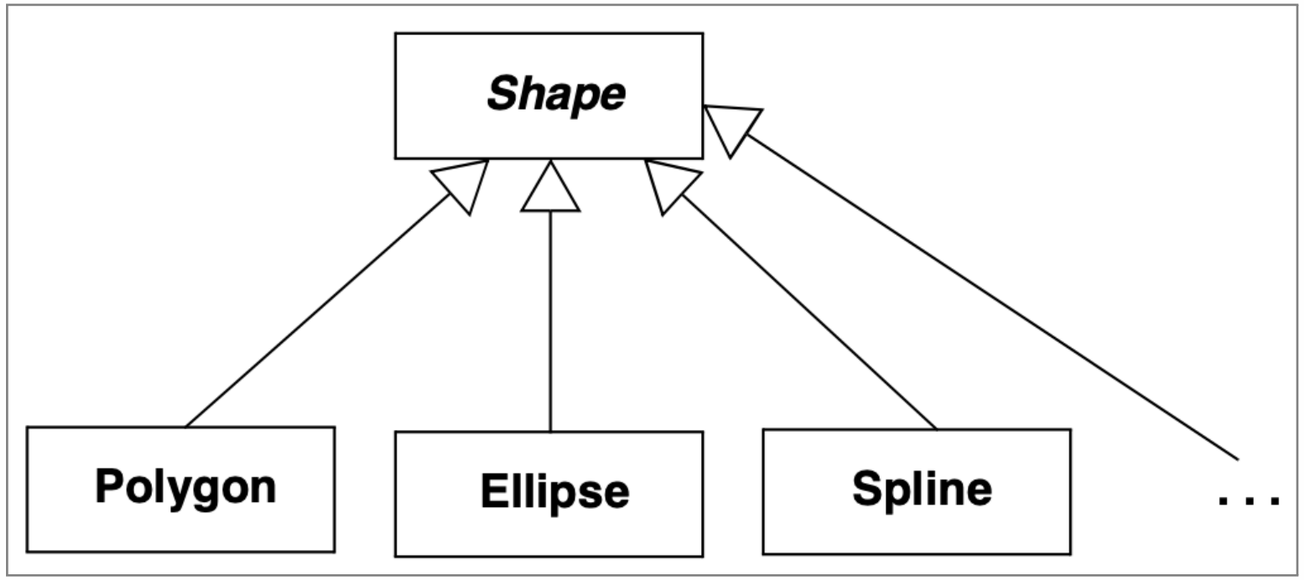
Chapter #1:

Class Diagram

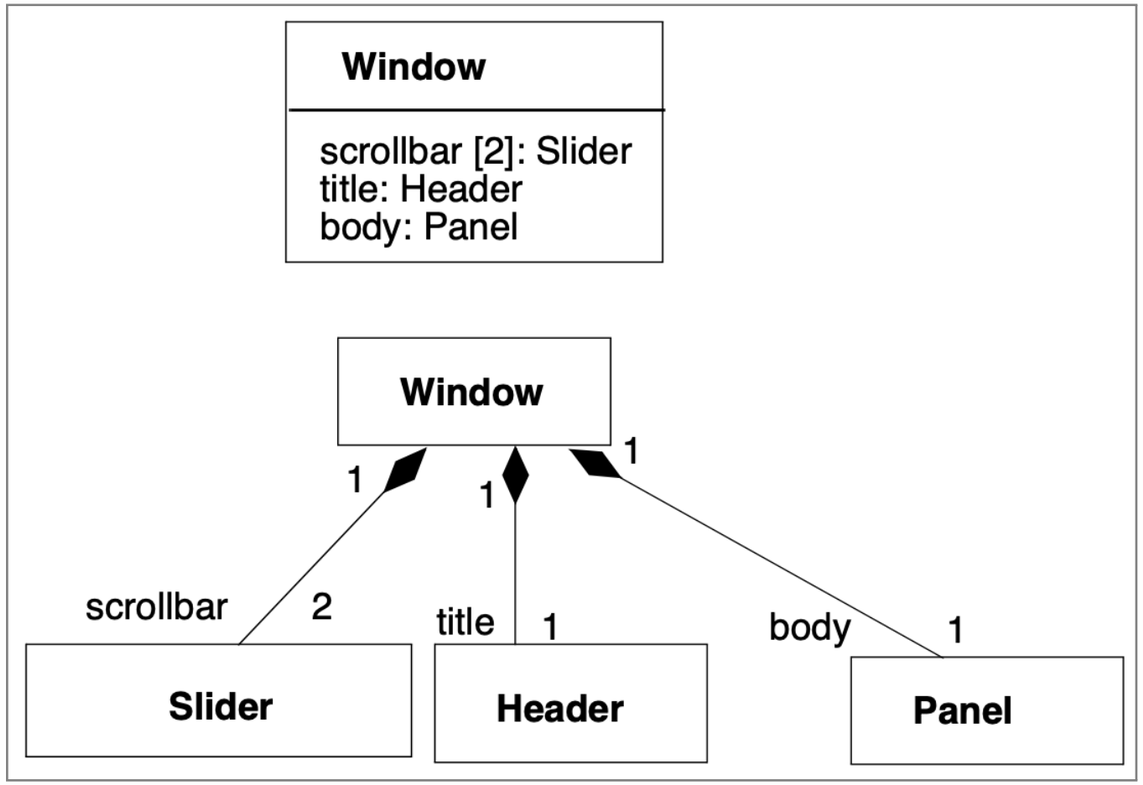
Classes


Document
-authors : String[ ]
-date : Date
+getAuthors() : String[ ]
+addAuthor(name) : void
+getDate() : date
Book
-title : String
+getTitle() : String
EMail
-subject : String
-to : String[ ]
+getSubject() : String
+getTo() : String[ ]

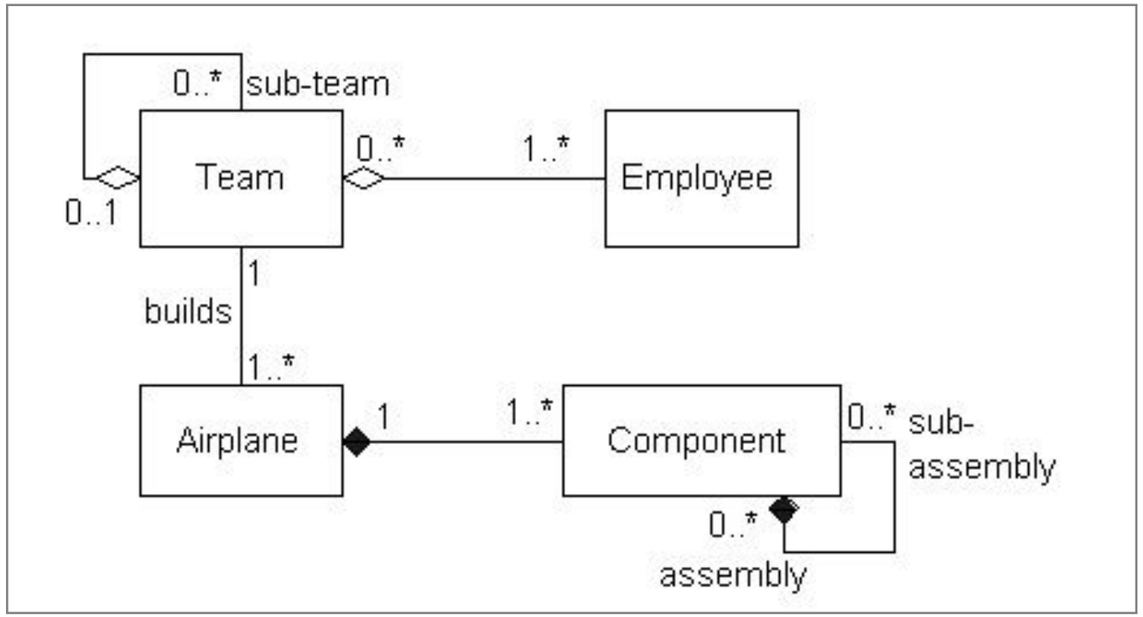
Generalization



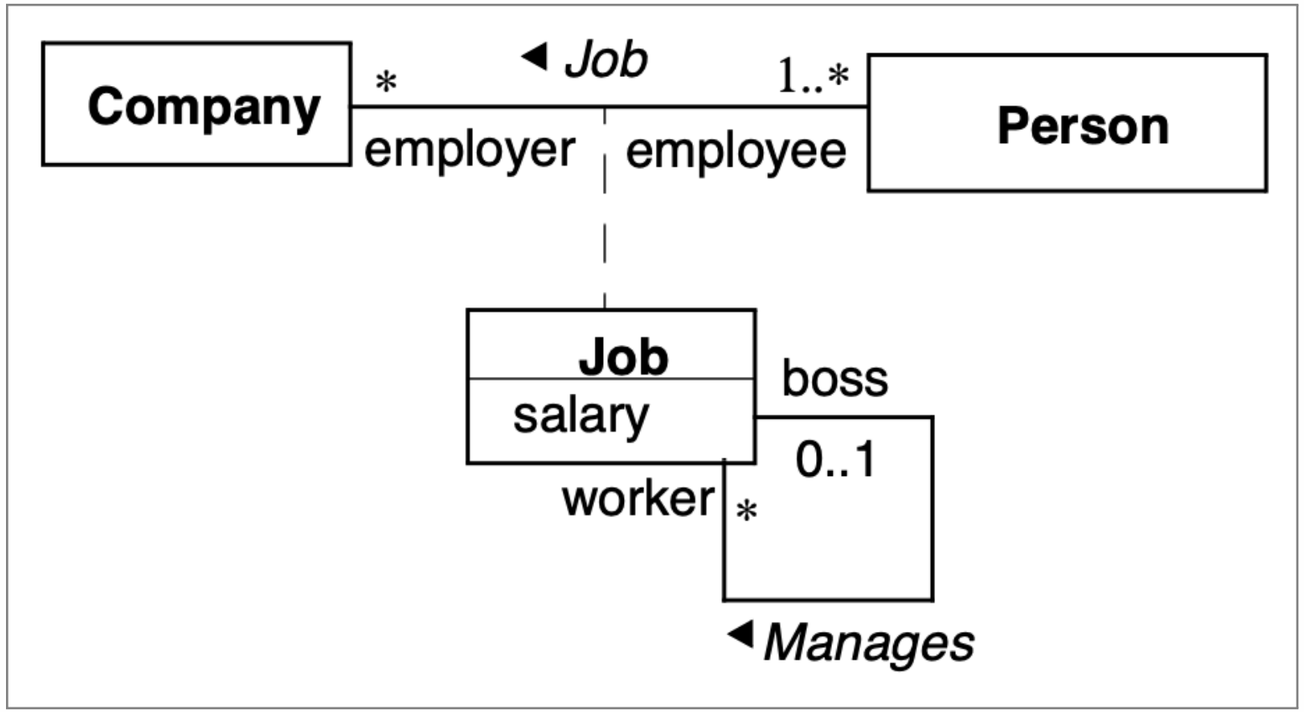
Composition



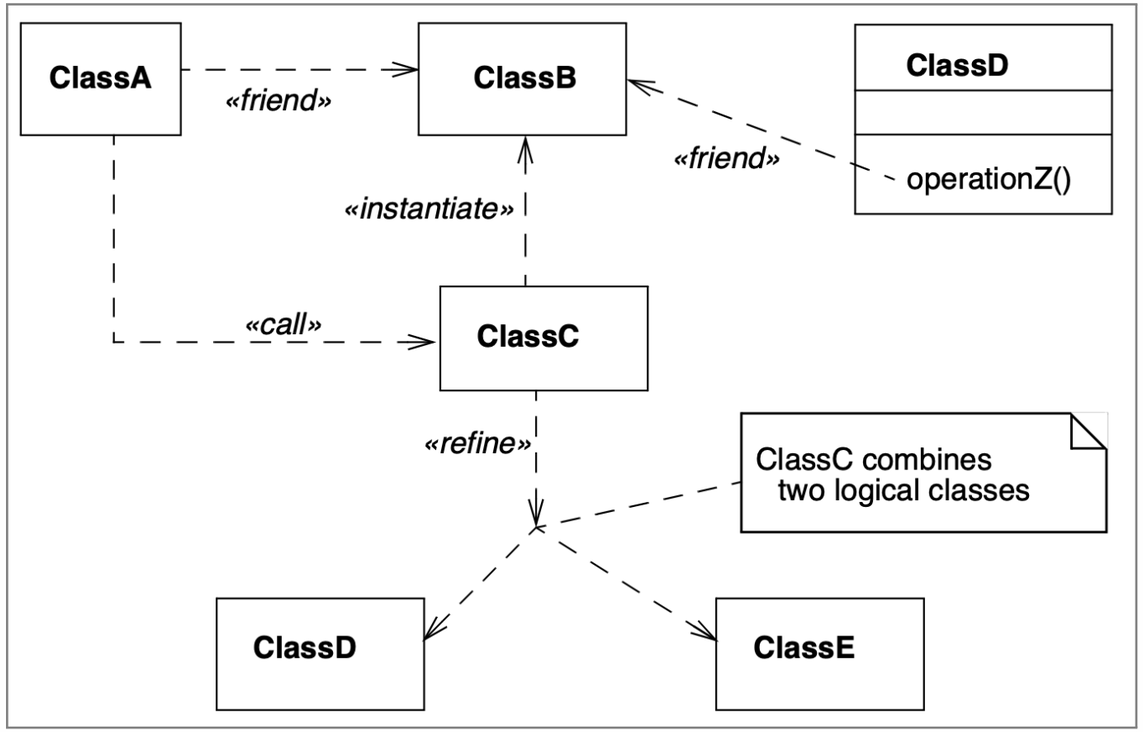
Aggregation



Association



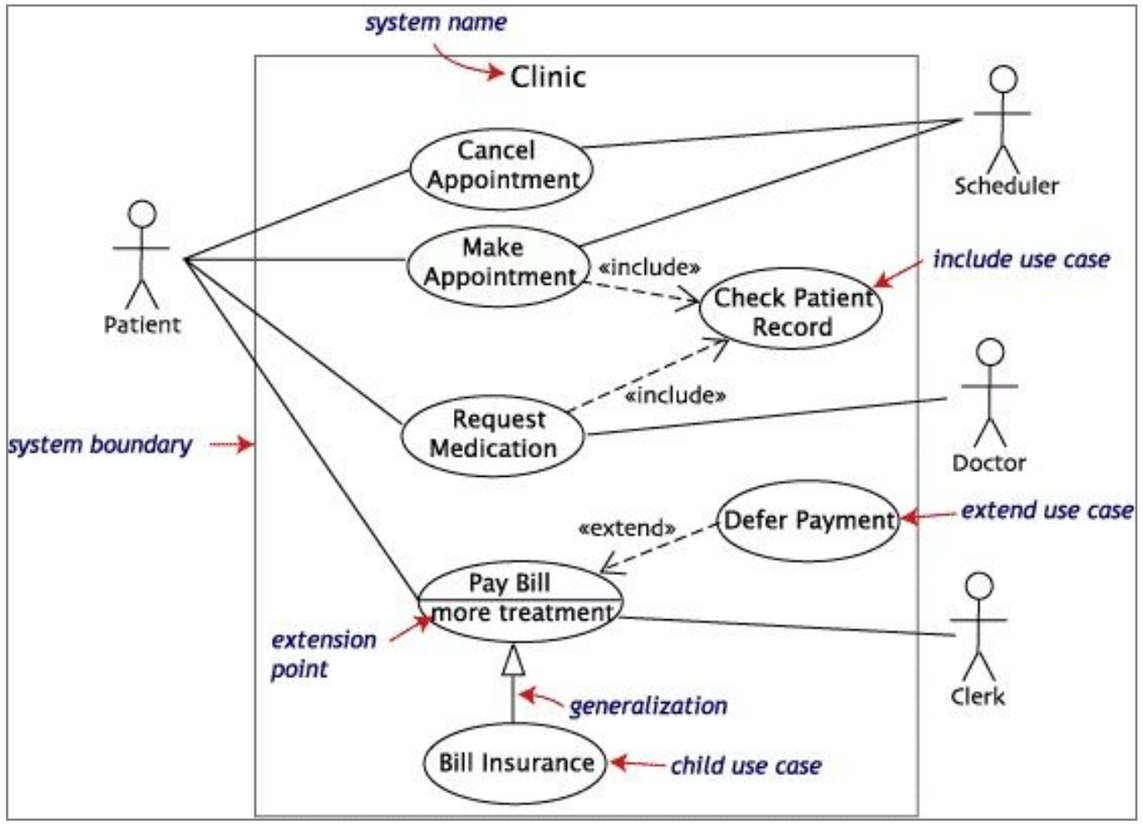
Dependency


ClassA
«friend»
ClassB
ClassD
operationZ()
«friend»
«instantiate»
«call»
ClassC
«refine»
ClassC combines
two logical classes
ClassD
ClassE

Chapter #2:

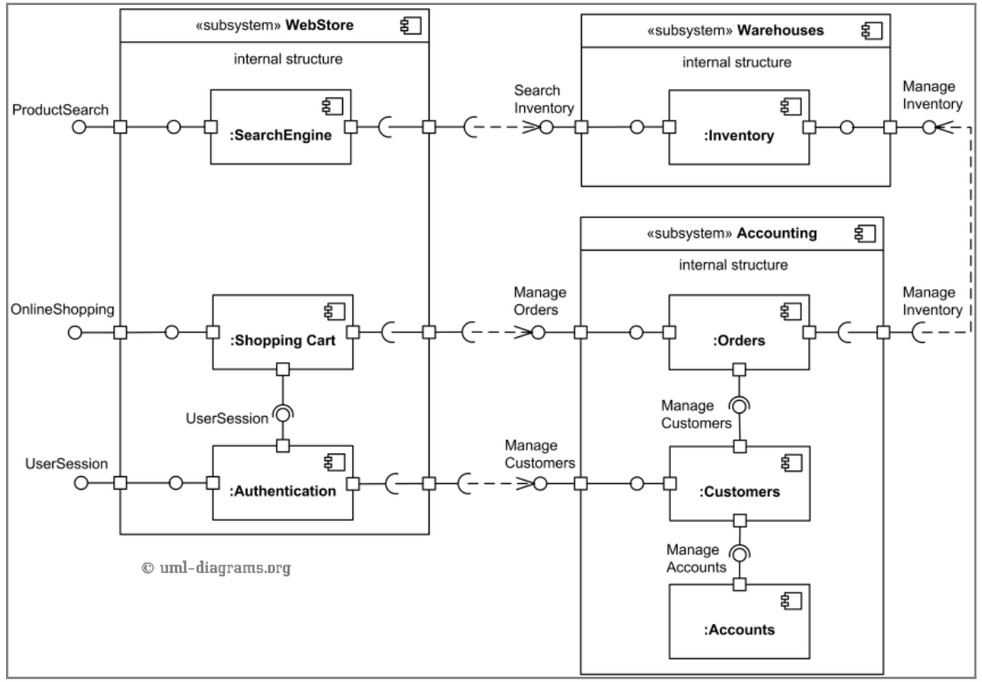
Some Other Diagrams

Use Case Diagram



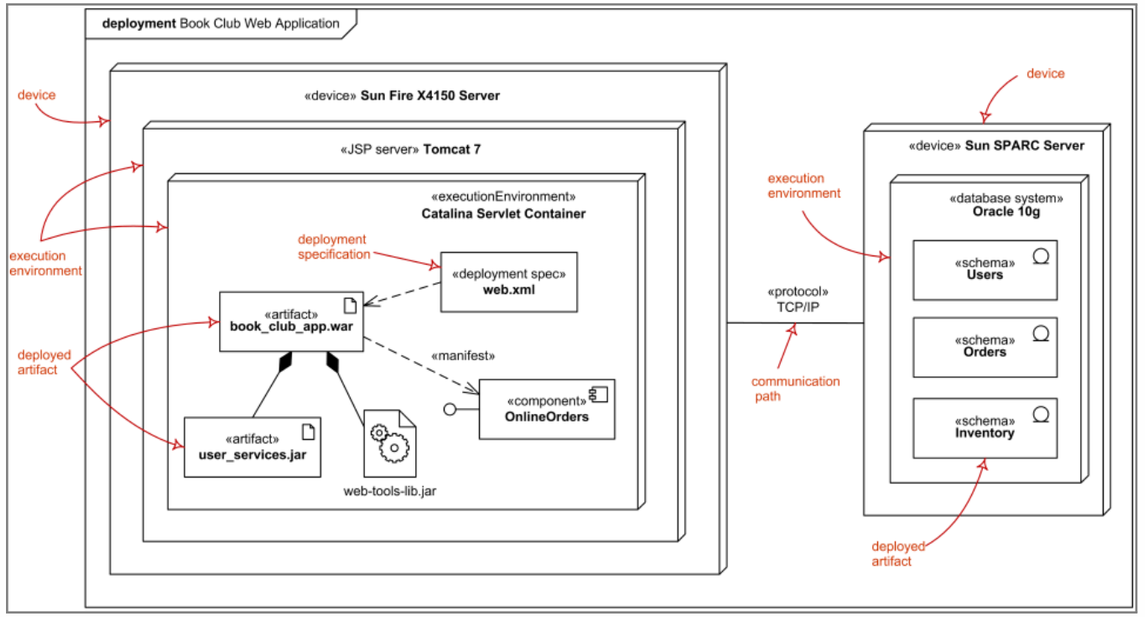
[UC Component Deployment Activity Sequence]

Component Diagram



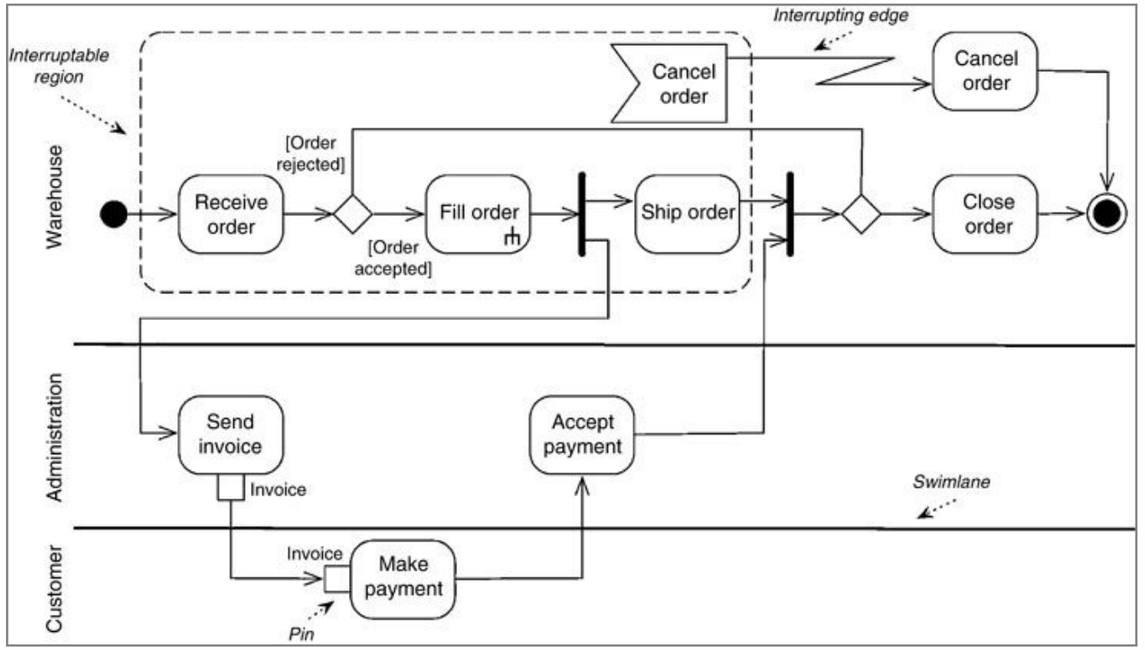
[UC Component Deployment Activity Sequence]

Deployment Diagram



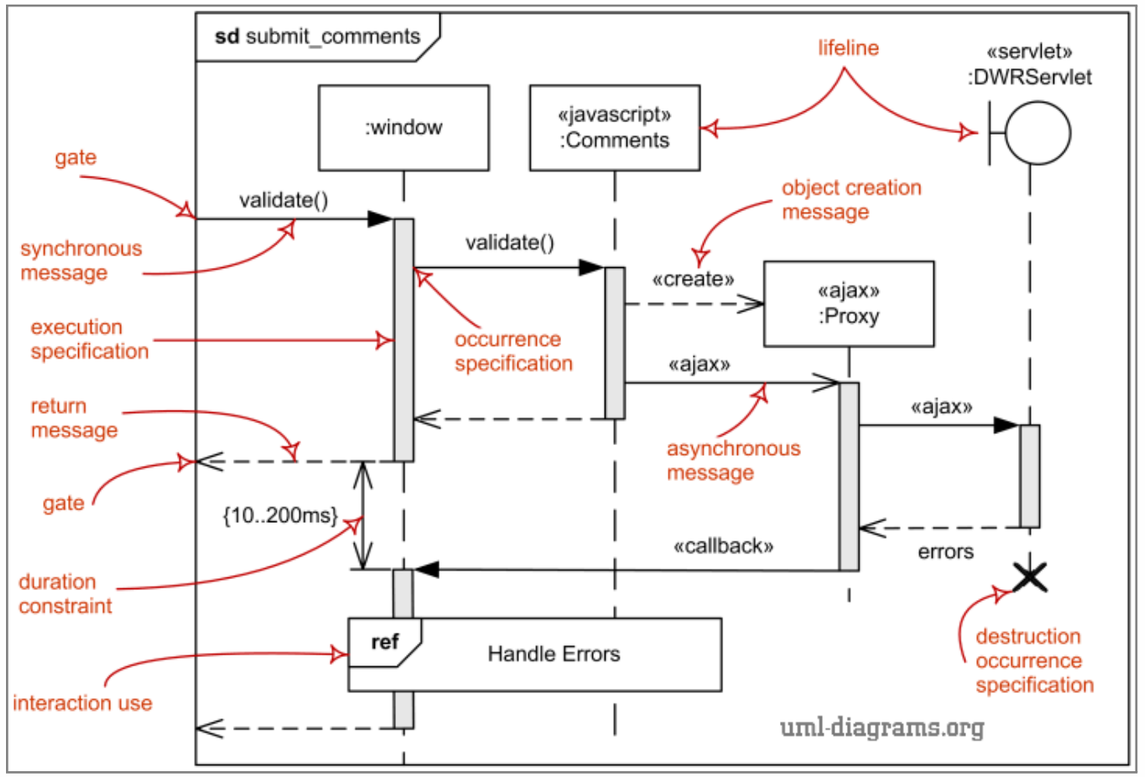
[UC Component Deployment Activity Sequence]

Activity Diagram



[UC Component Deployment Activity Sequence]

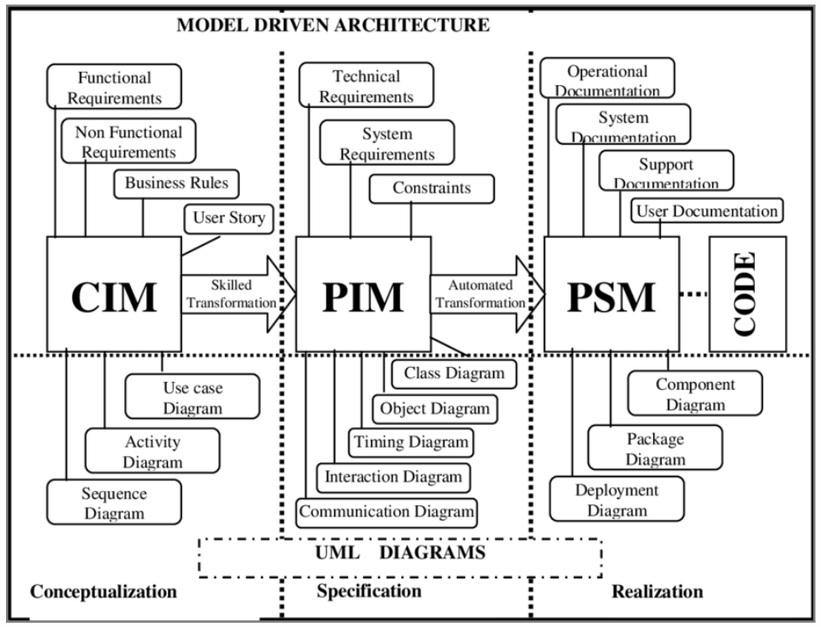
Sequence Diagram



Chapter #3:

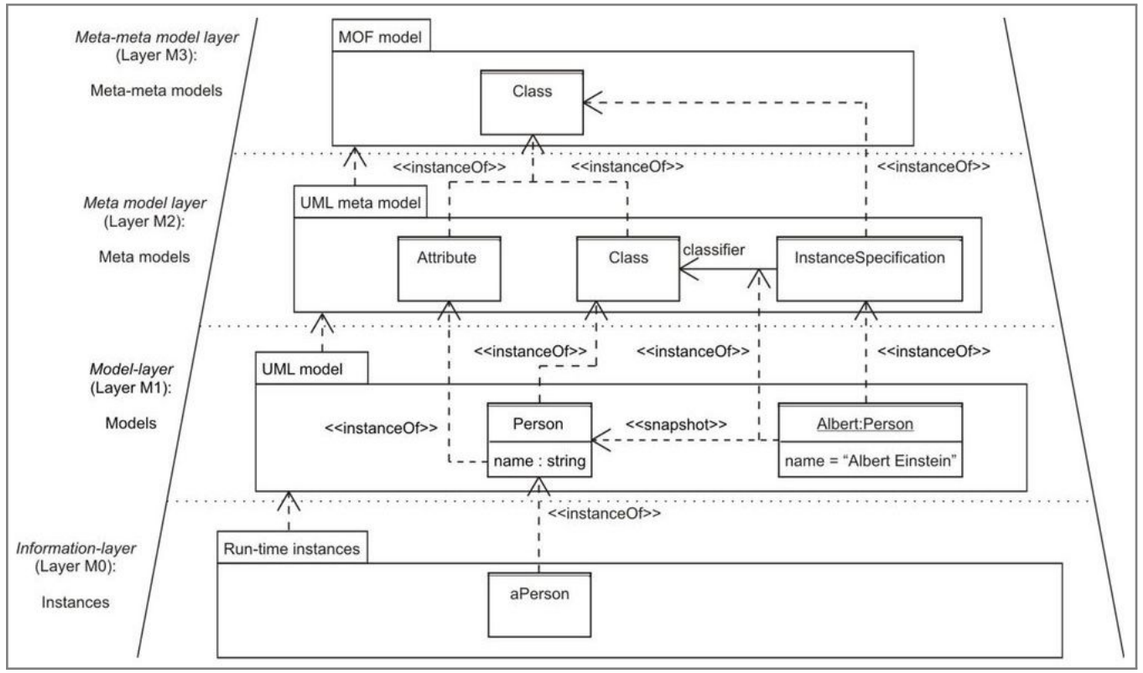
MDA: MOF, XMI, OCL, QVT, fUML, ...

Model Driven Architecture (MDA)



Computation Independent Model (CIM), Platform Independent Model (PIM), Platform Specific Model (PSM).

Meta-Object Facility (MOF)



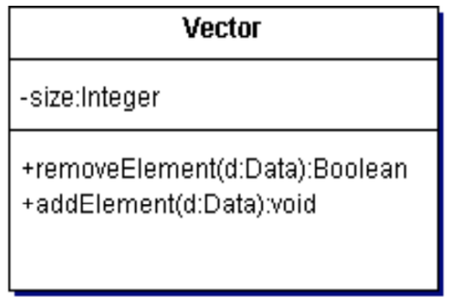
"MOF is a Domain Specific Language (DSL) used to define metamodels, just as EBNF is a DSL for defining grammars" — Wikipedia

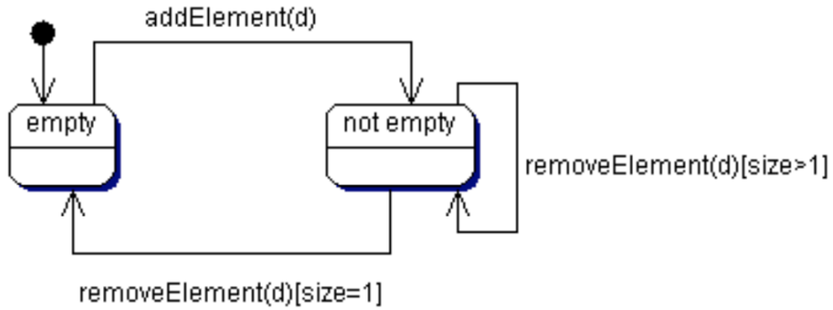
XML Metadata Interchange (XMI)


```
<?xml version='1.0' encoding='UTF-8'?>
<xmi:XMI xmi:version='2.1' xmlns:uml='http://schema.omg.org/spec/UML/2.1.2'
                           xmlns:xmi='http://schema.omg.org/spec/XMI/2.1'>
<uml:Model xmi:id='eee_1045467100313_135436_1' name='Data' visibility='public'>
 <packagedElement xmi:type='uml:Class' xmi:id='_477' name='Car' visibility='public'>
   <ownedAttribute xmi:type='uml:Property' xmi:id='_628' name='owner'
                   visibility='private' type='_498' association='_627'>
     <upperValue xmi:type='uml:LiteralUnlimitedNatural' xmi:id='_680' visibility='public' value='1'/>
     <lowerValue xmi:type='uml:LiteralInteger' xmi:id='_679' visibility='public' value='1'/>
   </ownedAttribute>
   <ownedAttribute xmi:type='uml:Property' xmi:id='_681' name='manufacturer' visibility='private'>
     <type xmi:type='uml:PrimitiveType' href='http://schema.omg.org/spec/UML/2.0/uml.xml#String'/>
   </ownedAttribute>
 </packagedElement>
 <packagedElement xmi:type='uml:Class' xmi:id='_498' name='Owner' visibility='public'>
   <ownedAttribute xmi:type='uml:Property' xmi:id='_629' name='ownedCars'
                   visibility='private' type='_477' association='_627'>
     <upperValue xmi:type='uml:LiteralUnlimitedNatural' xmi:id='_678' visibility='public' value='-1'/>
     <lowerValue xmi:type='uml:LiteralUnlimitedNatural' xmi:id='_677' visibility='public' value='-1'/>
   </ownedAttribute>
   <ownedAttribute xmi:type='uml:Property' xmi:id='_685' name='name' visibility='private'>
     <type xmi:type='uml:PrimitiveType' href='http://schema.omg.org/spec/UML/2.0/uml.xml#String'/>
   </ownedAttribute>
 </packagedElement>
 <packagedElement xmi:type='uml:Association' xmi:id='_627' visibility='public'>
   <memberEnd xmi:idref='_628'/>
   <memberEnd xmi:idref='_629'/>
 </packagedElement>
</uml:Model>
</xmi:XMI>
```

Object Constraint Language (OCL)

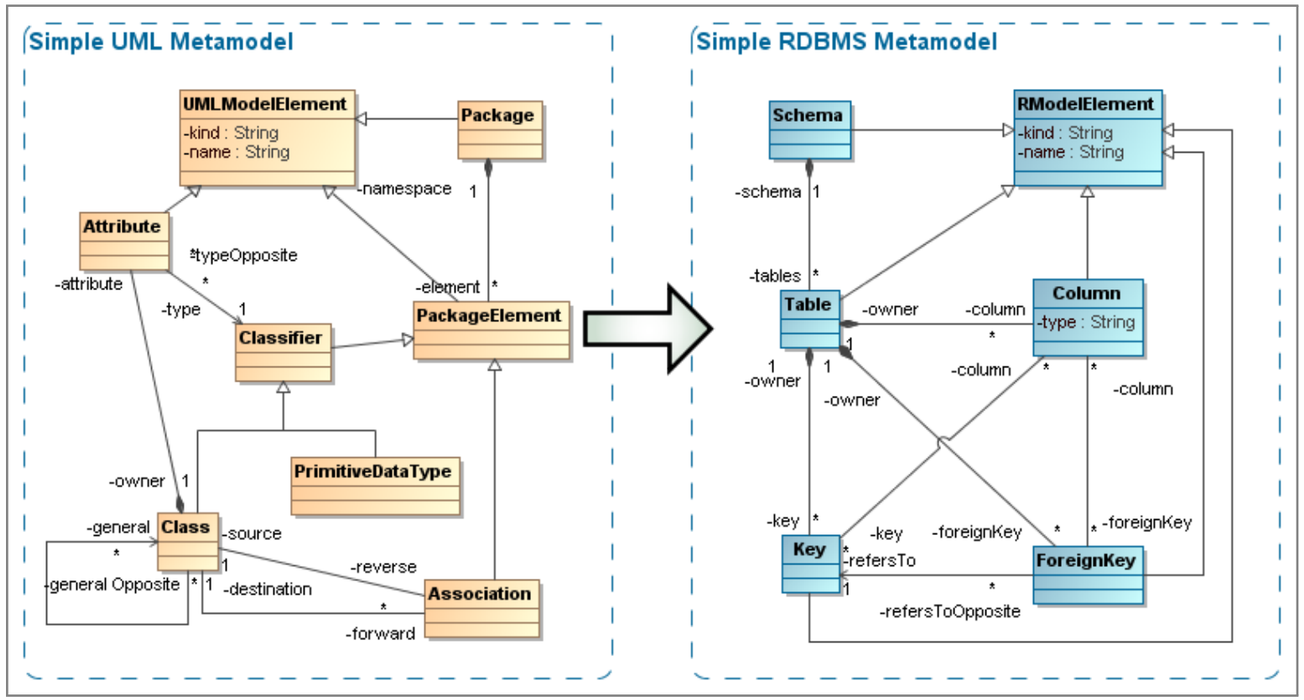
oclInState(s: OclState) : Boolean






```
context Vector::removeElement(d:Data)
   pre:  oclInState(notEmpty)
   post: size@pre = 1 implies oclInState(empty)
```

Query/View/Transformation (QVT)

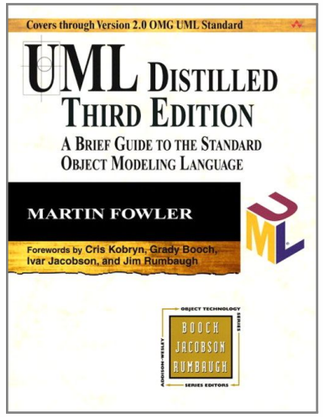


Executable UML, fUML, Alf

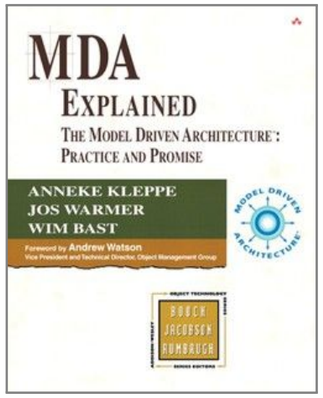
```
private import CustomerAccounts;
activity SumBalances(in customer : Customer) : Integer {
  totalBalance = 0;
  for (balance in customer.accounts.balance) {
      totalBalance += balance;
  }
  return totalBalance;
}
```

Chapter #4:

Books, Venues, Call-to-Action



Martin Fowler. *UML Distilled: A Brief Guide to the Standard Object Modeling Language.* Addison-Wesley, 3 edition, 2004



Anneke G. Kleppe, Jos B. Warmer, and Wim Bast. *MDA Explained: The Model Driven Architecture: Practice and Promise.* Addison-Wesley, 2003

Where to go:

OMG Certified UML Professional 2 (OCUP 2)

Call to Action:

For your application, make one class, one component, one deployment, and three sequence diagrams.

Still unresolved issues:

- How to reverse code to a model?
- How to sync a model with the code?
- How to simplify UML for practical programming?
- How to restore faith in MDA?

Bibliography

Martin Fowler. *UML Distilled: A Brief Guide to the Standard Object Modeling Language.* Addison-Wesley, 3 edition, 2004.

International Stardardization Organization ISO. ISO/IEC 19501:2005: Information Technology — Open Distributed Processing — Unified Modeling Language (UML) Version 1.4.2, 2005.

Anneke G. Kleppe, Jos B. Warmer, and Wim Bast. *MDA Explained: The Model Driven Architecture: Practice and Promise.* Addison-Wesley, 2003.