


Introduction to UML 2 Use Case Diagrams

UML 2 use case diagrams overview the usage requirements for a system. They are useful for presentations to management and/or project stakeholders, but for actual development  you will find that **use cases** provide significantly more value because they describe "the meat" of the actual requirements. Figure 1 provides an example of a **UML 2** use case diagram.

Use case diagrams depict:

- **Use cases.** A use case describes a sequence of actions that provide something of measurable value to an actor and is drawn as a horizontal ellipse.
- **Actors.** An actor is a person, organization, or external system that plays a role in one or more interactions with your system. Actors are drawn as stick figures.
- **Associations.** Associations between actors and use cases are indicated in use case diagrams by solid lines. An association exists whenever an actor is involved with an interaction described by a use case. Associations are modeled as lines connecting use cases and actors to one another, with an optional arrowhead on one end of the line. The arrowhead is often used to indicate the direction of the initial invocation of the relationship or to indicate the primary actor within the use case. The arrowheads are typically confused with data flow and as a result I avoid their use.
- **System boundary boxes (optional).** You can draw a rectangle around the use cases, called the system boundary box, to indicate the scope of your system. Anything within the box represents functionality that is in scope and anything outside the box is not. System boundary boxes are rarely used, although on occasion I have used them to identify which use cases will be delivered in each major release of a system. Figure 2 shows how this could be done.
- **Packages (optional).** Packages are UML constructs that enable you to organize model elements (such as use cases) into groups. Packages are depicted as file folders and can be used on any of the UML diagrams, including both use case diagrams and class diagrams. I use packages only when my diagrams become unwieldy, which generally implies they cannot be printed on a single page, to organize a large diagram into smaller ones. Figure 3 depicts how Figure 1 could be reorganized with packages.

In the example depicted in Figure 1 students are enrolling in courses with the potential help of registrars. Professors input the marks students earn on assignments and registrars authorize the distribution of transcripts (report cards) to students. Note

how for some use cases there is more than one actor involved. Moreover, note how some associations have arrowheads^{3/4}any given use case association will have a zero or one arrowhead. The association between *Student* and *Enroll in Seminar* (in the version shown in Figure 4) indicates this use case is initially invoked by a student and not by a registrar (the *Registrar* actor is also involved with this use case). Understanding that associations don't represent flows of information is important; they merely indicate an actor is somehow involved with a use case. Information is flowing back and forth between the actor and the use case, for example, students would need to indicate which seminars they want to enroll in and the system would need to indicate to the students whether they have been enrolled. However, use case diagrams don't model this sort of information. Information flow can be modeled using **UML activity diagrams**. The line between the *Enroll in Seminar* use case and the *Registrar* actor has no arrowhead, indicating it is not clear how the interaction between the system and registrars start. Perhaps a registrar may notice a student needs help and offers assistance, whereas other times, the student may request help from the registrar, important information that would be documented in the description of the use case. Actors are always involved with at least one use case and are always drawn on the outside edges of a use case diagram.

Figure 1. System use case diagram.

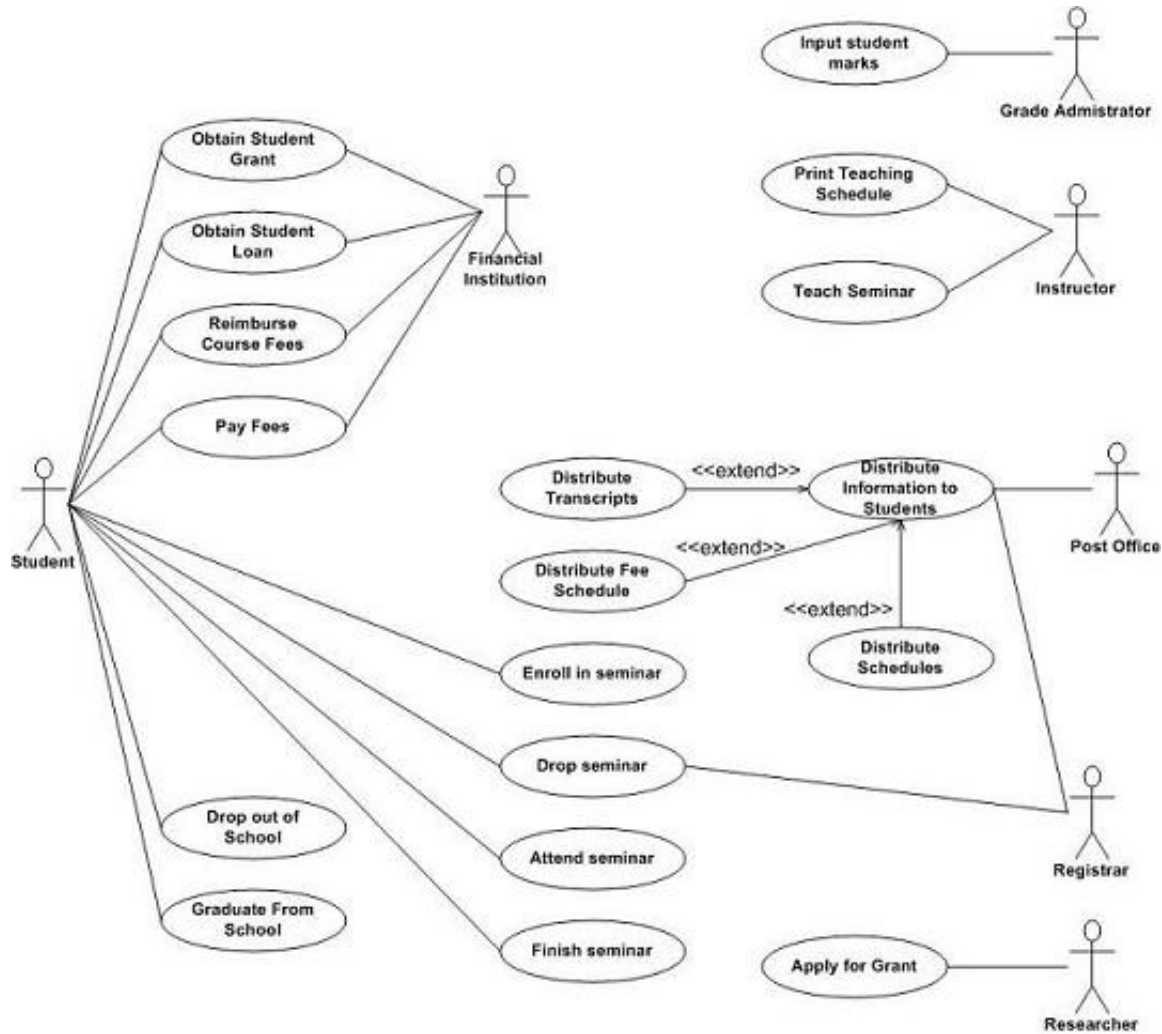
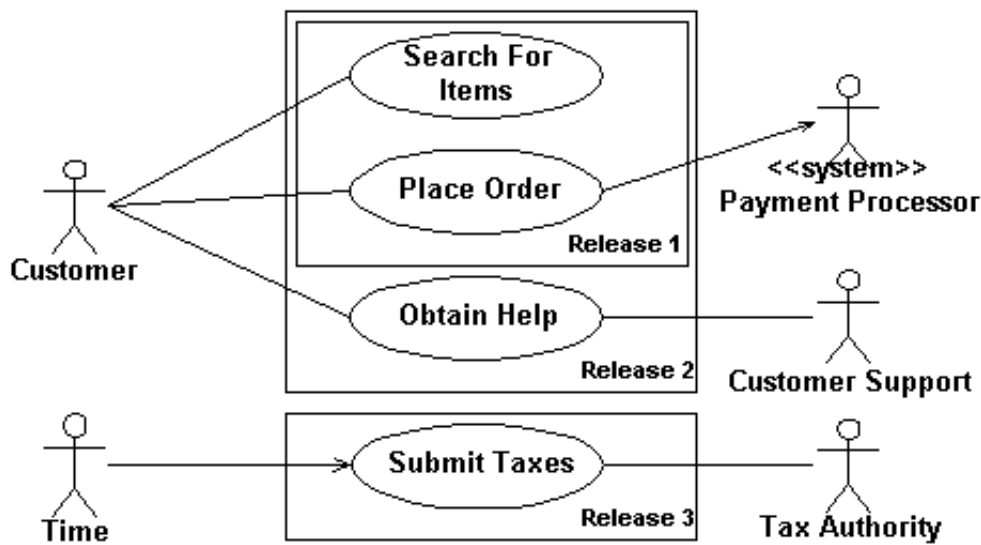
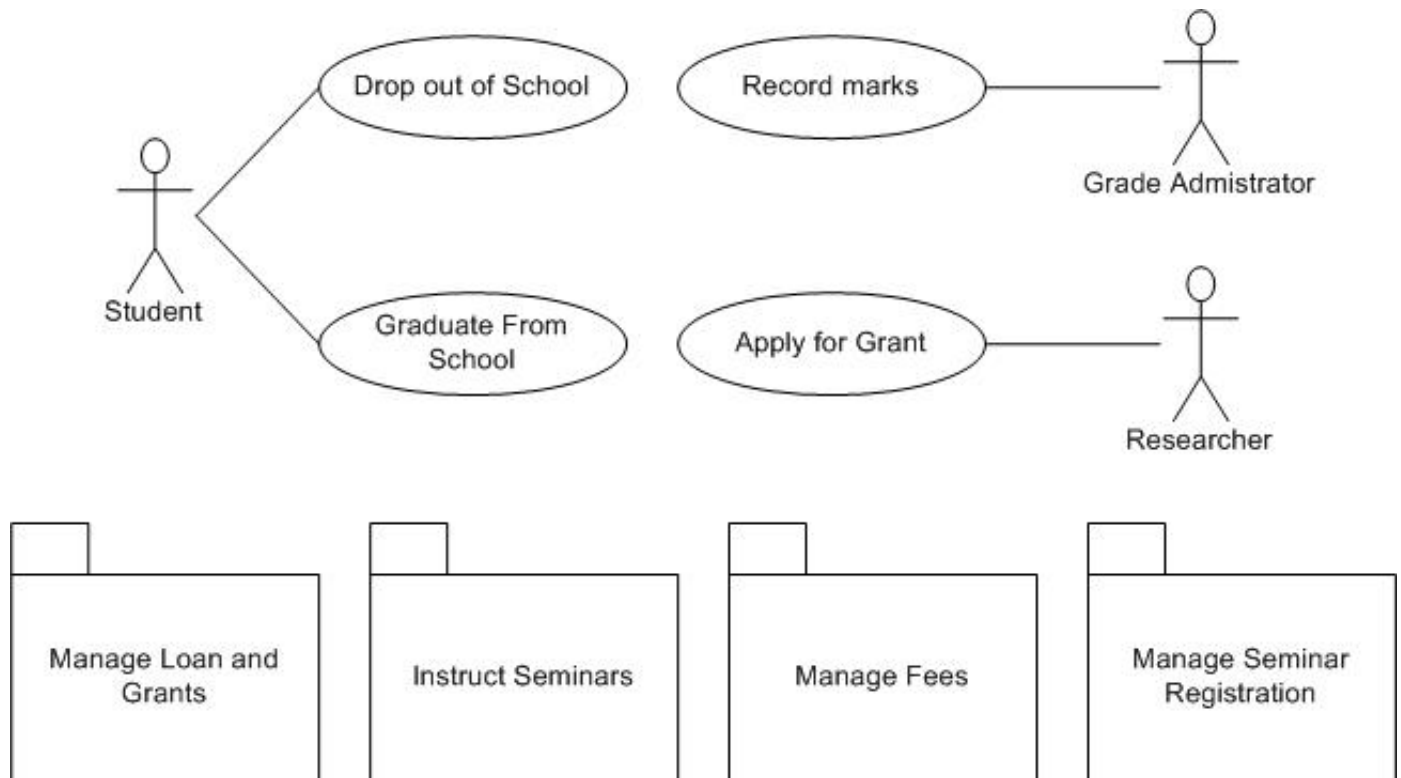


Figure 2. Using System boundary boxes to indicate releases.

Figure 3. Applying packages to simplify use case diagrams.





Creating Use Case Diagrams

I like to start by identifying as many actors as possible. You should ask how the actors interact with the system to identify an initial set of use cases. Then, on the diagram, you connect the actors with the use cases with which they are involved. If an actor supplies information, initiates the use case, or receives any information as a result of the use case, then there should be an association between them. I generally don't include arrowheads on the association lines because my experience is that people confuse them for indications of information flow, not initial invocation. As I begin to notice similarities between use cases, or between actors, I start modeling the appropriate relationships between them (see the Reuse Opportunities section).

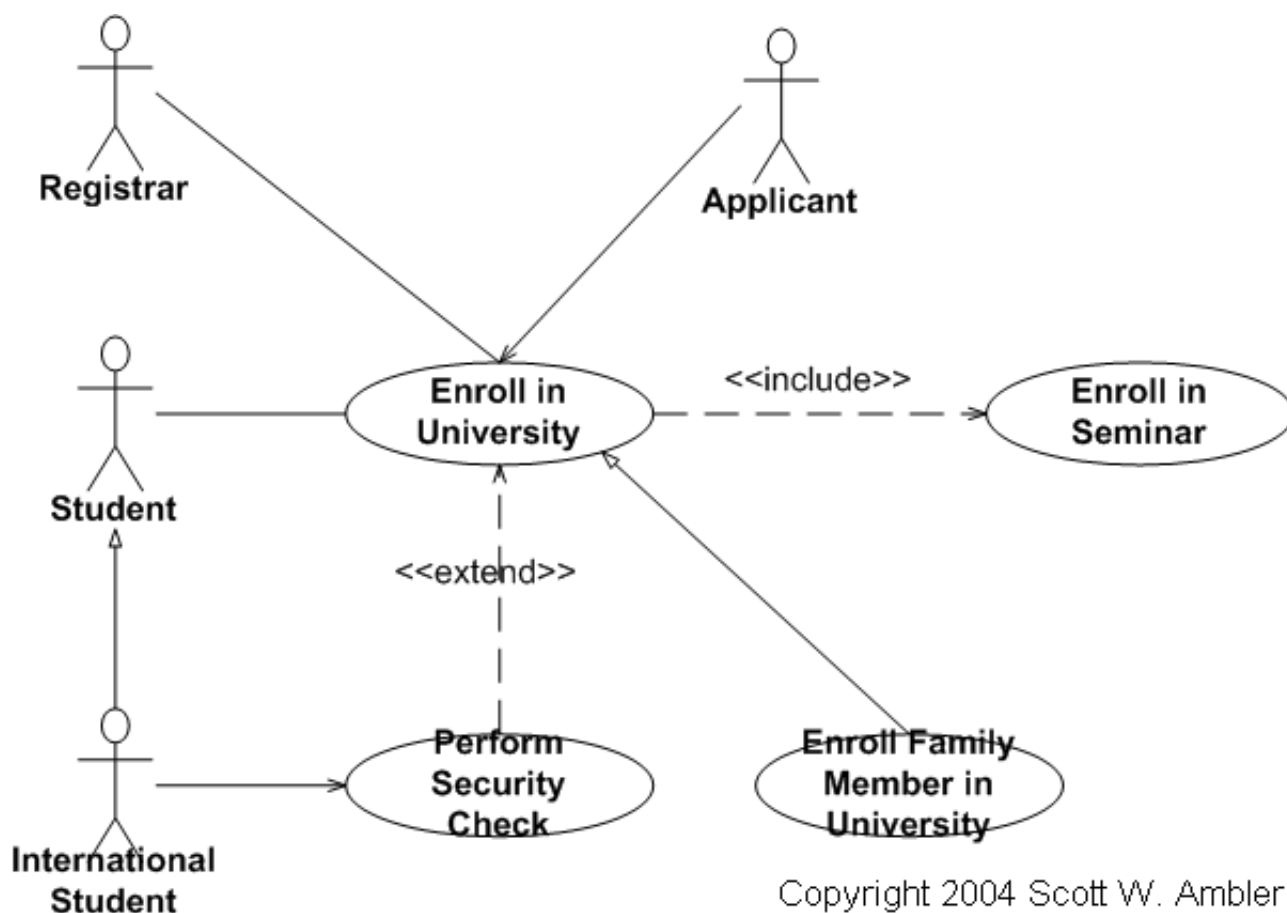
The preceding paragraph describes my general use case modeling style, an "actors first" approach. Others like to start by identifying one actor and the use cases that they're involved with first and then evolve the model from there. Both approaches work. The important point is that different people take different approaches so you need to be flexible when you're following AM's practice of **Model With Others**.

Reuse Opportunities

1 1

Figure 4 shows the three types of relationships between use cases -- extends, includes, and inheritance -- as well as inheritance between actors. I like to think of extend relationships as the equivalent of a "hardware interrupt" because you don't know when or if the extending use case will be invoked (perhaps a better way to look at this is extending use cases are conditional). Include relationships as the equivalent of a procedure call. Inheritance is applied in the same way as you would on **UML class diagrams** -- to model specialization of use cases or actors in this case. The essay **Reuse in Use Case Models** describes these relationships in greater detail.

Figure 4. Use case reuse.

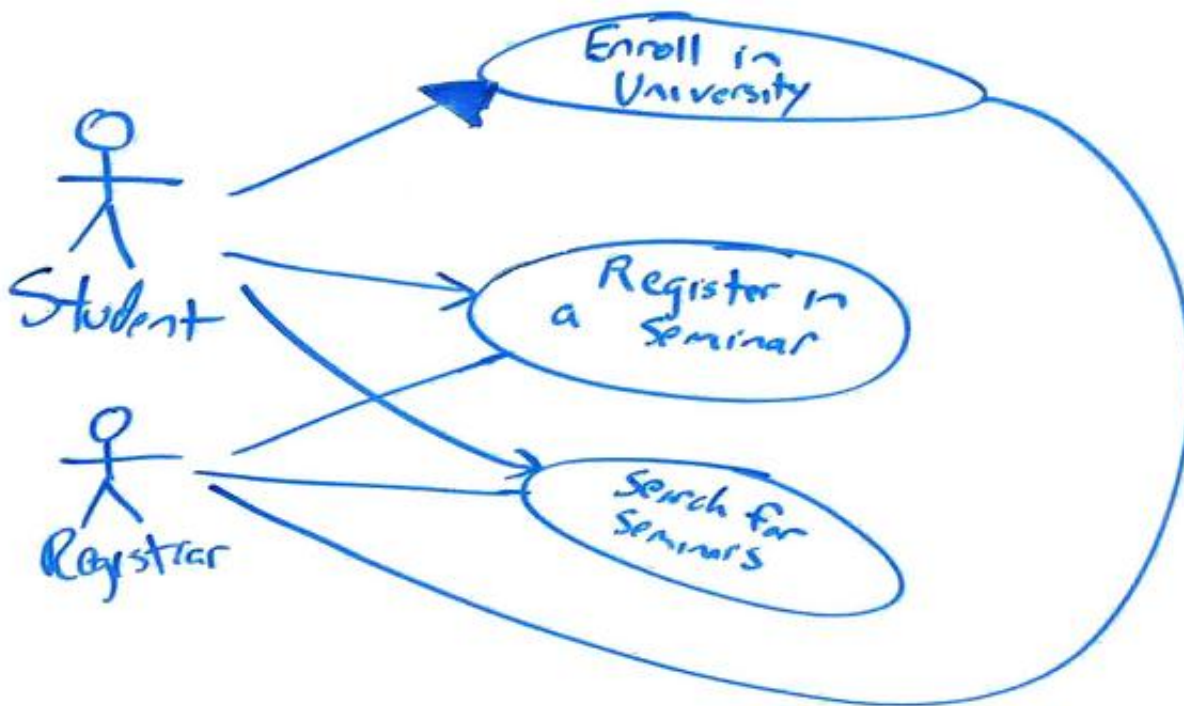


Remaining Agile

So how can you keep use case modeling agile? First, focus on keeping it as simple as possible. Use simple, flexible tools to model with. I'll typically create use case diagrams on a whiteboard, as you see in Figure 5 which is an example of an initial diagram that I would draw with my project stakeholders. AM tells us that **Content is More Important Than Representation** so it isn't a big issue that the diagram is hand

drawn, it's **just barely good enough** and that's all that we need. It's also perfectly okay that the diagram isn't complete, there's clearly more to a university than what is depicted, because we can always modify the diagram as we need to.

Figure 5. Whiteboard sketch.



In parallel to creating the sketch I would also write a very brief description of each use case, often on a whiteboard as well. The goal is to record just

enough information about the use case so that we understand what it is all about. If we need more details we can always add them later either as an **essential/business use case** or a **system use case**.

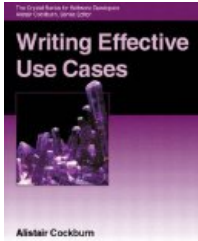
Source

This artifact description is excerpted from Chapter 5 of **The Object Primer 3rd Edition: Agile Model Driven Development with UML 2**.

Suggested Reading

- **Agile Data Home Page**
- **Artifacts for Agile Modeling: The UML and Beyond**
- **Introduction to the Diagrams of UML 2**

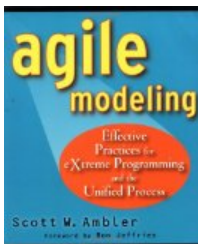
- **Introduction to Object Orientation (OO) and UML**
- **Modeling Style Guidelines**
- **Pavel Hruby's UML 2.0 Stencil for Visio**
- **Why Extend the UML Beyond Object and Component Technology?**



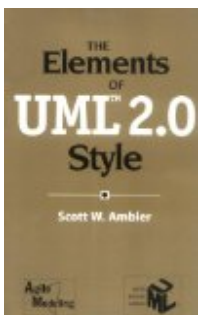
This is the best book to read if you want to learn how how write use cases effectively.



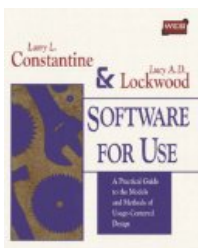
The Object Primer 3rd Edition: Agile Model Driven Development with UML 2 is an important reference book for agile modelers, describing how to develop 35 **types of agile models** including all 13 **UML 2 diagrams**. Furthermore, this book describes the techniques of the **Full Lifecycle Object Oriented Testing (FLOOT)** methodology to give you the fundamental testing skills which you require to succeed at agile software development. The book also shows how to move from your agile models to source code (**Java** examples are provided) as well as how to succeed at implementation techniques such as **refactoring** and **test-driven development (TDD)**. The Object Primer also includes a chapter overviewing the critical database development techniques (**database refactoring, object/relational mapping, legacy analysis**, and database access coding) from my award-winning **Agile Database Techniques** book.



Agile Modeling: Effective Practices for Extreme Programming and the Unified Process is the seminal book describing how agile software developers approach **modeling** and **documentation**. It describes principles and practices which you can tailor into your existing software process, such as **XP**, the **Rational Unified Process (RUP)**, or the **Agile Unified Process (AUP)**, to streamline your modeling and documentation efforts. Modeling and documentation are important aspects of any software project, including agile projects, and this book describes in detail how to **elicit requirements, architect**, and then **design** your system in an agile manner.



The Elements of UML 2.0 Style describes a collection of standards, conventions, and **guidelines** for creating effective **UML diagrams**. They are based on sound, proven software engineering principles that lead to diagrams that are easier to understand and work with. These conventions exist as a collection of simple, concise guidelines that if applied consistently, represent an important first step in increasing your productivity as a modeler. This book is oriented towards intermediate to advanced UML modelers, although there are numerous examples throughout the book it would not be a good way to learn the UML (instead, consider **The Object Primer**). The book is a brief 188 pages long and is conveniently pocket-sized so it's easy to carry around.



This is a very good book describing techniques for working with your stakeholders, including use case modeling.

Other
artifact
overviews

System Use Cases and **Essential Use Cases**.

Other Use-
Case
Related
Whitepapers

- **UML Use Case Diagram Style Guidelines**
- **Reuse in Use Case Models**
- **Use Cases of Mass Destruction**

Translations

- **Japanese**

Let Me Help

I actively work with clients around the world to improve their information technology (IT) practices as both a mentor/coach and trainer. A full description of what I do, and how to contact me, can be **found here**.

Disclaimer

The notation used in these diagrams, particularly the hand drawn ones, may not conform perfectly to the current version of the UML for one or more of reasons:

- The notation may have evolved from when I originally developed the diagrams. The UML evolves over time, and I may not have kept the diagrams up to date.
- I may have gotten it wrong in the first place. Although these diagrams were thoroughly reviewed for the book, and have been reviewed by thousands of people online since then, an error may have gotten past of us. We're only human.
- I may have chosen to apply the notation in "non-standard" ways. An agile modeler is more interested in created models which communicate effectively than in conforming to notation rules set by a committee.

If you're really concerned about the nuances of "official" UML notation then read the current version of the **UML specification**.