

Promoting Open Source Technology in Education

UML Modeling Tools

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Abstract

Unified Modelling Language (UML) is a collection of diagrams, terms, profiles, etc. that is used to design and develop complex software. There are many software, commercial as well as open source tools. IBM Rational Rose is the most popular commercial UML tool. But there are a number of open source alternatives like StarUML, AgroUML, UmLet etc which differ in pricing and features supported which are important criteria to be explored when the tools have to be used for educational purposes.

Keywords

UML, Rational Rose, StarUML, Agro UML, Education

I. Introduction

The UML stands for Unified Modelling Language and is controlled by the Object Management Group (OMG) a standards organization. It is a collection of diagrams, terms, profiles, etc. that is used to design and develop complex software. The current version of UML is 2.1. IBM Rational Rose is one of most popular tools for building UML models. Microsoft published a UML designer visual modeler with their Visual Studio 6 Tools, but that wasn't a success. StarUML is a fully fledged, open source, UML modeling tool that supports the ability to create software designs, from basic concepts, through to the coded solution. There are a number of other open source tools like AgroUML, ULet etc. This paper aims to analyse the suitability of various UML tools with respect to features offered, pricing and learnability especially with regard to higher education.

II. IBM Rational Rose

IBM Rational Rose is one of many tools for building UML models. Rational Rose was the most accepted UML product from IBM. It became more popular after the integration with some popular development IDEs like Microsoft's visual studio and Borland JBuilder. Rose is simple, powerful and efficient, but the licensing is a bit costly. The problem with Rose is that it stopped with version 1.5 of the UML. There were some follow-on products (Rational refers to them as RSx). (www.ibm.com/software/awdtools/developer/rose/)[6] Depending on your requirements there are many tools that are available. For example, if you are trying to design a complex system or trying to build a real time or embedded application, Rational's Rhapsody is a good choice. Rhapsody generates complete application code from class diagrams, state charts, activity diagrams and flow charts. The code it generates (C, C++, Java, and Ada) is very tight, easy to read and debug, and looks like the code you'd write by hand.

III. STAR UML

StarUML is an open source UML modeling application licensed under a modified version of GNU GPL. It helps in generating fast, flexible, extensible and freely-available UML/MDA platform running on Win32 platform. It is both a software modelling tool and a platform with a complete set of UML modelling features

making it nearly a convincing replacement of commercial UML tools such as Microsoft's Visio and IBM's Rational Rose.

Their latest version StarUML 5.0 is loaded with lots of features which can compete with Rational Rose in totality. It supports UML 2.0 specification and Model Driven Architecture (MDA). Code generation can be done for Java, C++ and C# and also supports the reverse engineering of the same. Moreover, documentation can be generated for all of the Microsoft Office suite programs such as Word, Excel and PowerPoint. StarUML is easily extensible through modules using a COM-based plug-in architecture. StarUML very seamlessly imports from Rational Rose too [1]. The OMG (Object Management Group) also specifies UML profile standards for specific purposes.

- Profiles for specific programming languages (C/C++, Java, C#, Python, etc.)
- Profiles for specific development methodologies (RUP, Catalysis, UML Components, etc.)
- Profiles for specific domains (EAI, CRM, SCM, ERP, etc.)

A. StarUML - The Open Source UML/MDA Platform

StarUML is an open source project to develop fast, flexible, extensible, featureful, and freely-available UML/MDA (Model-Driven Architecture) platform running on Win32 platform. The goal of the StarUML project is to build a software modeling tool and also platform that is a compelling replacement of commercial UML tools such as Rational Rose, Together and so on.

- UML Support : UML is continuously expanding standard managed by OMG (Object Management Group). StarUML support UML 2.0 and will support latest UML standard.
- MDA (Model Driven Architecture) : StarUML is designed to support MDA and provides many customization variables like as UML profile, Approach, Model Framework, MDA code and document template and so on.
- Plug-in Architecture : A good tool must have a well-defined plug-in platform. StarUML provides simple and powerful plug-in architecture so anyone can develop plug-in modules in COM-compatible languages (C++, Delphi, C#, VB, ...)
- Usability : StarUML is implemented to provide many user-friendly features such as Quick dialog, Keyboard manipulation, Diagram overview, etc thus enhancing its usability.

B. Features of StarUML

- Supports most of the diagrams specified in UML 2.0.
- Very rich feature set and formatting options.
- Ability to generate source code from the UML diagram.
- Reverse engineer the existing code into UML diagrams.
- Supported languages : C++, C# and Java.
- Fast load time/execution time compared with other UML tools.
- Familiar Visual Studio like user interface.
- Supports exporting diagrams into JPG / XMI formats, raster image format, and vector image format Windows Metafile.
- Supports import from XMI, and Rational Rose file format
- Professional, inter-connected models can be created.

- Supports plug-ins for both importing and exporting.
- Code and documentation plug-ins provided with package.
- Its Free ! the best feature.

C. What you cannot do with starUML

- Does not supports exporting diagrams into SVG and PNG format.
- Complex for the beginner.
- No longer on a release cycle.
- Not cross platform.
- Supports code generation for the Windows COM model only.

IV. ArgoUML

ArgoUML is a leading open source UML modeling tool and includes support for all standard UML 1.4 diagrams. It runs on any Java platform and is available in ten languages. ArgoUML is distributed under the Eclipse Public License (EPL) 1.0 [7]

A. Features of argoUML[2]

- Written in Java, so runs in all the platforms where Java runs.
- Supports Code generation from the UML diagram / UML Diagram generation from the code.
- Currently supported languages are C++, C#, Java and PHP.
- Ability to manage ToDo list.
- Export UML diagram into XMI / JPG / SVG / PS formats.

B. What is not Good with ArgoUML?

- Does not fully support UML 2.0.
- Can't Undo mistakes. You will have to redo all again .
- Written in Java, so run comparatively slower than starUML.
- Fewer formatting options as compared to that of starUML.

V. UMBRELLO

This was originally built for KDE and was ported to Windows, It seems like a decent tool. It seems like most of the screenshots are proving its cross-platform support as opposed to features, which is kind of disappointing [3].

A. Features of Umbrello

- Code generator for Java , C , C++
- Code generators (Perl, Python, SQL, Ada, ActionScript, JavaScript, IDL, XML Schema)
- PHP5 , Pascal code generator
- Advanced code generator for Ruby , Tcl
- Auto-complete in parameter properties dialog in class diagram
- Nestable components and subsystems in Component diagram
- User interaction with UMLWidget improvements
- Import Rose model files
- Automatically fill useful info into the Perl writer heading template
- Export-to-docbook and Export-to-HTML documentation generator

B. What is not Good with Umbrello?

- Does not fully support UML 2.0.
- Though code generators are available for a number of languages reverse engineering facility is not seen .

- The interface is not so friendly or encouraging .
- Limited Output formats , so sharing information is limited.

VI. UMLet

UMLet is an open-source Java-based UML tool designed for teaching and creating the Unified Modeling Language. It allows users to perform many different operations within it.

It is a drawing tool rather than a modelling tool as there is no underlying dictionary or directory of reusable design objects. UMLet runs on any Java platform, eg, Windows, Linux, and OS X. UML elements are modified using text input instead of pop-up dialogs. Elements can be modified and used as templates; this way, users can easily tailor UMLet to their modeling needs.

UMLet allows users to create their own custom UML elements. An element's look can be modified at run-time by changing a few lines of Java code; UMLet then compiles the new element's code on the fly [4].

A. Features of UMLet

- lightweight tool for rapidly drawing UML diagrams from within the Eclipse environment.
- Open-Source and no licence fee.
- Simple user interface.
- Runs on any Java platform, eg, Windows, Linux, and OS X
- export diagrams to eps, pdf, jpg, svg, and clipboard.
- Share diagrams using Eclipse.
- availability to create new, custom UML elements.
- Reduced file-created size.
- supports a variety of UML diagram types: class , use case, sequence, state, deployment , activity

B. What is not Good with UMLet?

- No support for XMI or rational Rose formats .
- No evident code generators more a diagramming tool
- Ready made templates not available
- Comparison of Open Source UML Tools

Table 1: Comparison of Open Source UML Tools

	StarUML	AgroUML	Umbrello	UMLet
Version	5	0.26.2 ,0.32.2	2	11.3
Platform	Windows	Java VM	Linux , KDE , Windows	Java VM , Windows, OS X and Linux
Language used to develop	Delphi / Any	Java	C	Java
XMI	Import , Export	Export* , Import *	Import , Export	
Rational Rose	Import		Import , Export	
Use Case	Yes	Yes	Yes	Yes
Activity Diagram	Yes	Yes	Yes	Yes
Class Diagram	Yes	Yes	Yes	Yes
Sequence Diagram	Yes	Yes	Yes	Yes
Collaboration	Yes	Yes	Yes	
Deployment	Yes	Yes	Yes	Yes
Output Formats	raster img, JPEG, Windows Metafile	GIF, PNG, PostScript, Encapsulated PS, PGML and SVG	PNG , HTML	JPG, SVG, PDF , EPS
C/C++	Forward / Reverse Engg	Forward / Reverse Engg	Forward Engg	
C#	Forward / Reverse Engg	Forward / Reverse Engg	Forward Engg	
Java	Forward / Reverse Engg	Forward / Reverse Engg	Forward Engg	
Other Code Generators		PhP , Ruby	Ada , PHP5 , Ruby , Tcl , Python , XML , Perl , Pascal	
Load /Execution Time	Fast	Slow	Slow	
Templates	Yes ,(Word, Excel, and PowerPoint) generation		Perl Writer Heading	
MDA	Yes			
Demo Screenshots	Yes	Yes	Very unfriendly	Yes

Price comparisons of various Open source and proprietary UML tools

Table 2: Price Comparison of Open Source UML Tools

Company	Product	Features	Platform	Price
Tigris	ArgoUML	open-source project, written in Java, run-time model critique, OCL, XMI reverse engineering for Java	Java VM	\$0
Tigris	StarUML	open-source project, language support. (Java, C++, C#) , High compatibility with (Rose, XMI modules)	Windows	\$0
Oracle	JDeveloper	Class and activity diagrams, Java round-trip engineering, XMI export	Java VM	\$0

UMlet	UMlet	open-source UML class and sequence diagrams, export to JPG, SVG, PDF	Java VM	\$0
Umbrello	Umbrello UML Modeller	KDE-based open-source program in C++, XMI file format, PNG export	Linux	\$0
Altova	UModel		Windows	\$129
Visual Object Modelers	Visual Paradigm UML Standard Edition	C++, C# and Java code generation and reverse engineering, data modeling	Windows , Mac OS	\$299
Microsoft Visio	Visio 2002 Professional	C++, VB reverse engineering, MS Visual Studio	Windows	\$499
Borland	Together Edition for Visual Studio .NET	integration of Together with Visual Studio .NET	VS .NET	\$1500
IBM-Rational	Rose XDE Developer for Java	Java, fully integrated with IBM Websphere Studio and Eclipse	Windows	\$2826
IBM-Rational	Rose XDE Developer for Visual Studio	J2EE support, patterns support, round-trip engineering	Windows	\$2,968
IBM-Rational	Rose Technical Developer	real-time modeling based on ObjecTime technology	Linux , Windows	\$5995- \$10625.0

VI. Conclusion

StarUML is a better alternative to Rational Rose says Renjith in his blog post <http://todayslearnings.blogspot.com> [5] and Peter Gordon in the Software Discussion group by Joel discuss alternative open source various options in UML tools [8]. NetBeans Editor also can be used with the NetBeans UML plugin. It has got very cool features like Reverse engineering, Design patterns documentation, applying design patterns, etc.,

There are many constraints to creating UML diagrams quickly; that being cost, ease of use, portability, and most importantly, the ability to quickly share the diagrams. In the education environment; the cost and complexity of maintaining a license server and handing out software programs with a large footprint would be too much money to spend if all that needs to be done is teach students simple UML modeling techniques.

UMlet is an open-source Java-based UML tool designed for teaching and creating the Unified Modeling Language. It allows users to perform many different operations within it. Using the drawing tool users can draw UML diagrams fast. Most experts after having used StarUML on small to mid-sized projects, find it a great tool. It seems to be rather good for creating projects using the Reverse Engineering for C#. It has C++, Java, and C# support for Reverse Engineering, and Code Generation. ArgoUML on the other side, seems to be short on the number of features. Ultimately, StarUML is amazing for UML diagrams. It is highly recommended tool for academics to use it for teaching and implementing Object Oriented Techniques. There is no need for any institution of higher learning to go for a proprietary Modeling tool by paying a high license fee since these open source alternatives come loaded with all the necessary features.

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