
proobjectlink-jpi-jiprolog
v. 1.1-SNAPSHOT
User Guide

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1 What Is

1.1 What is

1.1.1 Introduction

Java Prolog Interface (JPI) is an Application Provider Interface (API) for interaction between Java and Prolog programming languages. Is a bidirectional interface that communicate Java applications with Prolog program or database and Prolog procedures with Java class and methods.

JPI is an abstraction layer over concrete prolog drivers over Prolog Engines. This API define all mechanism to interact with any Prolog Engine and maintain the application independent to a specific underlying engine. JPI have several connectors to open source prolog engines like SWI, YAP, XSB native engines and tuProlog, jTrolog, jLog Java based prolog engines.

JPI study all related Java-Prolog integration libraries and take the better features from each solution with the propose to achieve a common integration interface. The last feature allows switch the underlying Prolog Engine driver and the application code still be the same.

JPI run over any Java Virtual Machine that support Java SE 5 or above. The project was tested over HotSpot, Open J9 and JRockit Virtual Machines over Operating Systems like Windows (7,8,10), Linux (Debian, Ubuntu) and Mac OS X. Can be deployed on Servlets Containers like Jetty, Tomcat or Glassfish Application Server. JPI can be include in any Java Project using the commonest Java Integration Development Enviroment (IDE) like Eclipse, Netbeans, IntelliJIDEA and so on.

JPI is developed and maintained by Prolobjectlink Project an open source initiative for build logic based applications using Prolog like fundamental Logic Programming Language in the persistence layer and application programming.

The selected license for JPI is Simplified BSD License a permissive license allowing to concrete implementations can use some possibilities like GPL, Apache 2.0 and others in the interface implementation. We suggest adopt the same license from prolog java driver if it is possible. In this way the java prolog driver and your JPI implementation share the same license and can be combined with JPI interface that is less restrictive licensed. Finally, license is the most restrictive licensed, being in many occasions the java prolog driver licenses the most restrictive.

1.1.2 Copyright and License Information

JPI is release under Simplified BSD License:

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SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

1.1.3 Release Notes

Version 1.0.0: Initial release.

1.1.4 Acknowledgments

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2 Getting Started

2.1 Getting Started

2.1.1 Install

Java Prolog Interface API is distributed with implementation adapter and concrete prolog driver library until it is possible according to related libraries licenses. The distributions are named normally such that **proobjectlink-jpi-jpl7-swi7-x.y.z-dist.zip** meaning that this distribution is a JPI implementation over JPL version 7 or above and SWI-Prolog version 7 or above. The x.y.z is the distribution version. The distribution can be downloaded in zip or tar.gz compresses format. To install you need perform the following steps:

- Install Java Runtime Environment (JRE) 1.8 or above.
- Install Native Prolog Engine compatible to Operating System and your architecture. If the Prolog Engine to use is Java-based this step is omitted.
- Configure System Path with Prolog Engine routes. If the Prolog Engine to use is Java-based this step is omitted.
- Download Java Prolog Interface compatible to related prolog engine and unzip the distribution over Operating File System.
- Configure System Path with JPI unzip folder route.
- Open a new System console and type `plink -i` to see the product information.

For the JPI beginners we recommended start with a Pure Java-Prolog Engine because have less configuration aspects and native engine are more difficult to link.

2.1.2 Directories

After download and unzip JPI distribution in the final JPI folder you will see the following structure:

Folder/File	Description
bin	Binaries scripts
docs	Documentation
prt	Prolog programs files
lib	Library jars files
obj	Programs to link native engine procedures
src	Adapter source folder
CONTRIBUTING	Binaries scripts
LICENSE	Binaries scripts
NOTICE	Binaries scripts
README	Binaries scripts

2.1.3 Architecture

In general way and in bottom-up order the JPI architecture is composed by the guest Operating System at low level. Over this level we find compatible with guest Operating System and Native Prolog Engines implementations. Over this level we find Pure Java Prolog Engine implementations

and Java Driver libraries to Native Prolog Engine. Over this layer is the JPI interface adapter implementation for your correspondent Java Prolog Driver. In the top level we find a User Application that use the JPI interface.



2.1.4 Getting started Java to Prolog

After installation and architecture compression you can use the hello world sample for test the system integration. This hello world sample show how interacts with JPI from Java programming language with Abstracted Prolog Engine. For the first experience we suggesting use a Java-based Prolog engine like tuProlog because have less configuration aspects.

Create in your preferred development environment an empty project. Set in the project build path the JPI downloaded libraries located at lib folder. Create a Main Java class that look like below code:

```

public class Main {

    public static void main(String[] args) {
        PrologProvider provider = Prolog.
            getProvider(XsbProlog.class);
        PrologEngine engine = provider.newEngine();
        engine.asserta("sample('hello wolrd')");
        PrologQuery query=engine.query("sample(X)");
        System.out.println(query.one());
    }

}

```

2.1.5 Getting started Prolog to Java

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3 Prolog Programming

Paragraph 1, line 1. Paragraph 1, line 2.

Paragraph 2, line 1. Paragraph 2, line 2.

3.1 Section title

3.1.1 Sub-section title

3.1.1.1 Sub-sub-section title

3.Sub-sub-sub-section title

3.Sub-sub-sub-sub-section title

- List item 1.
- List item 2.
Paragraph contained in list item 2.
 - Sub-list item 1.
 - Sub-list item 2.
- List item 3. Force end of list:

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1. Numbered item 1.

A.Numbered item A.

B.Numbered item B.

2. Numbered item 2.

List numbering schemes: [[1]], [[a]], [[A]], [[i]], [[I]].

Defined term 1

of definition list.

Defined term 2

of definition list.

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Figure caption

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cell 2,1	cell 2,2	cell 2,3

Table caption

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Italic font. **Bold** font. Monospaced font.

Anchor. Link to [anchor](#). Link to <http://www.pixware.fr>. Link to [showing alternate text](#). Link to [Pixware home page](#).

Force line
break.

Non breaking space.

Escaped special characters: ~, =, -, +, *, [,], <, >, {, }, \.

Copyright symbol: ©, ©, ©.

4 Bidirectional Interface

4.1 Bidirectional Interface

4.1.1 Install

Java Prolog Interface API is distributed with implementation adapter and concrete prolog driver library until it is possible according to related libraries licenses. The distributions are named normally such that `proobjectlink-jpi-jpl7-swi7-x.y.z-dist.zip` meaning that this distribution is a JPI implementation over JPL version 7 or above and SWI-Prolog version 7 or above. The `x.y.z` is the distribution version. The distribution can be downloaded in zip or tar.gz compresses format. To install you need perform the following steps: •Install Java Runtime Environment (JRE) 1.8 or above. •Install Native Prolog Engine compatible to Operating System and your architecture. If the Prolog Engine to use is Java-based this step is omitted. •Configure System Path with Prolog Engine routes. If the Prolog Engine to use is Java-based this step is omitted. •Download Java Prolog Interface compatible to related prolog engine and unzip the distribution over Operating File System. •Configure System Path with JPI unzip folder route. •Open a new System console and type `pllink -i` to see the product information. For the JPI beginners we recommended start with a Pure Java-Prolog Engine because have less configuration aspects and native engine are more difficult to link.

4.1.2 Getting started Java to Prolog

After installation and architecture compression you can use the hello world sample for test the system integration. This hello world sample show how interacts with JPI from Java programming language with Abstracted Prolog Engine. For the first experience we suggesting use a Java-based Prolog engine like tuProlog because have less configuration aspects.

Create in your preferred development environment an empty project. Set in the project build path the JPI downloaded libraries located at lib folder. Create a Main Java class that look like below code:

```
public class Main {  
    public static void main(String[] args) {  
        PrologProvider provider = Prolog.getProvider();  
        PrologEngine engine = provider.newEngine();  
        engine.asserta("sample('hello wolrd')");  
        PrologQuery query=engine.query("sample(X)");  
        System.out.println(query.one());  
    }  
}
```

4.1.3 Architecture

JPI use a layered architecture pattern where every layer represents a component. The multi-engine Java Prolog connectors provide different levels of abstraction to simplify the implementations of common inter-operability task JPC. Java Prolog Connectors architectures describe three fundamentals layers, High-level API layer, Engine Adapter layer and Concrete Engine layer. High-level API layer define all services to be used by the users in the Java Prolog Application that is the final architecture layer on the architecture stack. High-level API provide the common implementation of Engine Abstraction, Data Type and Inter-Language conversion. The adapter layer adapts before mentioned features to communicate with the concrete Engine Layer, being the last responsible of execute the request services.

All existing Java Prolog Connectors implementation only bring support for Native Prolog Engines that have JVM bindings driver. JPI project is more inclusive and find connect all Prolog Engines Categories, Native and Java Based implementations. Some particular Java Based implementations in the future can be implement in strike forward mode the JPI interface. This particulars implementations reduce the impedance mismatch by remove the adapter layer. Therefore, JPI reference implementations will be faster than other that use adapter layer.

In JPI architecture stack in the bottom layer we have the Operating System. The Operating System can be Windows, Linux or Mac OS. Over Operating System, we have the native implementation of JVM and Prolog Engines like SWI, SWI7 and others. Over JVM and Prolog Engines we have Java Based Prolog Engines implementations and JVM bindings driver that share the runtime environment with JVM and native Prolog Engines. Over Java Based Prolog Engines implementations and JVM bindings drivers we have the JPI correspondent adapters. The adapters artifacts are the JPI implementations for each Prolog Engines. Over each adapter we have the JPI application provider interface and at the top stack we the final user application. The user application only interacts with the JPI providing single sourcing and transparency.

4.1.4 Prolog Provider

Prolog Provider is the mechanism to interact with all Prolog components. Provider classes implementations allow create Prolog Terms, Prolog Engine, Java Prolog Converter, Prolog Parsers and system logger. Using `io.github.prologobjectlink.prolog.Prolog` bootstrap class the Prolog Providers are created specifying the provider class in `getProvider(Class ?)` method. This is the workflow start for JPI. When the Prolog Provider is created the next workflow step is the Prolog Terms creation using Java primitive types or using string with Prolog syntax. Provider allow create/parsing all Prolog Terms (Atoms, Numbers, Variables and Compounds). After term creation/parsing the next step is create an engine instance with `newEngine()` method. Using previous term creation and engine instance Prolog Queries can be formulated. This is possible because the engine class have multiples queries creation methods like a query factory. After query creation the Query interface present many methods to retrieve the query results. The result methods are based on result quantities, result terms, result object types, etc... This is the final step in the workflow. In the table 10 is resumed all Prolog Provider Interface methods.

4.1.5 Prolog Terms

All Java Prolog connector libraries provide data type abstraction. Prolog data type abstraction have like ancestor the Term class. Prolog term is coding like abstract class and other Prolog terms are derived classes. In `PrologTerm` is defined the common term operation for all term hierarchy (functor, arity, compare, unify, arguments). The derived classes implement the correct behavior for each before mentioned operations. All Prolog data types `PrologAtom`, `PrologNumber`, `PrologList`, `PrologStructure` and `PrologVariable` are derived from this class. All before mentioned classes extends from this class the commons responsibilities. `PrologTerm` extends from `Comparable` interface to compare the current term with another term based on Standard Order.

`PrologAtom` represent the Prolog atom data type. Prolog atoms are can be of two kinds simple or complex. Simple atoms are defined like a single alpha numeric word that begin like initial lower case character. The complex atom is defining like any character sequence that begin and end with simple quotes. The string passed to build a simple atom should be match with `{a-z}{A-Za-z0-9_}*` regular expression. If the string passed to build an atom don't match with the before mentioned regular expression the atom constructor can be capable of create a complex atom automatically. For complex atom the string value can have the quotes or just can be absent. The printed string representation of the complex atom implementation set the quotes if they are needed.

```
PrologTerm pam = provider.newAtom("pam");
PrologTerm bob = provider.newAtom("bob");
```

PrologDouble represent a double precision floating point number. Extends from PrologNumber who contains an immutable Double instance. The Prolog Provider is the mechanism to create a new Prolog double invoking PrologProvider.newDouble(Number). PrologFloat represent a single precision floating point number. Extends from PrologNumber who contains an immutable Float instance. The Prolog Provider is the mechanism to create a new Prolog float invoking PrologProvider.newFloat(Number). PrologInteger represent an integer number. Extends from PrologNumber who contains an immutable Integer instance. The Prolog Provider is the mechanism to create a new Prolog integer invoking PrologProvider.newInteger(Number). Prolog term that represent a long integer number. Extends from PrologNumber who contains an immutable Long instance. The Prolog Provider is the mechanism to create a new Prolog long integer invoking PrologProvider.newLong(Number).

```
PrologTerm pi = provider.newDouble(Math.PI);
PrologTerm euler = provider.newFloat(Math.E);
PrologTerm i = provider.newInteger(10);
PrologTerm l = provider.newLong(10);
```

PrologVariable is created using PrologProvider.newVariable(int) for anonymous variables and PrologProvider.newVariable(String, int) for named variables. The Prolog variables can be used and reused because they remain in java heap. You can instantiate a prolog variable and used it any times in the same clause because refer to same variable every time. The integer parameter represents the declaration variable order in the Prolog clause starting with zero.

```
PrologTerm x = provider.newVariable("X", 0);
PrologTerm y = provider.newVariable("Y", 1);
PrologTerm z = provider.newVariable("Z", 2);

engine.assertz(
    provider.newStructure(grandparent, x, z),
    provider.newStructure(parent, x, y),
    provider.newStructure(parent, y, z)
);
```

PrologReference term is inspired on JPL JRef. This term is like a structure compound term that have like argument the object identification atom. The functor is the @ character and the arity is 1. An example of this prolog term is e.g. @(J#000000000000000425). To access to the referenced object, is necessary use PrologTerm.getObject().

PrologList are a special compound term that have like functor a dot (.) and arity equals 2. Prolog list are recursively defined. The first item in the list is referred like list head and the second item list tail. The list tail can be another list that contains head and tail. A special list case is the empty list denoted by no items brackets ([]). The arity for this empty list is zero. The Prolog Provider is the mechanism to create a new PrologList is invoking PrologProvider.newList() for empty list or PrologProvider.newList(PrologTerm) for one item list or PrologProvider.newList(PrologTerm[]) for many items.

```

PrologTerm empty = provider.newList();
PrologTerm one = provider.newInteger(1);
PrologTerm two = provider.newInteger(2);
PrologTerm three = provider.newInteger(3);
PrologTerm list = provider.newList(
    new PrologTerm[] { one, two, three }
);
for (PrologTerm prologTerm : list) {
    System.out.println(prologTerm);
}

```

PrologList implement Iterable interface to be used in for each sentence iterating over every element present in the list.

```

Iterator<PrologTerm> i = list.iterator();
while (i.hasNext()) {
    PrologTerm prologTerm = i.next();
    System.out.println(prologTerm);
}

```

```

for (Iterator<PrologTerm> i = list.iterator(); i.hasNext();) {
    PrologTerm prologTerm = i.next();
    System.out.println(prologTerm);
}

```

Prolog structures consist in a relation the functor (structure name) and arguments enclosed between parenthesis. The Prolog Provider is the mechanism to create a new Prolog structures invoking `PrologProvider.newStructure(String, PrologTerm...)`. Two structures are equals if and only if are structure and have equals functor and arguments. Structures terms unify only with same functor and arguments structures, with free variable or with with structures where your arguments unify if they have the same functor and arity. Structures have a special property named arity that means the number of arguments present in the structure. There are two special structures term. They are expressions (Two arguments structure term with operator functor) and atoms (functor with zero arguments). For the first special case must be used `PrologProvider.newStructure(PrologTerm, String, PrologTerm)` specifying operands like arguments and operator like functor.

```

PrologTerm pam = provider.newAtom("pam");
PrologTerm bob = provider.newAtom("bob");
PrologTerm parent = provider.newStructure("parent", pam, bob);

```

4.1.6 Prolog Engine

Prolog Engine provide a general propose application interface to interact with Prolog Programing Language. Is a convenient abstraction for interacting with Prolog Virtual Machine from Java. In Java Prolog Engine connectors libraries, the abstract engine is able to answer queries using the abstract term representation before mentioned. There are several implementation engines and in this project we try connect from top level engine to more concrete or specific Prolog Engine. Based on JPC we have a top level engine that communicate with more concretes engines. Over this concretes engines we offer several services to interact with the concrete engines with low coupling and platform independency.

4.1.7 Prolog Query

Prolog query is the mechanism to query the prolog database loaded in prolog engine. The way to create a new prolog query is invoking query() method in the Prolog Engine. When this method is called the prolog query is open and only dispose() in PrologQuery object close the current query and release all internal resources. Prolog query have several methods to manipulate the result objects. The main difference is in return types and result quantities. The result types enough depending of desire data type. Maps of variables name key and Prolog terms as value, Maps of variables name key and Java objects as value, List of before mentioned maps, Prolog terms array, Prolog terms matrix, list of Java Objects and list of list of Java Objects. Respect to result quantities Prolog query offer one, n-th or all possible solutions. This is an important feature because the Prolog engine is forced to retrieve the necessary solution quantities. Prolog query implement Iterable and Iterator. This implementation helps to obtain successive solutions present in the query.

```
public class Main {
    public static void main(String[] args) {
        PrologProvider provider = Prolog.getProvider();
        PrologEngine engine = provider.newEngine("zoo.pl");
        PrologVariable x = provider.newVariable("X", 0);
        PrologQuery query = engine.query(provider.newSt
        while (query.hasNext()) {
            PrologTerm value =
            System.out.println(value);
        }
        query.dispose();
        engine.dispose();
    }
}
```

```
public class Main {
    public static void main(String[] args) {
        PrologProvider provider = Prolog.getProvider();
        PrologEngine engine = provider.newEngine("zoo.pl");
        PrologVariable x = provider.newVariable("X", 0);
        PrologQuery query = engine.query
        for (Collection<PrologTerm> col : query) {
            for (PrologTerm prologTerm : col) {
                System.out.println(prologTerm);
            }
        }
        query.dispose();
        engine.dispose();
    }
}
```

4.1.8 Prolog Query Builder

Prolog query builder to create prolog queries. The mechanism to create a new query builder is using PrologEngine.newQueryBuilder(). The query builder emulates the query creation process. After define all participant terms with the begin(PrologTerm) method, we specify the first term in the query. If the query has more terms, they are created using comma(PrologTerm) for everyone. Clause builder have a getQueryString() for string representation of the clause in progress. After clause definition this builder have query() method that create the final query instance ready to be used. The follow code show how create a Prolog query ?- big(X), dark(X). using PrologQueryBuilder interface.

```

PrologVariable x = provider.newVariable("X", 0);
PrologStructure big = provider.newStructure("big", x);
PrologStructure dark = provider.newStructure("dark", x);
PrologQueryBuilder builder = engine.newQueryBuilder();
PrologQuery query = builder.begin(dark).comma(big).query();

```

4.1.9 Prolog Clause

Prolog clause is composed by two prolog terms that define a prolog clause, the head and the body. This representation considers the prolog clause body like a single term. If the body is a conjunctive set of terms, the body is a structure with functor/arity (, /2) and the first argument is the first element in the conjunction and the rest is a recursive functor/arity (, /2). The functor and arity for the clause is given from head term functor and arity. This class define some properties for commons prolog clause implementations. They are boolean flags that indicate if the prolog clause is dynamic multi-file and discontiguos. This class have several methods to access to the clause components and retrieve some clause properties and information about it. Additionally, this class contains a prolog provider reference for build terms in some operations.

4.1.10 Prolog Clause Builder

Prolog clause builder to create prolog clauses. The mechanism to create a new clause builder is using `PrologEngine.newClauseBuilder()`. The clause builder emulates the clause creation process. After define all participant terms with the `begin(PrologTerm)` method, we specify the head of the clause. If the clause is a rule, after head definition, the clause body is created with `neck(PrologTerm)` for the first term in the clause body. If the clause body have more terms, they are created using `comma(PrologTerm)` for everyone. Clause builder have a `getClauseString()` for string representation of the clause in progress. After clause definition this builder have `asserta()`, `assertz()`, `clause()`, `retract()` that use the wrapped engine invoking the correspondent methods for check, insert or remove clause respectively.

```

PrologTerm z = provider.newVariable("Z", 0);
PrologTerm darkZ = provider.newStructure("dark", z);
PrologTerm blackZ = provider.newStructure("black", z);
PrologTerm brownZ = provider.newStructure("brown", z);
PrologClauseBuilder builder = engine.newClauseBuilder();
builder.begin(darkZ).neck(blackZ).assertz();
builder.begin(darkZ).neck(brownZ).assertz();

```

The Prolog result in database is showed in the follow code. The table 19 show the Prolog clause builder interface methods.

```

dark(Z): -
    black(Z).
dark(Z): -
    brown(Z).

```

4.1.11 Prolog Scripting in Java

Java 6 added scripting support to the Java platform that lets a Java application execute scripts written in scripting languages such as Rhino JavaScript, Groovy, Jython, JRuby, Nashorn JavaScript, etc. All classes and interfaces in the Java Scripting API are in the `javax.script` package. Using a scripting language in a Java application provides several advantages, dynamic type, simple way to write programs, user customization, easy way to develop and provide domain-specific features

that are not available in Java. For achieve this propose Java Scripting API introduce a scripting engine component. A script engine is a software component that executes programs written in a particular scripting language. Typically, but not necessarily, a script engine is an implementation of an interpreter for a scripting language. To run a script in Java is necessary perform the following three steps, create a script engine manager, get an instance of a script engine from the script engine manager and Call the eval() method of the script engine to execute a script.

```
public class Main {
    public static void main(String[] args) {
        ScriptEngineManager manager = new ScriptEngineManager();
        ScriptEngine engine = manager.getEngineByName("prolog");
        Boolean result = engine.eval("?- X is 5+3.");
        Integer solution = engine.get("X");
        System.out.println(solution);
    }
}
```

Using script engine, it possible read Prolog source file. Read Prolog source file allow coding all prolog source in separate mode respect to Java program.

```
public class Main {
    public static void main(String[] args) {
        ScriptEngineManager manager = new ScriptEngineManager();
        ScriptEngine engine = manager.getEngineByName("prolog");
        Boolean read = engine.eval(new FileReader("family.pl"));
        Boolean eval = engine.eval("?- parent( Parent, Child)");
        Object parent = engine.get("Parent");
        Object child = engine.get("Child");
        System.out.println(parent);
        System.out.println(child);
    }
}
```

4.1.12 Getting started Prolog to Java

JIProlog supplies two ways to call Java from Prolog. The first one allows extending the set of built-in predicates implementing them in Java classes. As result it is feasible to add to Prolog custom predicates, custom dialogs and windows or custom algorithms implemented in Java. To do that JIProlog supplies an abstract class and an interface to extend Prolog with custom predicates, dialogs and windows. The second one allows to manage directly Java objects from prolog through the Java Reflection API mapped on a set of Prolog predicates implemented in the extension package jipxreflect.jar.

The extension package jipxreflect.jar supplies a set of custom built-in predicates that allows creating Java objects, invoking their methods, retrieving values from their fields and so on. Such predicates are implemented using the functionalities given by Java Reflection API.

4.1.12.1 Predicates

create_object/3

```
create_object(ConstructorProto, Params, Handle)
```

Creates the object specified in ConstructorProto calling the constructor whose prototype matches with the given one with the parameters specified in Params. If creation succeeds Handle is unified with a reference to the created object. ConstructorProto can be a functor or an Atom. In the former case the functor name specifies the class name while the parameters specify the class of the constructor parameters. In the latter case default constructor is used and Params must be []. Es.:

```
JIP:-load_library('jipxreflect.jar') % this is not needed with JIPrologIDE and JIP
Yes
JIP:-create_object('java.lang.String'('java.lang.String'), ['Hello World'], Handle)
Yes
Handle = #12345
JIP:-create_object('java.lang.StringBuffer', [], Handle).
Yes
Handle = #67890
```

invoke/4

```
invoke(Handle, MethodProto, Params, RetVal)
```

Invokes the method specified in MethodProto on the object or class referenced by Handle passing the parameters specified in Params. If the invocation succeeds RetVal is unified with the value returned by the method. Handle can be a reference to an object obtained by create_object/3 or can be a class name. The former case causes a call to an object method. The latter case causes a call to class method (static). MethodProto can be a functor or an Atom. In the former case the functor name specifies the method name while the parameters specify the class of the method parameters. In the latter case method is assumed having no parameters and Params must be []. Es.

```
JIP:-invoke('#12345', substring(int, int), [0, 5], RetVal).
Yes
RetVal = Hello
JIP:-invoke('java.lang.String', valueOf(int), [5], RetVal).
Yes
RetVal = 5
```

get/3

```
get(Handle, FieldName, Val)
```

Gets the value of a field related to the object or class referenced by Handle. Handle can be a reference to an object obtained by create_object/3 or can be a class name (static) Es.:

```
JIP:-get('#12345', myName, Val).
Yes
Val = Ugo
JIP:-get('java.io.File', separator, Val).
Yes
Val = \
```

get_class/2

```
get_class(Handle, ClassName)
```

Retrieves the class of the object specified in Handle Es.:

```
JIP:-get_class('#12345', ClassName).
Yes
ClassName = java.lang.String
```

get_constructors/2

```
get_constructors(Handle, MethodList)
```

Retrieves the constructors of an object or class. Handle can be a reference to an object obtained by create_object/3 or can be a class name. Es.:

```
JIP:-get_constructors('java.lang.Integer', X).
Yes
X = [java.lang.Integer(java.lang.String), java.lang.Integer(int)]
```

get_methods/2

```
get_methods(Handle, MethodList)
```

Retrieves the methods of an object or class. Handle can be a reference to an object obtained by create_object/3 or can be a class name. Es.:

```
JIP:-get_methods('java.lang.Object', MethodList).
Yes
MethodList = [hashCode, getClass, wait(long, int), wait, wait(long),
equals(java.lang.Object), toString, notify, notifyAll]
```

get_fields/2

```
get_fields(Handle, FieldList)
```

Retrieves the fields of an object or class. Handle can be a reference to an object obtained by create_object/3 or can be a class name. Es.:

```
JIP:-get_fields('java.lang.String',X).
Yes
X = [CASE_INSENSITIVE_ORDER]
```

set/3

```
set(Handle, FieldName, Val)
```

Sets the value of a field related to the object or class referenced by Handle. Handle can be a reference to an object obtained by create_object/3 or can be a class name (static) Es.:

```
JIP:-set('#12345', myName, ugo).
Yes
```

release_object/1

```
release_object(Handle)
```

Releases the object referenced by Handle. Java Garbage Collector will free the related memory.

```
JIP:-release_object('#12345').  
Yes
```

5 Development Tools

Paragraph 1, line 1. Paragraph 1, line 2.

Paragraph 2, line 1. Paragraph 2, line 2.

5.1 Section title

5.1.1 Sub-section title

5.1.1.1 Sub-sub-section title

5.Sub-sub-sub-section title

5.Sub-sub-sub-sub-section title

- List item 1.
- List item 2.
Paragraph contained in list item 2.
 - Sub-list item 1.
 - Sub-list item 2.
- List item 3. Force end of list:

Verbatim text not contained in list item 3

1. Numbered item 1.

A.Numbered item A.

B.Numbered item B.

2. Numbered item 2.

List numbering schemes: [[1]], [[a]], [[A]], [[i]], [[I]].

Defined term 1

of definition list.

Defined term 2

of definition list.

Verbatim text
in a box

--- instead of +++ suppresses the box around verbatim text.

Figure caption

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cell 2,1	cell 2,2	cell 2,3

Table caption

No grid, no caption:

cell	cell
cell	cell

Horizontal line:

5.2 ^L New page.

Italic font. **Bold** font. Monospaced font.

Anchor. Link to [anchor](#). Link to <http://www.pixware.fr>. Link to [showing alternate text](#). Link to [Pixware home page](#).

Force line
break.

Non breaking space.

Escaped special characters: ~, =, -, +, *, [,], <, >, {, }, \.

Copyright symbol: ©, ©, ©.

6 Contribution

6.1 Contribution

6.1.1 Issues

See the issue tracker at <https://github.com/proobjectlink/proobjectlink-jpi-jiprolog> to create a new issue or take an existing one.

6.1.2 Changes and Build

Fork the repository in GitHub.

Clone your forked repository in your preferred IDE

Proobjectlink development requires.

- Java 1.8 - Maven 3.1.0 or above

Make changes in your cloned repository

Run all test to see if the system still consistent after your changes

Create unit-tests and make sure that the include changes are covered to 100%

Run the benchmark to see if the system performance still consistent after your changes

Add a description of your changes in CHANGELOG.txt and src/changes/changes.xml

Commit the changes.

Run an integration test on Travis-CI

Submit a pull request.

6.1.3 New Implementations

The project start with some adapters implementations over most used open source prolog engines.

We accept any new adapter implementation of another prolog engine not covered at this moment.

For this propose create a new GitHub source code repository naming this follow the project convesion:

proobjectlink-jpi- new engine implementation name

Create an new maven project in your preferred IDE named like repository.

Copy the src/assembly/dist.xml descriptor

Copy the src/build/filters folder and change by your console main entry point

Copy and clean src/changes/changes.xml to go reporting every change

Copy src/site folder to generate a similar project site.

Copy the pom.xml properties, build, report, etc... from another implementation

Change the project information.

Add your dependencies including Java Prolog Interface API

```

<dependencies>
    ...
    <dependency>
        <groupId>org.proobjectlink</groupId>
        <artifactId>proobjectlink-jpi</artifactId>
        <version>[1.0.0, )</version>
    </dependency>
    ...
    <dependency>
        <groupId>junit</groupId>
        <artifactId>junit</artifactId>
        <version>[4.10, )</version>
        <scope>test</scope>
    </dependency>
    ...
</dependencies>

```

In test package copy the unit-tests cases from another implementation to develop in test driven mode.

We suggest like adapter implementation order begin with data types, parsers, engine and finally query.

Run all test to see if the system to see if your implementation pass all.

Create unit-tests and make sure that the include changes are covered to 100%

Create the benchmark to see if the system performance.

Add a description of your changes in CHANGELOG.txt and src/changes/changes.xml

Commit the changes.

Run an integration test on Travis-CI or another CI system

6.1.4 Version Numbering

Proobjectlink version signature is Major.Minor.Micro.

Major version is change when the API compatibility is broken. Minor version is change when a new feature is include in the release. Micro version is change when some bug is fixed or some maintenance take place

Proobjectlink suggest work over the started 1.Y.Z version to preserve compatibility all the time. You are free of make any change adding new features, fixing bugs or code maintenance.

6.1.5 Contact us

Please contact us at our project mailing list <https://groups.google.com/group/proobjectlink> to debat over project evolution

Thanks for contributing to Proobjectlink!

7 Related Works

Paragraph 1, line 1. Paragraph 1, line 2.

Paragraph 2, line 1. Paragraph 2, line 2.

7.1 Section title

7.1.1 Sub-section title

7.1.1.1 Sub-sub-section title

7.Sub-sub-sub-section title

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of definition list.

Defined term 2

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Figure caption

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Force line
break.

Non breaking space.

Escaped special characters: ~, =, -, +, *, [,], <, >, {, }, \.

Copyright symbol: ©, ©, ©.

8 FAQ

8.1 Frequently Asked Questions

General

1. [What is the difference between `mvn site` and `mvn site:site`?](#)
2. [How do I Integrate static \(X\)HTML pages into my Maven site?](#)
3. [How to include a custom Doxia module, like Twiki?](#)
4. [How can I validate my xdoc/fml source files?](#)
5. [How does the Site Plugin use the `<url>` element in the POM?](#)

Specific issues

1. [Why do my absolute links get translated into relative links?](#)
2. [Why don't the links between parent and child modules work when I run "`mvn site`"?](#)
3. [Can I use entities in xdoc/fml source files?](#)

8.2 General

What is the difference between `mvn site` and `mvn site:site`?

`mvn site`

Calls the *site* **phase** of the site **lifecycle**. Full site lifecycle consists in the following life cycle phases: `pre-site`, `site`, `post-site` and `site-deploy`. See [Lifecycle Reference](#). Then it calls plugin goals associated to `pre-site` and `site` phases.

`mvn site:site`

Calls the *site* **goal** of the site **plugin**. See [site:site](#).

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How do I Integrate static (X)HTML pages into my Maven site?

You can integrate your static pages by following these steps:

- Put your static pages in the resources directory, `${basedir}/src/site/resources`
- Create your `site.xml` and put it in `${basedir}/src/site`
- Link to the static pages by modifying the menu section, create items and map them to the filenames of the static pages

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How to include a custom Doxia module, like Twiki?

The site plugin handles out-of-box apt, xdoc and fml formats. If you want to use a custom format like Twiki, Simple DocBook, or XHTML (or any other document format for which a doxia parser exists, see the list of [Doxia Markup Languages](#)), you need to specify the corresponding Doxia module dependency, e.g. for Twiki:

```

<project>
  ...
  <build>
    <plugins>
      ...
      <plugin>
        <groupId>org.apache.maven.plugins</groupId>
        <artifactId>maven-site-plugin</artifactId>
        <dependencies>
          <dependency>
            <groupId>org.apache.maven.doxia</groupId>
            <artifactId>doxia-module-twiki</artifactId>
            <version><!-- doxia version appropriate to the site plugin version -->
          </dependency>
        </dependencies>
      </plugin>
    </plugins>
  </build>
  ...
</project>

```

Note that the doxia version has to be adjusted to the site-plugin version you are using, see the [Migration Guide](#). In particular, for site plugin versions `>=2.1` you need to use doxia `>=1.1`.

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How can I validate my xdoc/fml source files?

Since version 2.1.1 of the Site Plugin, there is a `validate` configuration parameter that switches on xml validation (default is off). Note that in the current implementation of the parser used by Doxia, validation requires an independent parsing run, so that every source file is actually parsed twice when validation is switched on.

If validation is switched on, **all** xml source files need a correct schema and/or DTD definition. See the Doxia documentation on [validating xdocs](#), and the schema definitions for [xdoc](#) and [fml](#).

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How does the Site Plugin use the <url> element in the POM?

The Site Plugin does not use the `<url>` element in the POM. The project URL is just a piece of information to let your users know where the project lives. Some other plugins (e.g. the `project-info-report-plugin`) may be used to present this information. If your project has a URL where the generated site is deployed, then put that URL into the `<url>` element. If the project's site is not deployed anywhere, then remove the `<url>` element from the POM.

On the other hand, the `<distributionManagement.url>` is used in a multi-module build to construct relative links between the generated sub-module sites. In a multi module build it is important for the parent and child modules to have **different** URLs. If they have the same URL, then links within the combined site will not work. Note that a proper URL **should** also be terminated by a slash (`"/`).

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8.3 Specific issues

Why do my absolute links get translated into relative links?

This happens because the Site Plugin tries to make all URLs relative, when possible. If you have something like this defined in your `pom.xml`:

```
<url>http://www.your.site.com/</url>
```

and create links in your `site.xml` (just an example) like this:

```
<links>
  <item name="Your Site" href="http://www.your.site.com/" />
  <item name="Maven 2" href="http://maven.apache.org/maven2/" />
</links>
```

You will see that the link to "Your site" will be a relative one, but that the link to "Maven 2" will be an absolute link.

There is an [issue for this in JIRA](#), where you can read more about this.

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Why don't the links between parent and child modules work when I run "mvn site"?

What "mvn site" will do for you, in a multi-project build, is to run "mvn site" for the parent and all its modules **individually**. The links between parent and child will **not** work here. They **will** however work when you deploy the site.

If you want to test this, prior to deployment, you can run the `site:stage` goal as described in the [usage documentation](#) instead.

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Can I use entities in xdoc/fml source files?

Yes. Entity resolution has been added in Doxia version 1.1, available in Site Plugin 2.1 and later.

There is a catch however. In the current implementation (as of maven-site-plugin-2.1.1), entities are only resolved by an independent [validation](#) run. Therefore, if you want to use entities, you **have** to switch on validation for your xml source files. See [MSITE-483](#).

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