User's Guide of the CROSSMINER Advanced Integrated Development Environments Plug-in

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Chapter 1

Introduction

The general layout of the development and testing process are shown on Figure 1.1

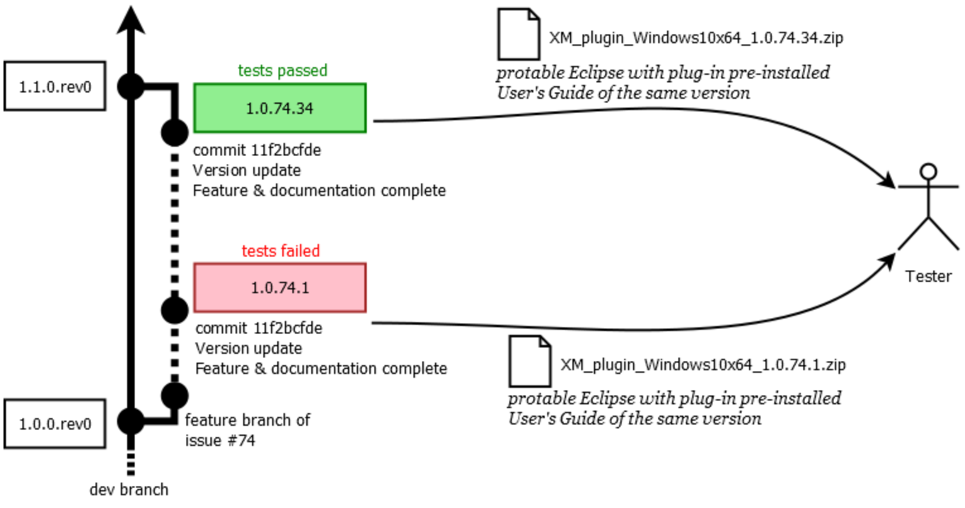

1.1.0.rev0
tests passed
1.0.74.34
XM_plugin_Windows10x64_1.0.74.34.zip
protable Eclipse with plug-in pre-installed
User's Guide of the same version
commit 11f2bcfde
Version update
Feature & documentation complete
Tester
tests failed
1.0.74.1
commit 11f2bcfde
Version update
Feature & documentation complete
XM_plugin_Windows10x64_1.0.74.1.zip
protable Eclipse with plug-in pre-installed
User's Guide of the same version
1.0.0.rev0
feature branch of
issue #74
dev branch

Figure 1.1: Overview of the testing and development process

1.1 Versions

The version number consists of three parts separated by period. It follows the layout $\langle main\rangle.\langle sub\rangle.\langle issue\rangle.rev\langle revision\rangle$. To understand when and how to change these parts please consider the following guide.

Increasing main version Request rights of lead developer or above. It will be increased when the current version are shipped and demonstrated to the (whole) consortium.

Increasing sub version Could be changed by any participant. Increase it by one respecting to the current version of the `dev` branch when a new feature are finished, passed all required tests and merged into the current development version (on `dev` branch). Reset it to 0 every time main version number increases.

Changing issue number You have to set this part to be equal the identification number of the current issue associated to the feature branch you are on. Set it 0 on non-feature branches.

Incrementing the revision Could be changed by any participant. Increment it by one, before you send a new version for testing. It could be the first version containing a testable new feature or any fixes applied due to testers concerns. Reset it to 0 at the beginning of each new feature branch.

There are some additional rules need to consider, partially implicated by the these statements. You have to follow these as well the previous ones.

Development versions Each version on the `dev` branch should follow this scheme: ⟨*main*⟩*.*⟨*sub*⟩*.0.rev0*, for example *1.12.0.rev0.*

Testable versions Each version sent for testing should follow this scheme: ⟨*main*⟩*.*⟨*sub*⟩*.*⟨*current-issue*⟩*.rev*⟨*revision*⟩, for example *2.23.42.rev11.*

Version tagging Each version should be explicitly tagged in the Git repository using the following commands (if your HEAD points to the relevant commit):

```
git tag ⟨version⟩
git push origin ⟨version⟩
```

Issue-branch-feature tracibility Each feature branch has to have a single and unique issue. Do not change (create new) version off the plugin after merging a branch contains only refactoring without any new features or fixes.

Tracability of User's Guide The User's Guide (this document) has to follow the version any version changes. You have to update the guide before you change the version number.

1.2 Structure of Releases

After chancing the version you have to assemble a new release package. By doing so please follow these rules.

Naming Each release package should be named by the following scheme:
XM_plugin_⟨operation-system⟩_v⟨version⟩.zip,
for example `XM_plugin_Windows10x64_2.23.0.rev0`

Content Each release should consist of a single, self-contained compressed folder, containing a portable Eclipse with the plug-in pre-installed.[1]

Placing Documentation The relevant version of this document should be placed in the root folder of the compressed package in PDF format.

1.3 Testing

Each feature and function should be tested against expected functionality described in this document. Any discrepancies should be reported.

Reporting failed tests All failed test should be reported using a dedicated issue recorded in the project. `https://git.sed.hu/geryxyz/crossminer/issues/new`

Content of the report Each report should contain a detailed description of the action and condition of test to be repeatable. You have to specify the concrete version in which the divergence occur and the exact place in this document where the feature was described.

Goal of testing As a tester you have to ensure that each features are working as described in this document with reasonable reliability.

[1]Except in the cases, when the goal of testing is installation.

Chapter 2

General features

In this chapter we present several functions which can not be linked to any single feature. These embodied an overview about the general principles which interwove the whole plug-in.

Requirement U12 SHALL **Status:** done
Able to obtain the API results in JSON format

Requirement U13 SHALL **Status:** done
Able to use the API over REST

Requirement U18 SHALL **Status:** done
API is utilised by all UIs (dashboard, IDE plugin)

done up to date

Requirement U154 SHALL **Status:** to do
Eclipse users can invoke code recommender via an easy shortcut

Requirement U156 SHALL **Status:** to do
Eclipse IDE proposes a dedicated view or perspective for recommendations

Requirement U158 SHALL **Status:** to do
Eclipse IDE plugin can be installed via the Marketplace

Requirement U159 SHALL **Status:** done
Eclipse IDE plugin can be installed via an update site

Requirement U220 SHALL **Status:** to do
User and admin documentation is embedded into the UI

Requirement U225 SHALL **Status:** done
Plugin supports the latest supported release of Eclipse

Requirement D138 SHALL **Status:** done

up to date

The CROSSMINER REST API shall use UTF-8 encoding for all kind of data sent or received in text mode.

Chapter 3

Acquire Recommendations

There are several kind of suggestions and recommendation which could be helpful for the developer during their daily tasks. In this chapter we introduce those features which result some kind of recommendation. One of the main properties is the type of entity which are the subject of the suggestion. To simplify any further discussion our tool only permit recommendation with a single subject type. You can find more details in the following sections.

Requirement U1 SHALL **Status:** waiting for server side implementation
Able to extract the development dependencies of a project

Nothing to do directly on IDE side?

Requirement U2 SHALL **Status:** waiting for server side implementation
Able to extract the test dependencies of a project

Nothing to do directly on IDE side?

Requirement U3 SHALL **Status:** waiting for server side implementation
Able to extract the runtime dependencies of a project

Nothing to do directly on IDE side?

Requirement U157 SHALL **Status:** to do
Eclipse IDE proposes filtering options for recommendations

Requirement U223 MAY **Status:** waiting for server side implementation
Provides recommendations to improve test coverage

It is a MAY. Howto: e.g. label recommendation as TEST

Requirement D75 SHALL **Status:** partially done
Recommendation query shall be initiated from the menu, from context menus, and from the toolbar in the IDE. So the user can easily start working with the recommendations.

Requirement D76 SHALL **Status:** to do waiting for server side implementation

Some recommendation types needs to be defined in details (with examples).

The IDE shall use a view to list the code recommendations for the examined project. The view shall provide hierarchical grouping of listed items, filtering by meta-properties, and navigation.

API needs to be defined. According to L'Aquila the server will receive only a string fr a prepared set options.

Requirement U167 SHALL **Status:** waiting for server side implementation
CROSSMINER IDE provides the ability for the developer to give feedback on the usefulness of the advices in the given situation

Not IDE! Needed for U167 and D79

Requirement D105 SHOULD **Status:** waiting for server side implementation
The CROSSMINER REST API should provide an interface that allows the user to report if the answer of query previously returned by the API was inappropriate answer for the query. So the knowledge base gets feedback and can be improved.

3.1 Library Based Recommendations

Recommendation which subject are libraries are called *library based recommendations.*

WEB Dashboard functionality

Requirement U4 SHOULD **Status:** N/A
Able to warn about superfluous dependencies

WEB Dashboard functionality

Requirement U5 SHOULD **Status:** N/A
Able to warn about overly precise dependencies

Requirement U81 SHALL **Status:** done
Able to identify and list the third-party components used in a project.

U81: If we can support all case studies, then the current, client-side maven-based identification is enough.

Requirement D78 SHALL **Status:** partially done
The IDE shall provide an interface to the user, where libraries that match some recommendations are listed with their selected set of details in filterable and sortable form. So the developer can easily compare the libraries and choose those best fit to their expectations.

Requirement D79 SHOULD **Status:** waiting for server side implementation
The IDE should provide the ability to the user to mark a library proposed for a query as "not appropriate". This information can help in the improvement of the knowledge base.

Requirement D80 SHALL **Status:** done
The IDE shall provide an interface where known information from a single library is shown. This interface can help the user to check details of the library, and reach out for more information through links (e.g. to project home page).

Requirement D100 SHALL **Status:** waiting for server side implementation
The CROSSMINER REST API shall provide an interface that accepts a name and version description and returns the library that is described by them.

Not IDE! Needed for D78

Requirement D101 SHALL **Status:** done
The CROSSMINER REST API shall provide an interface that accepts a library and returns detailed information about it (including description, metric values, URLs).

Not IDE! Needed for D78

3.1.1 Searching Additional Libraries

One sub-type of library based recommendation when the goal of the developer is to find new libraries based on some user specified search criteria.

Requirement U172 SHALL **Status:** waiting for server side implementation
CROSSMINER IDE provides developers code templates and example of codes related to the usage of the API of a specific project

U172: A new sub-type of code recommendations is needed to handle code templates. The KB will send only the changes of the API, which have to be applied on the client side. The details of the communication must be defined.

U172

Requirement D77 SHALL **Status:** to do waiting for server side implementation
The IDE shall provide an interface, where recommendations against a new (to-be-used-in-the-project) library can be given. So the user can describe features and functionalities they wants to perform using an external library. The user can also give some constraints, e.g. minimal age or users of the library.

On the IDE side, it is a free text search (with some pre-defined constraints, if needed). Free text search is okay as far as it satisfies all the use cases.

Requirement D99 SHALL **Status:** partially done waiting for server side implementation
The CROSSMINER REST API shall provide an interface that accepts a description and some filtering constraints and returns a list of libraries that match with the description and fulfil the constraints.

Not IDE! Needed for D77.

3.1.2 Searching Similar Libraries

There are usually some pre-existing selection of libraries which serve as a base to find more relevant API-s. We split these kind of recommendation into two major sub-category: when the pre-existing set of libraries are already installed or not.

Not IDE! Needed for U174

Requirement D102 SHALL **Status:** waiting for server side implementation
The CROSSMINER REST API shall provide an interface that accepts a library, a description and some filtering constraints and returns a list of libraries that match with the description, fulfil the constraints, and can be used as a replacement to the given library.

Suggestion Based on Non-installed Libraries

Suggestion Based on Already Installed Libraries

Not IDE! Needed for D81

Requirement U174 SHOULD **Status:** waiting for server side implementation
CROSSMINER IDE provides suggested alternatives to the usage of third-party jar which offer the same range of services as a jar used in current project

Requirement D81 SHALL **Status:** to do waiting for server side implementation
The IDE shall provide an interface to the user, where recommendations for replacing a library used in the current project with some alternative libraries can be given. The user can select the library currently used in the project to be replaced and can give further recommendations against the alternatives.

3.1.3 Handling Changed and Deprecated APIs

Third party libraries are prone to change and evolution. To help the developers adapt their project to these changes we defined an other sub-category of recommendations, namely when their goal is to provide information about modified or deprecated interfaces.

Not IDE! Needed for U160-162, U164, U168, U169

Requirement U70 SHALL **Status:** waiting for server side implementation
Able to identify the list of changed third-party API methods from the source code of the third-party API

Not IDE! Needed for U160-162, U164, U168, U169

Requirement U71 SHALL **Status:** waiting for server side implementation
Able to identify the list of deprecated third-party API methods from the source code of the third-party API

t IDE! Needed U160-162, U164, 68, U169, U173, 75

Requirement U72 SHALL **Status:** waiting for server side implementation
Able to determine migration pattern from two (or more) code snippets when one of them uses the old third-party API and the other uses the new third-party API

Requirement U80 SHALL **Status:** waiting for server side implementation
Able to detect from the configuration settings if a new version of a used third-party library is available

Not IDE! Nedded for U160-162, U164, U168, D83-84

Requirement U130 SHALL **Status:** waiting for server side implementation
Able to identify if the developer is not using the most recent version of a library and provide notification

Not IDE! Nedded for U160-162, U164, U168, D82-84

Requirement U160 SHALL **Status:** to do waiting for server side implementation
CROSSMINER IDE notifies if a new version of a third-party API used by the project on which the developer is working is available

Requirement U161 SHALL **Status:** to do waiting for server side implementation
CROSSMINER IDE notifies if a new version of a third-party API used by the project on which the developer is working breaks backward compatibility

Requirement U162 MAY **Status:** to do waiting for server side implementation
CROSSMINER IDE is able to offer the use of the newest version of a third-party API utilised in the project

Requirement U163 SHALL **Status:** partially done waiting for server side implementation
CROSSMINER IDE is able to identify and navigate to those places that became suspicious for changing behaviour after the third-party API version used in the project has changed

Requirement U164 SHALL **Status:** partially done waiting for server side implementation
CROSSMINER IDE is able to mark the usage of deprecated third-party APIs in the source code the developer is working on.

Requirement U168 MAY **Status:** to do waiting for server side implementation

CROSSMINER IDE is able to notify the developer about third-party API changes that are in design or development phase

Summary on IDE side

Requirement U169 MAY **Status:** to do waiting for server side implementation
CROSSMINER IDE is able to provide an overview of the impact of a third-party API change on the project the developer is working on

Howto: simply insert the received snippet

Requirement U173 SHALL **Status:** partially done waiting for server side implementation
CROSSMINER IDE assists developers to migrate the current version of a third-party jar to the new version by providing a list of required changes, advices and code templates

Howto: simply insert the received snippet

Requirement U175 SHOULD **Status:** partially done waiting for server side implementation
CROSSMINER IDE assists developers to address a deprecated API by proposing an alternative for obtaining the same behaviours of the code

Requirement D82 SHALL **Status:** to do waiting for server side implementation
The IDE shall provide the user the ability to initiate library version check. So the user is notified if some libraries used in their project have new versions.

Requirement D83 SHALL **Status:** to do waiting for server side implementation
The IDE shall perform library version checks on the libraries used in the current project. The check is performed on project load, and only marks the upgradeable libraries.

Requirement D84 SHALL **Status:** to do waiting for server side implementation
The IDE shall be able to show if a library used in the current project has a new version that satisfies some pre-determined criteria set globally for library upgrades by the user. So the user can see the relevant results of the library upgrade search.

ready, up to date

Requirement D85 SHALL **Status:** partially done
The IDE shall provide an interface where the details of an available library upgrade can be shown. These may include the new version number, release date, number of users, number of bugs, estimated impact of the upgrade, etc.

dy, up to date

Requirement D86 SHOULD **Status:** partially done
The IDE should provide the ability to initiate a library upgrade that marks all those places in the source code that needs rework due to the change of the library version.

Requirement D88 MAY **Status:** partially done
The IDE may perform the steps of a library upgrade autonomously (if the user requested the upgrade).

ready, up to date

Requirement D103 SHALL **Status:** partially done waiting for server side implementation
The CROSSMINER REST API shall provide an interface that accepts a library and filters, and returns a list of versions available for that library and match the filters.

Not IDE!

Requirement D104 SHALL **Status:** waiting for server side implementation
The CROSSMINER REST API shall provide an interface that accepts a library and two versions, and returns the differences between these library versions. Differences include removed, deprecated, changed, new API elements, and API elements with changed behaviour.

Not IDE! Needed for D86, D88

3.2 Source Code Based Recommendations

In this section we elaborate features related to those recommendation which subject entities are present in the source code of the project under development. They usually retrieve some code chunk, which could be annotated to ease further understanding.

Requirement U73 SHALL **Status:** partially done
Able to identify the part of the API that the developer is currently using to provide code snippets in relation with current development activity

Not IDE! Needed for U170-171...

Requirement U170 SHOULD **Status:** partially done waiting for server side implementation
CROSSMINER IDE provides the ability for the developer to ask recommendations for a code chunk previously marked by the CROSSMINER IDE as suspicious

no data for "as suspicious"

Requirement U171 SHOULD **Status:** done
CROSSMINER IDE provides the ability for the developer to ask recommendation for an arbitrary code chunk or code element

Requirement D92 SHOULD **Status:** partially done
The IDE should provide the ability to the user to select a code snippet or a file and ask for code recommendations for it. So the user can check whether there is a better practice to solve her problem.

D92

Code recommendations for arbitrary code is enough. The CROSSMINER API should provide a point where context information (the whole project?) can also be uploaded (Davide said that it already exists). The content and form of it must be discussed.

Requirement D93 SHOULD **Status:** partially done
The IDE should be able to show recommendations assigned with code elements. So the user can see what the knowledge base suggested for a code snippet.

D93

Code recommendations for arbitrary code can be enough, but the CROSSMINER API can also provide a point for code element recommendations. The CROSSMINER API should provide a point where context information (the whole project?) can also be uploaded (Davide said that it already exists). The content and form of it must be discussed.

Not IDE! Needed for U170-171, D91-94

Requirement D107 MAY **Status:** waiting for server side implementation
The CROSSMINER REST API may provide an interface that accepts code snippets and library context, and returns recommendations on how to improve that part of the code.

3.2.1 Retrieving Suggested Code Snippets

Based on the current development context, our plug-in is able to yield a set of source code snippets (code chunks), which could be useful to implement or to understand various features.

done, up to date

Requirement D91 MAY **Status:** done
The IDE may insert a recommendation in the code if the user accepts it and requested it on a code position.

Requirement D94 MAY **Status:** partially done waiting for server side implementation
The IDE may be able to process recommendations and perform code migration autonomously. So the user can point to a recommendation and the IDE replaces the old code to the new one.

"IDE replaces ..." will probably not be implemented, unless the server gives proper recommendations

Not IDE! Needed for U170-171, D91-94

Requirement D106 MAY **Status:** waiting for server side implementation
The CROSSMINER REST API may provide an interface that accepts a list of libraries and a description and returns recommendations about how to implement the described functionality using the given libraries.

3.3 Text Based Recommendations

Finally there are tons of documentation and discussion available for various topics, which could be useful for the developers. Those recommendations which yield some natural language documents (or reference to them) are called *text based recommendations.*

3.3.1 API Usage

Developers could use these recommendation to get more information about the features and their usage of a 3rd part API, for example official pages, documentations, and examples.

Requirement D89 MAY **Status:** to do waiting for server side implementation
The IDE may provide an interface where description of a feature to be implemented and libraries that should be used to implement it can be given. So the user can ask for recommendations how to implement features using specific libraries.

It is a MAY. Davide said that the API is prepared for sending context-data

Requirement D90 MAY **Status:** to do waiting for server side implementation
The IDE may provide an interface to show recommendations on how to implement a feature using some specific libraries.

It is a MAY. Davide said that the API is prepared for sending context-data

3.3.2 Handling API changes

There several forum threads and change reports, which could ease the migration between different versions of the same library.

Requirement U165 SHOULD **Status:** to do waiting for server side implementation
CROSSMINER IDE offers a list of community discussion forums concerning the use of a changed third-party API element

Requirement U166 SHOULD **Status:** to do waiting for server side implementation
CROSSMINER IDE offers code examples for deprecated third-party API usage points

Requirement D87 SHALL **Status:** to do waiting for server side implementation
The IDE shall provide an interface that explains the steps of how to upgrade a library used in the project to a new version.

3.3.3 Inspecting Code Chunk Related Q&A Posts

Also there are some discussions about how to implement a function using a specific features or a set of libraries. The recommendations which present these documents (posts and blog entries) are represent an other subclass of text based recommendations.

Chapter 4

User Activity Monitoring

The main components of this scenario is the recording of developer interactions (events), computing process related metrics and sending them to the CROSSMINER server for further processing. The collected events is stored in a local database. Please note that none of the stored event contains information about the user, so there is no way to identify someone from these data, also all of the events are stored in a local database and only the metrics are sent to the CROSSMINER Server.

4.1 List of Collected Events

Document event Our plug-in using it to detect all keypresses in the editor and store which file is affected. For example during the implementation of a new method for an existing class.

Part event It stores information about life cycle of given parts (part activating, part deactivating, part closing etc). For example when you work on a existing class and select something in the Package Explorer.

Window event It stores information about window life cycle the same way as the Part event handles information about parts. For example when you open an another program.

Eclipse close event Eclipse closes are stored in this even type.

Launch event It stores information about code building and launching.

Resource element event It stores information about the file saving and deletion.

Class path event It stores information about class path changing (add entry to class path or removed entry from class path). For example when you add a library to your clashpath.

Project Structure Build event This is a special event that is in charge for mapping the hierarchy of the project. It creates the graph representation of the project in the database. It is called when we open Eclipse or open a project.

Idle event When there is no new event in the database for a pre-set amount of time we assume that to indicate the user is not using the IDE.

CROSSMINER event These events are invoked by using plug-in. It needs to be calculated for those metrics which measure the plug-in usage. For example when you use CROSSMINER Library Search function.

4.2 Metric calculation

File-Access-Rate Basic Metric Intend to express the Average count of Java source files open and brought to top.

Working-time Basic Metric Used to express the amount of time while the user works on different Java files.

Testing-rate Basic Metric Used to express the amount of test execution by the user. We use the following events and components to calculate this metric.

Gui-usage-rate Basic Metric Used to express the ratio of graphical interface interaction usage by the user.

Modification-rate Basic Metric Used to express the ratio of file modification usage by the user.

Aggregation strategies

To transform the event chain into metric values, we use two similar strategies. Both strategies process subsequent events and compute metric values based on the number or the property values of certain events. The two strategies differ in how the start and end events of the sequence are determined.

The first, so-called *time-based strategy* uses fixed time windows to compute the metrics. In this strategy we split the day into non-overlapping equal-length time periods (called *windows*), and compute the metric values using the events in a single window. Metrics are computed for all windows.

We call the second strategy *milestone-based strategy.* In this case, instead of the time-based windows, we use specific events to split and limit the event chains on which the metric values are calculated.

Aggregation Functions There are several aggregation function to use with either of the previously described strategies. In this section we elaborate the well known statistical function we choose to implement.

Average The arithmetic mean could be calculated with the following formula.

$$\operatorname{avg} X = \frac{1}{|X|} \sum_{x \in X} x$$

Summation The summation could be calculated with the following formula.

$$\operatorname{sum} X = \sum_{x \in X} x$$

Standard deviation The standard deviation could be calculated with the following formula.

$$\operatorname{stdev} X = \sqrt{\frac{\sum_{x \in X} (x_i - \overline{x})^2}{|X| - 1}}$$

Windows As stated earlier the calculation of basic metrics are constrained with various time-windows. In this section we list both the mile-stone and the duration based time window definitions included into the Crossminer plugin.

Duration-based windows Time-based windows are defined with a duration and a count of inspected windows counted from the present. Duration define the window's size and the count describes how many of these window will be analyzed (as shown in Table 4.1). For example a short-term time window works with 24 1-hour windows, in other word the last day. This duration and count values based in our experiences and common practices of the developers.

Name	**Duration (hours)**	**Count**
short-term	1	24
mid-term	24	7
long-term	168	4
overview-term	24	28

Table 4.1: Time-based windows which is used for metric aggregation.

Milestone-based windows The milestone-based windows are calculated from an event and a count. The event describe the event type what we are using for splitting the event chain to get the windows. The count just like before describe how many of these windows will be inspected. As shown in Table 4.2 for example a session window works with Eclipse close events, to split and using 15 of these windows. This event and count values are also from our daily observation.

Name	**Event**	**Count**
session	Eclipse close	15
engagement	Save	15
last-session	Eclipse close	1
last-engagement	Save	1
coding-session	Launch	15
last-coding-session	Launch	1

Table 4.2: Milestone-based windows which is used for metric aggregation

Calculated Metrics Any calculated metric are consists of the following components: a basic-metric and aggregation (which include the strategy and the function). In the following section we list all currently implemented combinations of these. In the following section we will introduce, the concrete calculated metrics what are built from a basic metric, a time window and an aggregation function. The tables for each metrics are shows which metric windows and which aggregation function is uses for calculations.

	average	**stdev**	**sum**
short-term	✓		
mid-term	✓		
long-term	✓		
overview-term	✓	✓	
session			
engagement			
last-session			
last-engagement			
coding-session			✓
last-coding-session			

Table 4.3: Different calculation methods for Crossminer-library-usage metric

Crossminer-library-usage This metric is for analyze the plug-in provided library related features. The different calculation methods to calculate this metric are shown in Table 4.3.

	average	**stdev**	**sum**
short-term	✓		
mid-term	✓		
long-term	✓		
overview-term	✓	✓	
session			
engagement			
last-session			
last-engagement			
coding-session			✓
last-coding-session			

Table 4.4: Different calculation methods for Crossminer-search-usage metric

Crossminer-search-usage This metric is for analyze the plug-in provided search function. The different calculation methods to calculate this metric are shown in Table 4.4.

	average	**stdev**	**sum**
short-term	✓		
mid-term	✓		
long-term	✓		
overview-term	✓	✓	
session			
engagement			
last-session			
last-engagement			
coding-session			✓
last-coding-session			

Table 4.5: Different calculation methods for Crossminer-search-success metric

Crossminer-search-success This metric is for analyze the successful plug-in provided library search function. The different calculation methods to calculate this metric are shown in Table 4.5.

	average	stdev	sum
short-term	✓		
mid-term	✓		
long-term	✓		
overview-term	✓	✓	
session			
engagement			
last-session			
last-engagement			
coding-session			
last-coding-session			

Table 4.6: Different calculation methods for Modification-rate metric

Modification-rate Used to express the rate of file modification by the user. The different calculation methods to calculate this metric are shown in Table 4.6.

	average	stdev	sum
short-term	✓		
mid-term	✓		
long-term	✓		
overview-term	✓	✓	
session			
engagement			
last-session			
last-engagement			
coding-session			
last-coding-session			

Table 4.7: Different calculation methods for Gui-usage-rate metric

Gui-usage-rate Used to express the rate of graphical interface interaction usage by the user. The different calculation methods to calculate this metric are shown in Table 4.7.

	average	**stdev**	**sum**
short-term			
mid-term			
long-term			
overview-term			
session			
engagement	✓	✓	
last-session			
last-engagement	✓		
coding-session			
last-coding-session			

Table 4.8: Different calculation methods for Trust metric

Trust This metric expresses the user's trust towards the IDE. It is calculated by measuring the rate of file modification between saves, how much changes are kept unsaved. The different calculation methods to calculate this metric are shown in Table 4.8.

	average	**stdev**	**sum**
short-term			
mid-term			
long-term			
overview-term			
session			
engagement			
last-session			
last-engagement			
coding-session	✓	✓	
last-coding-session	✓		

Table 4.9: Different calculation methods for Confidence metric.

Confidence This metric covers a similar concept like trust, but it expresses the self-confidence of the developers. It captures the amount of file modification without execution of the system under development. The different calculation methods to calculate this metric are shown in Table 4.9.

	average	**stdev**	**sum**
short-term	✓		
mid-term	✓		
long-term	✓		
overview-term	✓	✓	
session			
engagement			
last-session			
last-engagement			
coding-session	✓		
last-coding-session			

Table 4.10: Different calculation methods for Testing-rate metric

Testing-rate It is used to express the amount of test execution by the user. The different calculation methods to calculate this metric are shown in Table 4.10.

	average	**stdev**	**sum**
short-term			✓
mid-term			✓
long-term			✓
overview-term			✓
session			
engagement			
last-session			
last-engagement			
coding-session			✓
last-coding-session			

Table 4.11: Different calculation methods for Working-time metric

Working-time We use it to express the amount of time while the user works on different Java files. The different calculation methods to calculate this metric are shown in Table 4.11.

File-access-rate Intend to express the Average count of Java source files open and brought to top. The different calculation methods to calculate this metric are shown in Table 4.12.

	average	stdev	sum
short-term	✓		
mid-term	✓		
long-term	✓		
overview-term	✓	✓	
session			
engagement			
last-session			
last-engagement			
coding-session	✓		
last-coding-session			

Table 4.12: Different calculation methods for File-access-rate metric.

4.3 Using monitoring system

The user monitoring system uses Github URL to identify different projects. If you want to use this feature you have to set a project Github URL. You can set this in the project preferences page under the crossminer panel. As you can see in Figure 4.1. Only those project will be calculated which have Github identifier. If you set the URL the events which are related to the project are stored in the database.

A metrikák megtekintését a Crossminer/ Metric interface menüpont alatt elérni, itt json formában fognak megjelenni a metrikák, ha egy szekció üres, akkor nincs elég mérföldkő event a megfelelő számításhoz.

You can disable those events or metric which is not necessary for you in the Preferences page under crossminer panel as Figure 4.2 shows.

4.4 List of Recorded Metrics

Requirement U176 SHALL **Status:** to do
There is a strict and public strategy regarding privacy and data

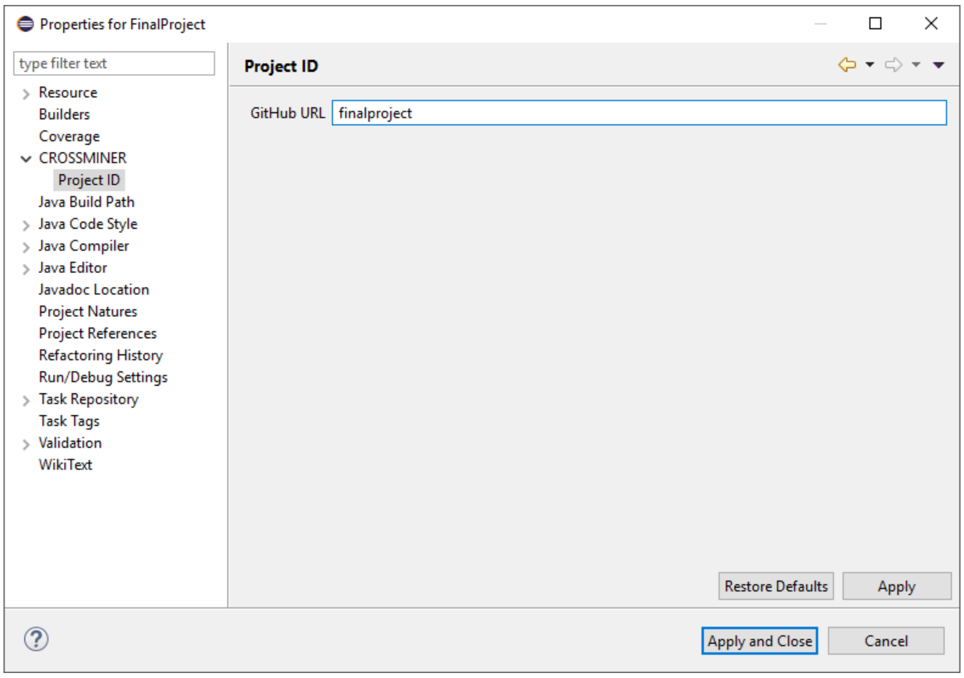
Add currently cal-culated metrics [illegible] precisse def (user computable). clearify it with any [illegible]er of formula if needed

Requirement U177 SHALL **Status:** to do waiting for server side implementation
Users cannot be identified from monitoring data

Not specific to IDE

Requirement U178 SHOULD **Status:** partially done
Monitoring is able to identify testing activities

[illegible]pecific to IDE



GitHub URL: finalproject

Figure 4.1: Project preferences page

Requirement U179 SHOULD **Status:** done
Monitoring is able to identify development activities

This needs to be clarified

Requirement U180 SHOULD **Status:** ???
Monitoring is able to identify errors in IDE

Requirement U181 SHOULD **Status:** partially done
Monitoring records the time the developer works on a given file/code element/line

Requirement U218 SHALL **Status:** partially done
All metrics are documented, motivated, possibly with references

Details needs to be defined. Search expressions come only from searches in the plug-in.

Requirement D96 SHALL **Status:** to do
The IDE shall recognize, compute, and extract the following user activities, metrics, or information: frequent search expression.

Search patterns come only from searches in the plug-in.

Requirement D97 SHOULD **Status:** partially done
The IDE should recognize, compute, and extract the following user activities, metrics, or information: project or file open, manipulation, close, program execution, test execution, user search patterns, working time on a file.

Requirement D108 SHALL **Status:** waiting for server side implementation
The CROSSMINER REST API shall provide an interface that accepts developer activity data. So the CROSSMINER can build this information in the knowledge base.

Not IDE! Needed for U176-181, D96-98

4.5 Retrieving Process Metrics via crossminer Web-based Dashboard

You are able to inspect any computed process metrics for your project by using the relevant features of CROSSMINER Web-based Dashboard.

4.6 Plug-in Side Debugging Features

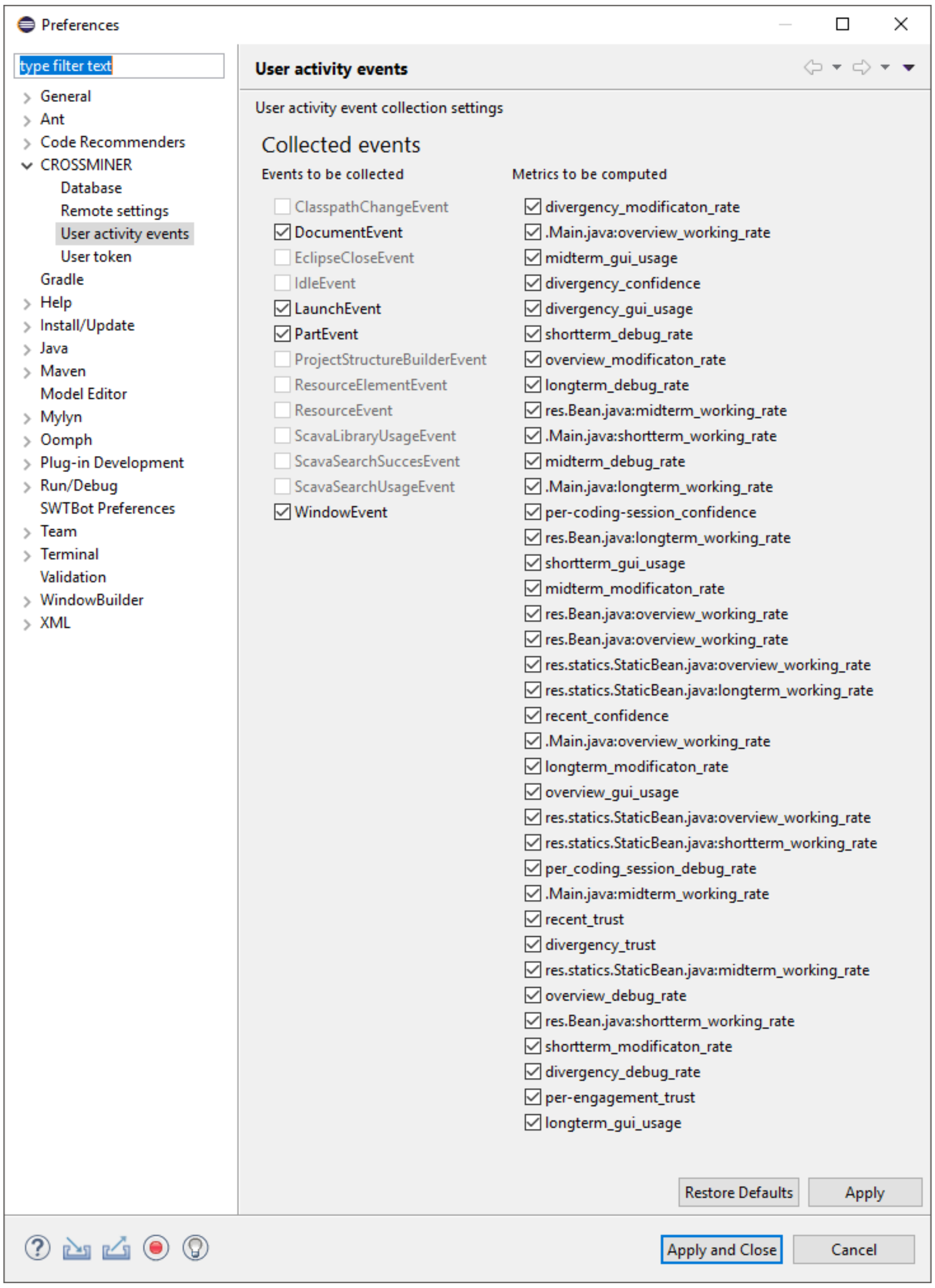
In the case of unexpected errors during the user activity monitoring, you are able to check the value of the process metrics and some relevant meta-data about the underlying database on the client side. To do this please activate some of the plug-in side debugging features. Please note that these are only available in the debug version of the plug-in.

4.7 Server Side Debugging Features

There are ways to access the raw data, stored at the server side. To do this you have to execute the following REST API calls. You could use your preferred REST client, but for illustration purposes we will use Postman[1]

Requirement D98 SHALL **Status:** to do
The IDE shall be able to send developer activity data (as controlled by the user settings) to the CROSSMINER server.

[1] `https://www.getpostman.com/`



User activity events

User activity event collection settings

Collected events

Events to be collected	Metrics to be computed
☐ ClasspathChangeEvent	☑ divergency_modificaton_rate
☑ DocumentEvent	☑ .Main.java:overview_working_rate
☐ EclipseCloseEvent	☑ midterm_gui_usage
☐ IdleEvent	☑ divergency_confidence
☑ LaunchEvent	☑ divergency_gui_usage
☑ PartEvent	☑ shortterm_debug_rate
☐ ProjectStructureBuilderEvent	☑ overview_modificaton_rate
☐ ResourceElementEvent	☑ longterm_debug_rate
☐ ResourceEvent	☑ res.Bean.java:midterm_working_rate
☐ ScavaLibraryUsageEvent	☑ .Main.java:shortterm_working_rate
☐ ScavaSearchSuccesEvent	☑ midterm_debug_rate
☐ ScavaSearchUsageEvent	☑ .Main.java:longterm_working_rate
☑ WindowEvent	☑ per-coding-session_confidence
	☑ res.Bean.java:longterm_working_rate
	☑ shortterm_gui_usage
	☑ midterm_modificaton_rate
	☑ res.Bean.java:overview_working_rate
	☑ res.Bean.java:overview_working_rate
	☑ res.statics.StaticBean.java:overview_working_rate
	☑ res.statics.StaticBean.java:longterm_working_rate
	☑ recent_confidence
	☑ .Main.java:overview_working_rate
	☑ longterm_modificaton_rate
	☑ overview_gui_usage
	☑ res.statics.StaticBean.java:overview_working_rate
	☑ res.statics.StaticBean.java:shortterm_working_rate
	☑ per_coding_session_debug_rate
	☑ .Main.java:midterm_working_rate
	☑ recent_trust
	☑ divergency_trust
	☑ res.statics.StaticBean.java:midterm_working_rate
	☑ overview_debug_rate
	☑ res.Bean.java:shortterm_working_rate
	☑ shortterm_modificaton_rate
	☑ divergency_debug_rate
	☑ per-engagement_trust
	☑ longterm_gui_usage

Figure 4.2: Disable metrics and events

Chapter 5

Settings and Customization

Requirement U155 SHALL **Status:** to do
Eclipse users can easily deactivate the analysis

Not IDE!

5.1 Integration Related Settings

Requirement D74 SHALL **Status:** partially done
The IDE shall provide a settings interface to the user, where the different properties of the CROSSMINER IDE plugin (like server address and port, global settings for recommendation queries, etc.) can be checked and changed. So the user can configure the plugin.

5.2 Process Metric Related Settings

Requirement U182 SHALL **Status:** to do
Monitoring of developer activity can be disabled by the developer

Requirement U183 SHALL **Status:** to do
Types of data collected from monitoring are transparent to the developer

Requirement D95 SHALL **Status:** to do
The IDE shall provide full control over the collected and transferred user activity monitoring data. So the user can allow or deny the collection and/or anonymised transfer of the activity data collected from their session.