



Krakatau Essential Project Manager (KEPM)

*ADA, Assembly, ASP, C#, C/C++, CSS, Fortran, IDL, HTML,
Java, JavaScript, JSP, MMP, Perl, PHP, PL/SQL, PowerBuilder,
Python, Ruby, ShellScript, Textfiles, UCode, VB6 / VB.NET /
VBScript, VHDL, Windows Batch and XML*

User Guide
2.3.0.0

Contents

1	Document	3
1.1	Purpose	3
1.2	Readership.....	3
1.3	Version History	3
2	Installation	6
2.1	Installing KEPM	6
2.2	Installing MySQL (optional)	6
2.3	Installing KEPM on Microsoft Windows Vista/7/8	6
2.4	Installing a License	6
2.5	EPM.XML Configuration file.....	7
3	Using KEPM	8
3.1	Startup	8
3.2	Creating a Project.....	9
3.2.1	Excluding Directories from the analysis	10
3.3	Opening an Existing Project file	11
3.4	Setting Old and New	11
3.5	Setting Preferences.....	12
3.6	Analysis	13
3.7	Results Browser.....	14
3.7.1	Filtering using a Metric Set.....	14
3.8	Metric Sets.....	15
3.9	Using KEPM with your CMVC System	16
4	FAQ	17
4.1	How does KEPM know which parser to use?.....	17
4.2	What does line_type in CSV reports mean?	19
4.3	Why do I get 'You do not have a valid license'?	19
4.4	What does the error stating the MySQL cannot start mean?	19
4.5	What do the Metric IDs and Codes mean?	20

1 Document

1.1 Purpose

This document is an Installation and User Guide for the Krakatau Essential Project Manager (KEPM) graphical source code metrics tool. It describes how to use KEPM to generate metrics results. It does not describe in detail how to use the command-line backend – Essential Project Manager (EPM) – this detail is covered in a separate EPM User Guide.

1.2 Readership

This User Guide is intended for end-users, system administrators. Management and non-technical users should refer to our website – <http://www.powersoftware.com/kepm/>

1.3 Version History

2.3.0.0	16-Sep-2013	11148 : Corrected bug in Ada CHG_LLOC
2.2.0.0	10-Mar-2012	11049 : Switch to new and improved License Manager
2.1.0.0	25-Jun-2011	10967 : Ability to support UPPERCASE extensions (Intel) 10963 : Add UCode language parser for Intel 10964 : Add MMP language parser for Intel 10968 : Ensure that when KEPM exits, any EPM processes are killed 10970 : Put the UG in the KEPM 'Help' menu
2.0.0.0	8-Oct-2010	10648 : Implement PowerHash for Operand Detection 10527 : Correct typo in default EPM.XML
1.16.0.0	16-Mar-2010	10581 : Create a local user epm.xml and use it to save changes 10597 : Add Popup Tips to KEPM 10599 : Change all spelling to en-US throughout software and documentation 10606 : Create Example project (Source file and resultant reports) for KEPM web page
1.15.1.0	05-Mar-2010	10558 : Create database Results Browser in main Krakatau window 10574 : Create a Diagnostics menu to Install/Remove MySQL service, and Start/Stop the Service 10580 : Ensure last column on Results Browser is auto-filled so that the user isn't tempted to adjust 10583 : Results Browser - Map Status values to more user friendly values and colour rows appropriately
1.14.0.0	17-Feb-2010	10555 : KEPM seems to only operate if installed in C:\Program Files 10563 : Add FLEXIm to source control 10565 : Windows 7 - Remove dependence on LOCAL_MACHINE\SOFTWARE regkey
1.13.0.0	12-Dec-2009	10508 : Added PowerBuilder (PB) Language to EPM.
1.12.4.0	17-Nov-2009	10502 : Added Excluded Directories, such that files in these directories are not parsed.
1.12.3.0	27-Oct-2009	10496 : Ensure integrity of build (following missing files in 1.12.2.0).
1.12.2.0	15-Sep-2009	10479 : Add PLOC (Preprocessor LOC) for Preprocessor Directives to C/C++ and Assembly

		10483 : Add logging to EPM 10484 : Add logging to KEPM 10488 : File extensions that do not exist in EPM.XML are excluded
1.12.0.0	22-Aug-2009	10450 : Added CSS Stylesheet (SS) Language to EPM 10452 : Added Ruby (RB) Language to EPM 10455 : Added Windows Batch File (WB) Language to EPM 10456 : Corrected issue with Halstead Bug Prediction (B) rounding to 0 or 1. 10461 : Added Check/Uncheck All to New Project Wizard
1.11.0.0	27-Jul-2009	10454 : Add Text files (TX) Language to EPM 10453 : Add Shell Script (SH) Language to EPM 10457 : Investigate Intel Issue: EPM crash parsing 'MKL sources' 10451 : Add Fortran (FT) Language to EPM
1.10.3.1	18-Jun-2009	10447 : Enabled installation on any drive other than C:.
1.10.3.0	12-May-2009	10445 : Ensure commas in filenames do not disrupt CSV reports.
1.10.2.0	05-May-2009	10441 : Ensure free text within HTML is counted as SLOC.
1.10.1.0	30-Apr-2009	10437 : Allow use of empty file extension using space (" ") and exclude directories in filelist
1.10.000	18-Apr-2009	10433 : Incorporate latest language additions to EPM: 10400 : Added JavaScript Language (JT) 10401 : Added HTML Language (HT) 10402 : Added Assembler Language (AY) 10403 : Added Python Language (PY) 10415 : Perl parser optimisation 10416 : C# parser optimisation 10418 : XML parser optimisation 10420 : Ada parser optimisation 10421 : ASP parser optimisation 10422 : C/C++ parser optimisation 10424 : Java parser optimisation 10426 : PHP parser optimisation 10428 : VB parser optimisation 10430 : Add Churn metrics (CRN_SLOC, CRN_LLOC & CRN_FILE)
1.09.000	30-May-2008	366 : Bundle EPM 1.16.005.
1.08.004	26-Apr-2008	360 : Build issues caused by compilation of EPM under VS2008 (upgraded from VC++6).
1.08.003	24-Apr-2008	359 : LLOC whitespace causing erroneous Diff values 355 : LLOC mismatch – C++-Style comments within C-style comments 356 : DEL_LLOC not being output to CSV file 357 : CHG_SLOC not being output to reports when using Metric Sets.
1.08.002	04-Jan-2008	338 : Added MetricsDefinitions.pdf to Help menu
1.08.001	14-Dec-2007	
1.08.000	11-Dec-2007	324 : Added JSP Parsing 325 : Added XML Parsing

		327 : Ensure MySQL Databasename contains only valid characters.
1.07.004	28-Nov-2007	323 : Resolved issues with missing PHP metrics.
1.07.003	01-Nov-2007	321 : Ensure Logical Lines are calculated corrected in Ada, ASP & C/C++/Java.
1.07.002	26-Oct-2007	319 : Remove duplicate files in projects before analysing
1.07.001	28-Jul-2007	317 : Changed default VHDL extension to *.vdh
1.07.000	26-Jul-2007	316 : Added VHDL language support.
1.06.000	16-Jul-2007	314 : Added IDL language support.
1.05.000	10-Nov-2006	301 : Added PHP language support.
1.04.000	02-Nov-2006	117 : Added ASP language support.
1.03.001	22-Jul-2006	291 : Added tooltips to Metric Sets buttons and Reporting options.
1.03.000	18-Jul-2006	272 : Added Changed Logical Lines of Code to EPM.
1.02.009	12-Jul-2006	282 : Cancel button frozen on Metric Sets.
1.02.008	08-Jul-2006	258 : Completion of Metric Sets in KEPM.
1.02.007	15-Jun-2006	258 : Development of Metric Sets in KEPM.
1.02.006	14-Jun-2006	268 : Better error handling during project creation.
1.02.002	02-Jun-2006	252 : Released including EPM 1.10.003.
1.02.001	10-Apr-2006	230 : Ensure Ada parsing is case-insensitive
1.02.000	26-Mar-2006	213 : Retrieve EPM Analysis options from project.txt.epm.cmd file
1.01.004	18-Mar-2006	210 : Added Deselect to right-click menu
1.02.003	06-Jun-2006	255 : Released including EPM 1.10.003.
1.02.005	08-Jun-2006	243 : Correctly remembers the file types chosen for the project when it was created.
1.01.003	15-Mar-2006	202 : Correct summed/calculated Halstead project metrics
1.01.002	13-Mar-2006	199 : Ensure Ada files are compared correctly
1.01.001	14-Feb-2006	185 : Saved Project List request
1.00.006	24-Jan-2006	179 : Readonly Project Filename box, limit Project Title to 30 non-space characters

2 Installation

2.1 Installing KEPM

Unzip the downloaded file and double-click on setup.exe. Follow the installation prompts, clicking Next through the wizard as normal.

For Windows 7 and Windows 8, we recommend "Installing for all users".

If you accept the defaults, KEPM will be installed in:

C:\Program Files\Power Software\Krakatau EPM

2.2 Installing MySQL (optional)

We recommend using the MySQL server that comes bundled with KEPM.

However, if you wish to use an existing MySQL server in the organisation, you can do so using the -s (and -u/-p if required) parameter.

Otherwise, a local MySQL database will be started implicitly as KEPM runs.

2.3 Installing KEPM on Microsoft Windows Vista/7/8

Be sure to read the separate Quick Start Guide which gives some good recommendations for installing KEPM on Vista, Windows 7 and Windows 8. For a foolproof installation:

1. Run the setup as Administrator (by right-clicking and choosing **Run/Install as Administrator**)
2. After installing, right-click on Krakatau EPM and **Run as Administrator**, then chose Diagnostics > MySQL > Install Service

2.4 Installing a License

You must obtain either a time-locked (for testing) or node-locked/floating (following purchase) license from Power Software. The recommended way to install the license is to place it where you installed Essential Metrics (see default directory above) and then simply launch Krakatau EPM from Start – Programs – Power Software – Krakatau EPM. This will prompt for you to Browse to the license.dat file.

If you do not have a valid license, you will see the following dialog on startup:

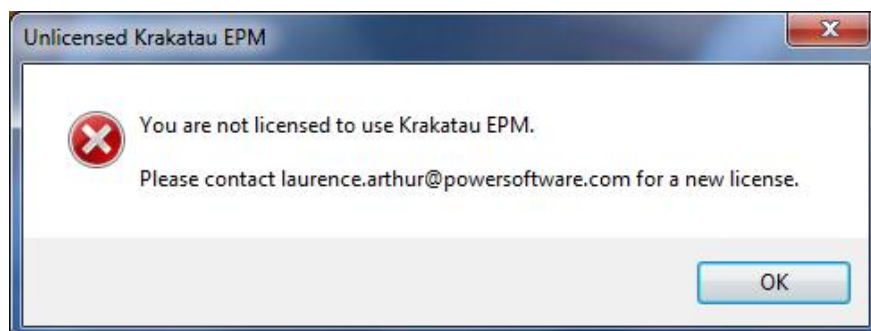


Figure 1: Unlicensed error dialog

2.5 EPM.XML Configuration file

KEPM ships with a default EPM.XML in the Program Files directory.

The first time you run KEPM, it will copy this file to your User Home Directory if one does not already exist there.

Table 1: User Home directories for different Windows versions

Windows XP	C:\Documents and settings\Fred
Windows Vista/7/8	C:\Users\Fred

From that point on, KEPM will use your User Home EPM.XML to get/set configuration changes – the default remains untouched in the Program Files directory.

If you have a standard EPM.XML used within your organization, copy this file to your User Home directory at any point after installation and KEPM will use this file.

3 Using KEPM

3.1 Startup

When you launch KEPM, you will see the window shown in **Figure 2**.

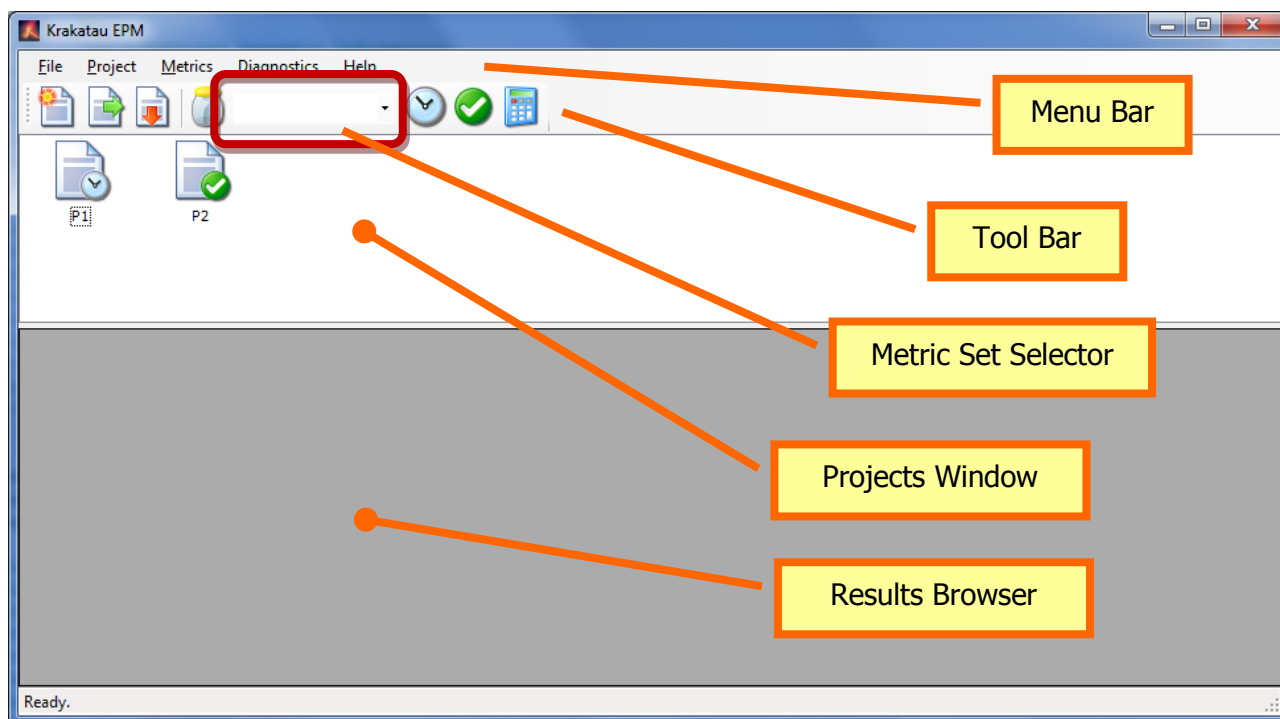


Figure 2: KEPM main window

As with other applications, there is more than one way to carry out an operation. We will describe operations using the application Tool Bar:



New Project wizard – allows you to create new project files containing a Project Title, Snapshot date, Base directory and actual source files in the project.



Open an existing Project file.



Remove a Project from the Projects windows.



Open the Metric Sets dialog and add, edit and delete Metric Sets.



Set the currently selected Project as the Old Project.



Set the currently selected Project as the New Project.



Analyze. If Old and New Projects are selected, perform a Project comparison, otherwise a Single Project analysis.

3.2 Creating a Project

To create a new Project, click the New Project Wizard toolbar button.

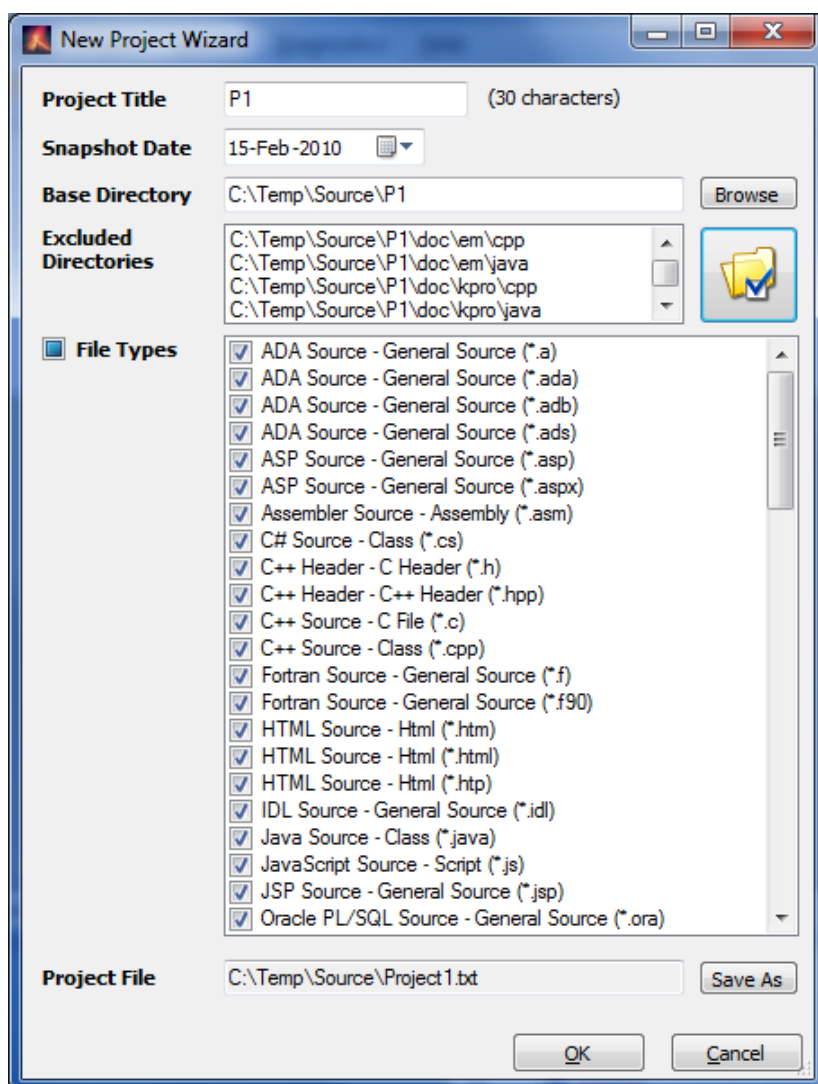


Figure 3: New Project Wizard

Enter **Project Title** (a name for the Project, representing the software and possibly a version number)

Choose the **Snapshot Date** – the date the source was extracted or labeled.

Browse to the **Base Directory** for the source code – the top-level directory where the source may be found.

You may exclude certain directories if that is appropriate – see **3.2.1**.

If required, select the file types you require in the Project. You may use the checkbox beside **File Types** to Check/Uncheck All.

Finally, click **Save As** to save the Project file.

When you click OK, the Base directory will be examined (and all subdirectories below it) for the types of files you have selected. These files, along with the Project Title and Snapshot date are then stored in the KEPM Project file you chose.

Note: as well as the Project file (in the example above 'mn105a.txt'), a Windows command file with the extension .cmd will also be created (e.g., 'mn105a.txt.cmd'). Experienced users can use these sample command files to create their own Project files. They may be deleted, if not required. Each time you create a New Project, KEPM creates a command file for it.

Once the Project file has been created it will appear in the Project window.

3.2.1 Excluding Directories from the analysis

You may wish to exclude certain directories from the analysis, to prevent configuration or other undesirable code from being included in the metrics results.

To do this, click the Exclude Directories  button and the following dialog will appear:

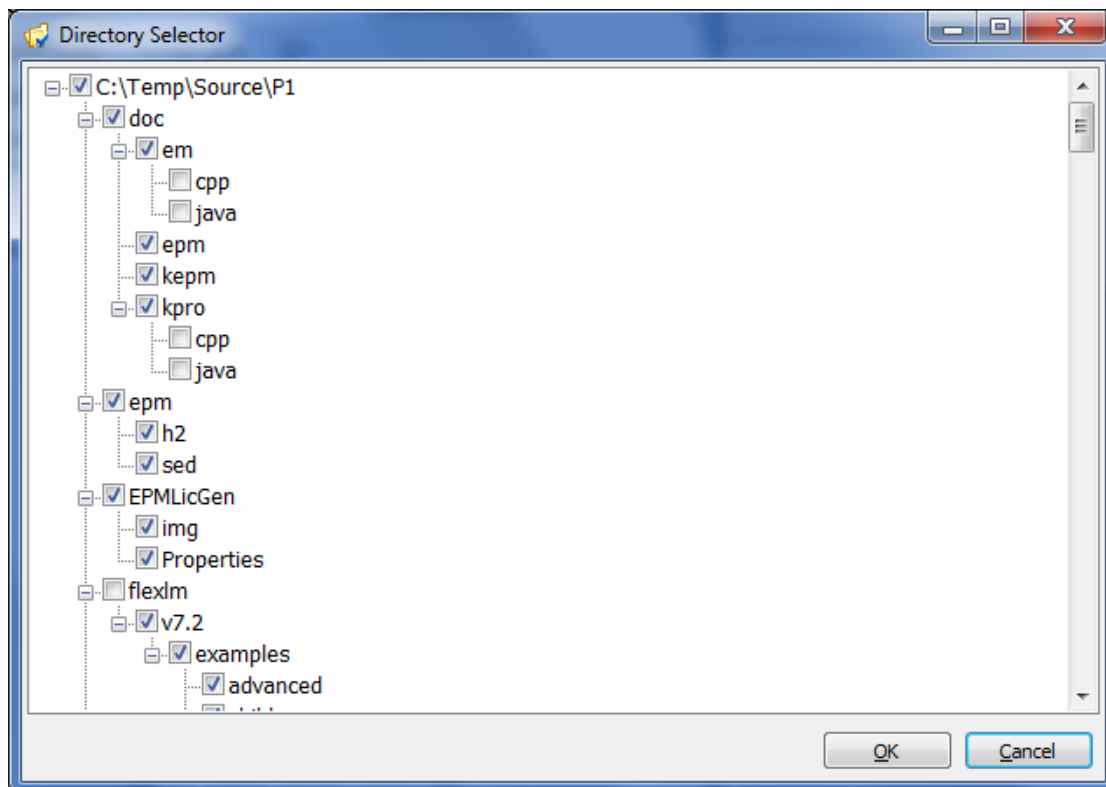


Figure 4: Directory Selector

All directories are expanded and selected by default. To exclude a directory, simply uncheck. Note: excluding a parent directory does not mean the child directories will be excluded, only the files in the parent.

Click OK when you have finished and you will see the Excluded Directories appear in the listbox for your information.

3.3 Opening an Existing Project file

If you have previously created a Project file, you may open it in KEPM using the Open Project toolbar button. This loads the file into the Projects Window.

3.4 Setting Old and New

When you have a Project open, you can click on it then choose either Old or New toolbar buttons:

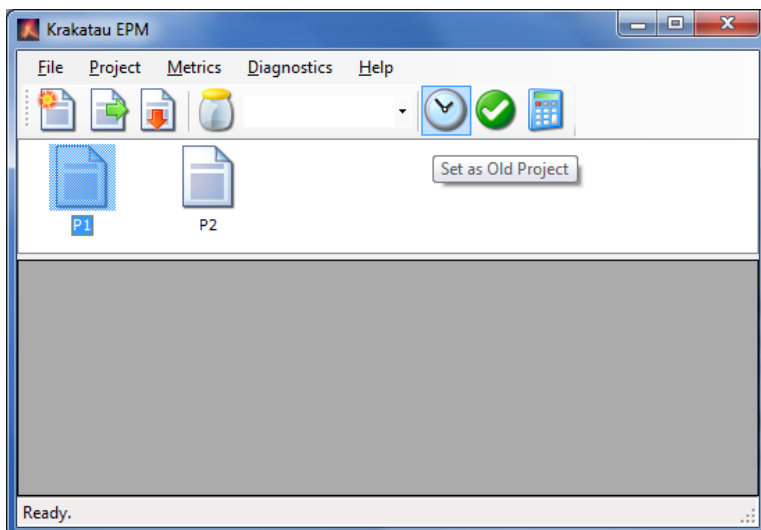


Figure 5: Setting Old Project

The **P1** Project has been selected. By then clicking the Old button, it will get a clock icon.

If we then click the **P2** Project and click the New button, it is highlighted in green, as below.

You may also right-click on a Project and choose Set as Old or Set as New from the popup menu.

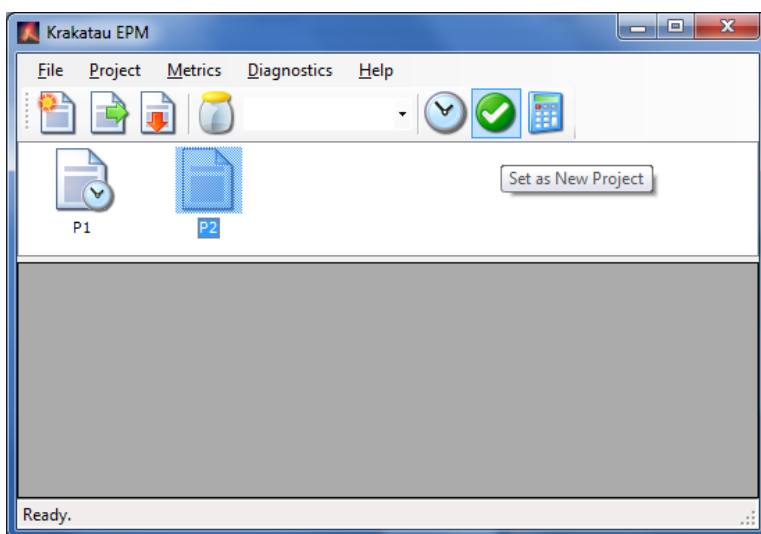


Figure 6: Setting New Project

We are telling KEPM that **P1** is the Old Snapshot of the source, and that **P2** is the New Snapshot.

When comparing these projects, **P2** will be examined with reference to **P1**.

For instance, a file that existed in **P1** but no longer exists in **P2** is considered to have been deleted. Source Lines that exist in a file in the new Project but not in the old are New Source Lines.

If you only set a New Project, KEPM will perform a Single Project analysis, with no changed information.

3.5 Setting Preferences

KEPM preferences allow you to configure the default MySQL connection properties. Only change these settings if you have explicitly installed MySQL separately, or you wish to access a specific MySQL Server.

To set Preferences, select **Project – Preferences...**

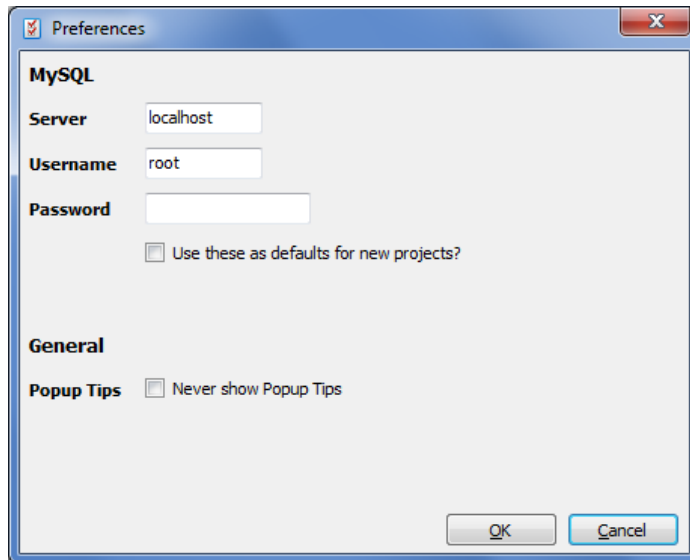


Figure 7: Preferences

To ensure these settings are set as the defaults for new projects, check the appropriate box.

KEPM will occasionally show you Popup Tips as you are working. The dialog allows you to opt out of that particular tip again, and all tips. If you wish to re-enable tips, uncheck the "Never show Popup Tips" checkbox.

Click OK to save.

3.6 Analysis

To perform an analysis of your selected Project(s), click the Analyze:

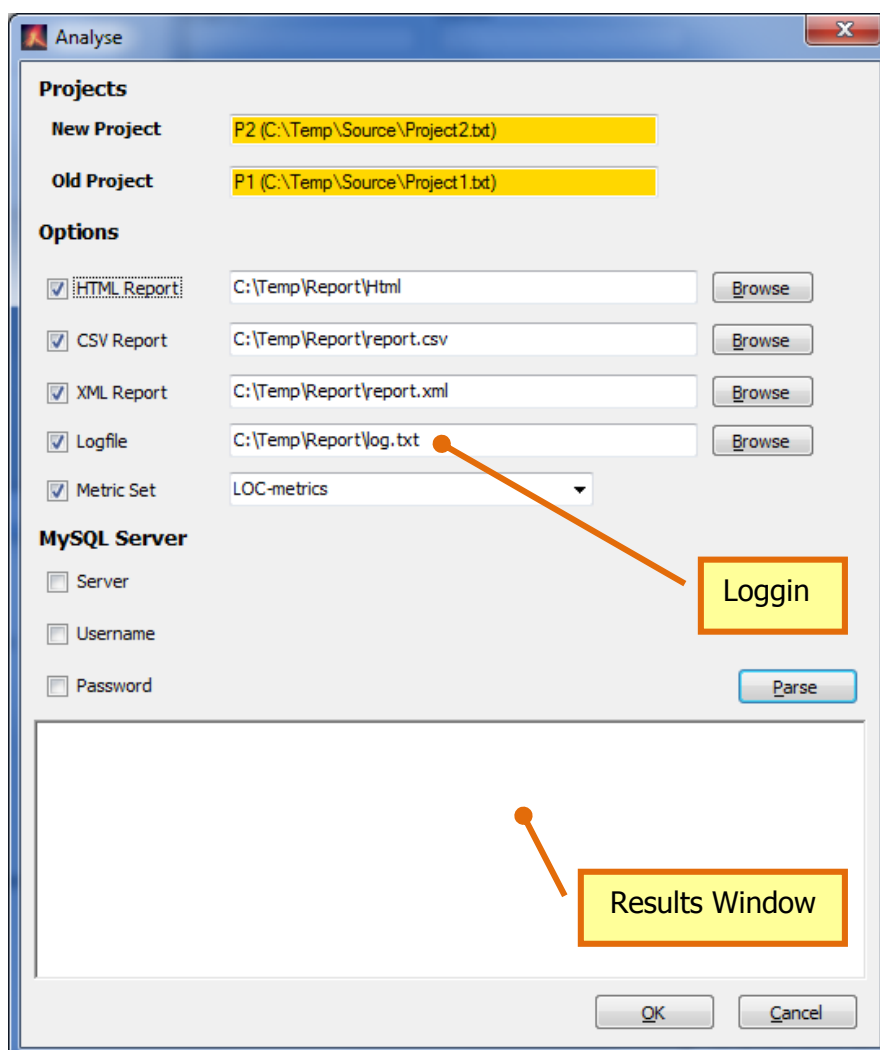


Figure 8: Analysis dialog

The dialog tells you what the New and Old Projects are.

You can then select the reporting options you require – ticking a checkbox to force an option, and specifying files/folders in the textbox that appears. Use the Browse button if you wish.

Choose a Metric Set if you wish to filter the metrics that are output on the report.

If you have a MySQL server on your network that you wish to use, specify the hostname (Server) and user/password details as required.

When ready, click the Parse button.

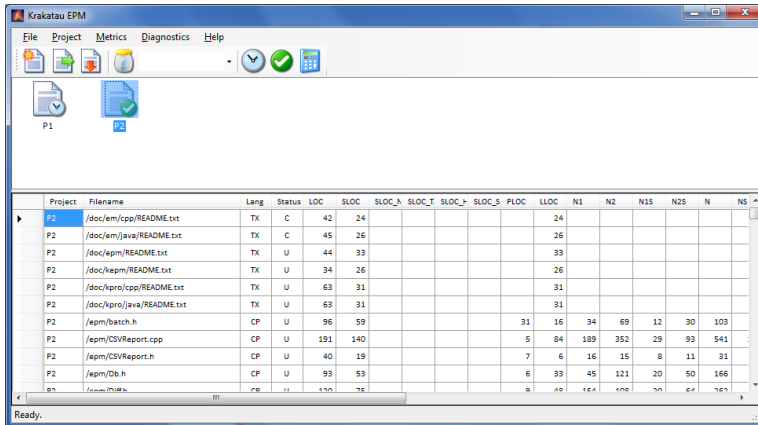
The **Parse** button creates another Windows command file (e.g., called 'mn105a.txt.epm.cmd'). This is then executed and the results are shown in the Results Window. As the Projects are parsed you will see the analysis and differences, and finally the reports you have selected.

Each time you press **OK** or **Parse**, the .epm.cmd file is recreated, and this file is also used to retrieve your Analysis options when you reopen the project. The checkboxes you have ticked and the values entered, will be retrieved from the .epm.cmd file and populated in this dialog the next time you Analyze, in the same KEPM session or at a later date.

If you select an HTML report, it will be launched in your default browser once parsing is complete.

3.7 Results Browser

To use the Results Browser, right-click on your project and select Refresh Results, see **Figure 9**. If the project has been parsed (using the Analysis dialog) then you will see the results in the Browser.



Project	Filename	Lang	Status	LOC	SLOC	SLOC_A	SLOC_T	SLOC_I	PLOC	LLOC	N1	N2	N15	N25	N	N5
P1	/doc/em/cpp/README.txt	TX	C	42	24					24						
P2	/doc/em/java/README.txt	TX	C	45	26					26						
P2	/doc/epm/README.txt	TX	U	44	33					33						
P2	/doc/kepm/README.txt	TX	U	34	26					26						
P2	/doc/kpro/cpp/README.txt	TX	U	63	31					31						
P2	/doc/kpro/java/README.txt	TX	U	63	31					31						
P2	/epm/batch.h	CP	U	96	59					31	16	34	69	12	30	103
P2	/epm/CSVReport.cpp	CP	U	191	140					5	84	189	352	29	93	541
P2	/epm/CSVReport.h	CP	U	40	19					7	6	16	15	8	11	31
P2	/epm/Db.h	CP	U	93	53					6	33	45	121	20	50	166
B1	/doc/README	CP	U	11	10					8	10	14	100	10	64	161

Figure 9: Results Browser populated

3.7.1 Filtering using a Metric Set

If you only wish to see a subset of metrics in the results, you should create a Metric Set. Refer to section **3.8** for help creating a Metric Set. Once you have created a Metric Set, you may select it from the Metric Set selector on the toolbar, and push F5 or right-click on your project to refresh the Results Browser with only the metrics you have defined in your Metric set.

3.8 Metric Sets

If you wish to limit the metrics that are output in your reports, you can define a Metric Set with only those metrics you wish to see. For example, your Project Manager is only interested in LOC, SLOC, the changed SLOC and the new changed LLOC.

From the main application, click the Metric Sets jar icon, or choose Metrics > Sets:

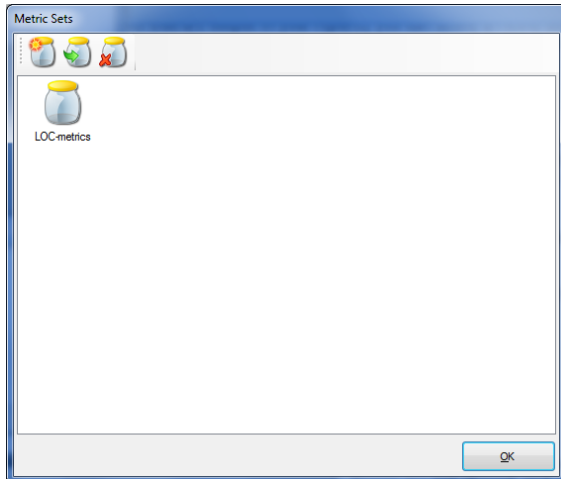


Figure 10: Metric Sets dialog

In this example, we already have an existing set called "LOC-metrics". This set, and any we create, are stored in the epm.xml configuration file.

Let's create a new one for our particular metric interests.

Click the New icon (the first one) on the toolbar.

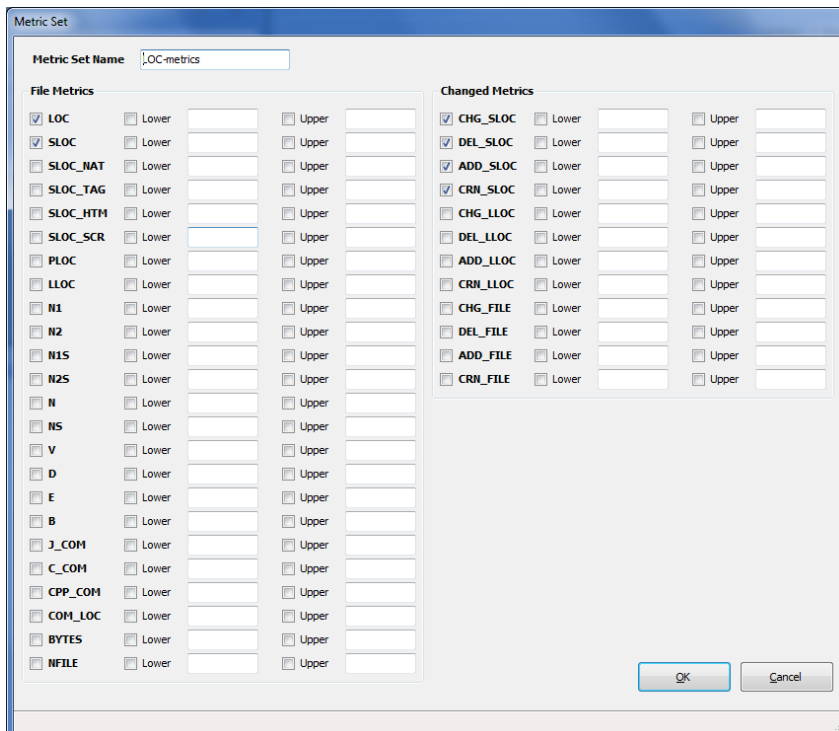


Figure 11: Metric Set definition

Enter a name for the metric set. Spaces are not allowed, and will be removed.

Check the box beside each metric code you wish to include in the set. The lower and upper bounds settings can also be set although they are not yet used by any EPM reports.

Click OK.

You can specify a metric set when you Analyze (see previous section).

3.9 Using KEPM with your CMVC System

KEPM does not restrict users to any CMVC (Configuration Management/Version Control) system, nor does it directly interface with any specific CMVC system. However, many of our customers are successfully using KEPM in conjunction with several popular CMVC systems, including:

- IBM Rational ClearCase
- Perforce
- Microsoft Team Foundation Server
- CVS
- Subversion

KEPM requires direct access to copies of your actual source files, not CMVC binaries such as ClearCase VOBs.

Typically this involves exporting a copy of your source to a location on your machine. You then create a new project in KEPM (see **3.2**) and point it at your exported source and proceed to Analyze (see section **3.6**).

4 FAQ

4.1 How does KEPM know which parser to use?

KEPM is supplied with a default XML Configuration file that instructs the tool to apply different languages parsers to the files based on the following file extensions:

Language	Extensions	Parser Code
ADA	.a .ada .adb .ads	AD
ASP	.asp .aspx	AS
Assembly	.asm	AY
C++	.cpp .c .hpp .h	CP
C#	.cs	CS
CSS	.css	SS
Fortran	.f .f90	FT
IDL	.idl	ID
HTML	.htm .html .htm	HT
Java	.java	JV
JavaScript	.js	JT
JSP	.jsp	JS
Modular Maths Processer	.mmp	MP
PHP	.php	PH
Perl	.pl	PL
PL/SQL	.sql .ora	S1
PowerBuilder	.srd .srf .srs .sru .srw	PB
Python	.py	PY
Ruby	.rb	RB
Shell Script	.ash .bash .bsh .csh .sh .tcsh .tsh .zsh	SH
Textfile	.cvs .install .readme .tsv .txt	TX
UCode	.uc	UC
VB.NET	.vb	VB
VB6	.frm .bas .cls	VB
VBScript	.vbs	VB
VHDL	.vhd	VH
Windows Batch	.bat .cmd	WB
XML	.xml .xsd .xsl .xslt .wsml	XM

You cannot simply add a language of your own. EPM only understands the **Parser Codes** listed above. Should you need a new language not listed here, please contact us to discuss.

If you need to modify this configuration, you may edit the EPM.XML configuration file supplied with the tool, **but please take a backup before you start** and if you experience any errors and you report these, please **include your EPM.XML file** and state what you were trying to achieve.

The default file looks like:

<pre><?xml version="1.0" encoding="UTF-8"?> <epm> <lang name="C++" parser="CP"> <filetype name="Source"> <ext name="Class" value="cpp" /> <ext name="C File" value="c" /> </filetype> <filetype name="Header"> <ext name="C++ Header" value="hpp" /> <ext name="C Header" value="h" /> </filetype> </lang> <lang name="C#" parser="CS"> <filetype name="Source"> <ext name="Class" value="cs" /> </filetype> </lang> ... </epm></pre>	<p>This extract from the file shows the definitions for two Languages: C++ and C#.</p> <p>Within each lang entity there are filetype entities. The C++ Language has two filetypes: Source and Header. Each filetype then has one or more ext entities representing the file extensions that comprise the filetype.</p> <p>C# only has one filetype – Source – and a single extension – cs.</p> <p><i>Extensions are the characters after the last period (.) in the filename.</i></p>
---	---

To add new `filetype` or `ext` entities, simply edit the file using a text editor, copy/paste an existing block and modify the name and value attributes accordingly.

The values in the **name** attributes are free-text. In a future version of EPM it will be possible to report on these values, including viewing files/metrics grouped by the same filetype (e.g. Source) across several languages.

If you have files that have no extension, you may use a value of " " (single space). This means that **all** files with no extension will be parsed using the language parser you have selected.

```
<ext name="MyFileType" value=" " />
```

The **parser** attribute of the **lang** entity must be one of the Parser Codes listed in the first table.

The **parser** attribute of the **lang** entity must be one of the Parser Codes listed in the first table.

4.2 What does line_type in CSV reports mean?

Line Type	Description	Meaning
C	Changed	The File/Project has Changed. This line gives details of the New File/Project and the original metrics can be found on a corresponding Old (O) line.
O	Old	Where a File/Project has Changed, the Old line will also be output to the CSV file.
X	Diff	Where a File/Project has Changed, the Diff line will also be output to the CSV file, showing the difference between Changed (C) and Old (O) lines.
U	Unchanged	The File/Project has not changed.
N	New	The File is New, it has been added to the Project.

Deleted files are not shown in CSV reports.

4.3 Why do I get 'You do not have a valid license'?

If you have not requested a license from laurence.arthur@powersoftware.com, please do so. Once you have received this file (supplied as an attachment called 'license.dat'), please detach this to the folder in which you installed KEPM.

If there is an existing license.dat, overwrite it. Then try re-executing KEPM. If you continue to experience problems, send an email support@powersoftware.com with the License [Code] value you see on starting up KEPM.

4.4 What does the error stating the MySQL cannot start mean?

If you are relying on KEPM to start a MySQL database for you, please ensure that you wait a few seconds between running successive KEPM sessions. MySQL takes a moment or so to start and stop the service at the beginning and end of a KEPM session.

4.5 What do the Metric IDs and Codes mean?

We use a unique numeric code for each metric, as well as an alpha code which is more descriptive.

For efficiency reasons, these numeric codes may change between releases, when a new metric is inserted into the list. We upgrading, be sure to check your Metric Sets and any other interfaces that rely upon the Metric ID.

ID	Code	Description	Project	File
100	LOC	Lines of Code	✓	✓
101	SLOC	Source Lines of Code	✓	✓
102	SLOC_NAT	Source Native Lines of Code	✓	✓
103	SLOC_TAG	Source Tag Lines of Code	✓	✓
104	SLOC_HTM	Source HTML Lines of Code	✓	✓
105	SLOC_SCR	Source Script Lines of Code	✓	✓
106	PLOC	Preprocessor Directive Lines of Code	✓	✓
107	LLOC	Logical Lines of Code (semi-colon count – formerly NSC)	✓	✓
108	N1	Total No. of Operators		✓
109	N2	Total No. of Operands		✓
110	n1	No. of unique or distinct Operators		✓
111	n2	No. of unique or distinct Operands		✓
112	N	Halstead program Length (calculated as $N1 + N2$)		✓
113	n	Halstead program Vocabulary (calculated as $n1 + n2$)		✓
114	V	Halstead Volume (calculated as $V = N \log_2 n$)		✓
115	D	Halstead program Difficulty		✓
116	E	Halstead program Effort (calculated as $D * V$)		✓
117	B	Halstead Bug Prediction		✓
118	J_COM	Java-style Comment Lines	✓	✓
119	C_COM	C-style Comment Lines	✓	✓
120	EOL_COM	To End of Line Comment Lines	✓	✓
121	COM_LOC	Total Comment Lines	✓	✓
122	BYTES	File size in bytes	✓	✓
123	NFILE	Number of Files	✓	
124	CHG_SLOC	Changed Source Lines of Code	✓	✓
125	DEL_SLOC	Deleted Source Lines of Code	✓	✓
126	ADD_SLOC	Added Source Lines of Code	✓	✓
127	CRN_SLOC	Churn Source Lines of Code ($CHG_SLOC + DEL_SLOC + ADD_SLOC$)	✓	✓
128	CHG_LLOC	Changed Logical Lines of Code	✓	✓
129	DEL_LLOC	Deleted Logical Lines of Code	✓	✓
130	ADD_LLOC	Added Logical Lines of Code	✓	✓
131	CRN_LLOC	Churn Logical Lines of Code ($CHG_LLOC + DEL_LLOC + ADD_LLOC$)	✓	✓
132	CHG_FILE	Changed Files	✓	
133	DEL_FILE	Deleted Files	✓	
134	ADD_FILE	Added Files	✓	
135	CRN_FILE	Churn Files ($CHG_FILE + DEL_FILE + ADD_FILE$)	✓	