

Project Estimation Using the Use Case Points Method When Using Enterprise Architect

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Abstract. This text is the third one from the series of articles concerning projects estimation in Enterprise Architect. In the first part ("Theoretical Aspects of Projects Estimation Using the Use Case Points Method" – White Paper published on Sparx Systems Enterprise Architect Community Site), theoretical aspects of the function points method have been presented. In the part two entitled: "Example of the Application of the Use Cases Points Method" (White Paper published on Sparx Systems Enterprise Architect Community Site) an example along with mathematical calculations have been discussed. Whereas in this part practical application of the function points method in Enterprise Architect have been presented.

Key words: use case point method, project estimation, Enterprise Architect.

1 Introduction

Use case point method [1], [2], [3], [4] has been proposed to estimate software development effort in early phase of software project and used in a lot of software organizations. Intuitively, use case point method is measured by counting the number of actors and transactions included in use case models. Several tools to support calculating UCP have been developed. However, Enterprise Architect manufactured by Sparx System [5] provides a comprehensive project estimation tool that calculates effort from use case and actor objects, coupled with project configurations defining the complexity of the work environment. This method is based on Karner's use case points method, with several variations noted below. You can also produce a metrics report containing the project estimation analysis to incorporate into your project documentation.

2 Project estimation in Enterprise Architect

Enterprise Architect supports the estimation of work effort in relation to the development of the IT system with the use of use case points method.

In order to take advantage of the functionality related to estimation of work effort, one should, when creating the model of IT system, consistently define parameters of selected components important from the point of view of the use case points method of which the model consists and to define relevant values of the parameters for the purposes of this method.

Let's start from the beginning and look at the example given in an article M. Wolski, M. Pilski entitled "Example of the Application of the Use Cases Points Method". For the purposes of the estimation of the work effort, in the first step we estimated use cases complexity. Therefore, for each use case defined in Enterprise Architect, in the window of its properties for *Complexity* parameter we need to choose the appropriate value from among: *Easy*, *Medium* or *Difficult* (see Figure 1).

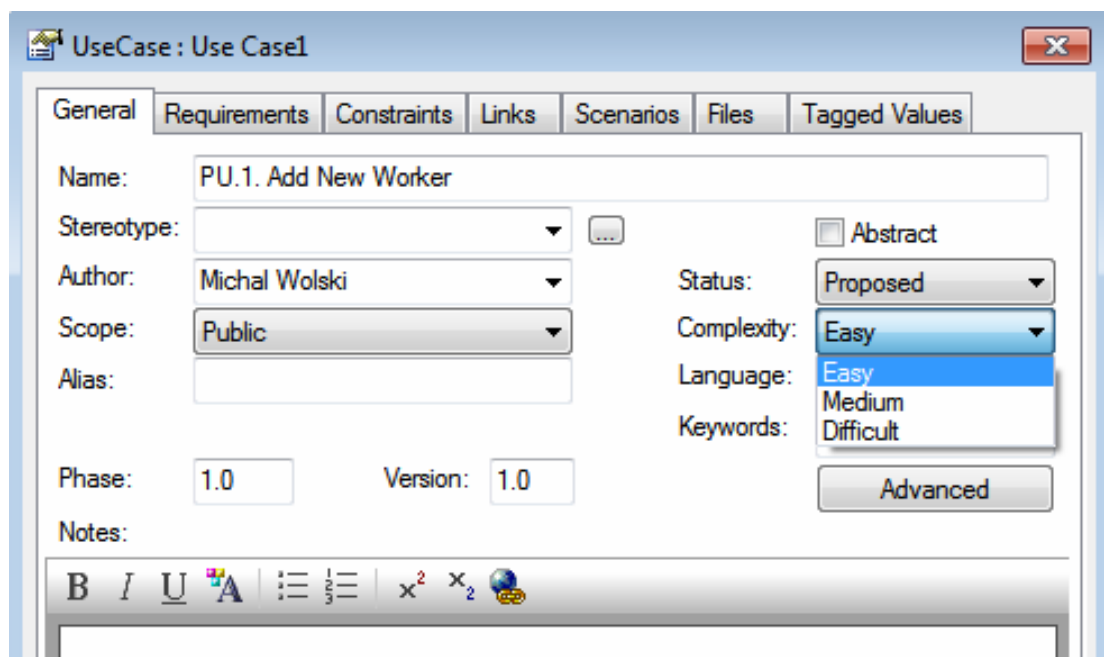


Figure 1. Defining use case complexity in Enterprise Architect tool

Subsequent steps, in accordance with the description in step 2 and step 3, consists in the estimation of the impact of eight environmental complexity factors ECF and impact of the thirteen technical complexity factors TCF. In Enterprise Architect tool, the list of both types of factors can be found in *Estimation Factors* window which are available in the *Settings* text menu when choosing *Estimation Factors* option.

Impact of environmental complexity factors ECF should be defined in the *Environment Complexity Factors* tab (see Figure 2). Here, subsequently for each ECF factor, one should define its effect on work effort by introducing appropriate value into the *Value* field.

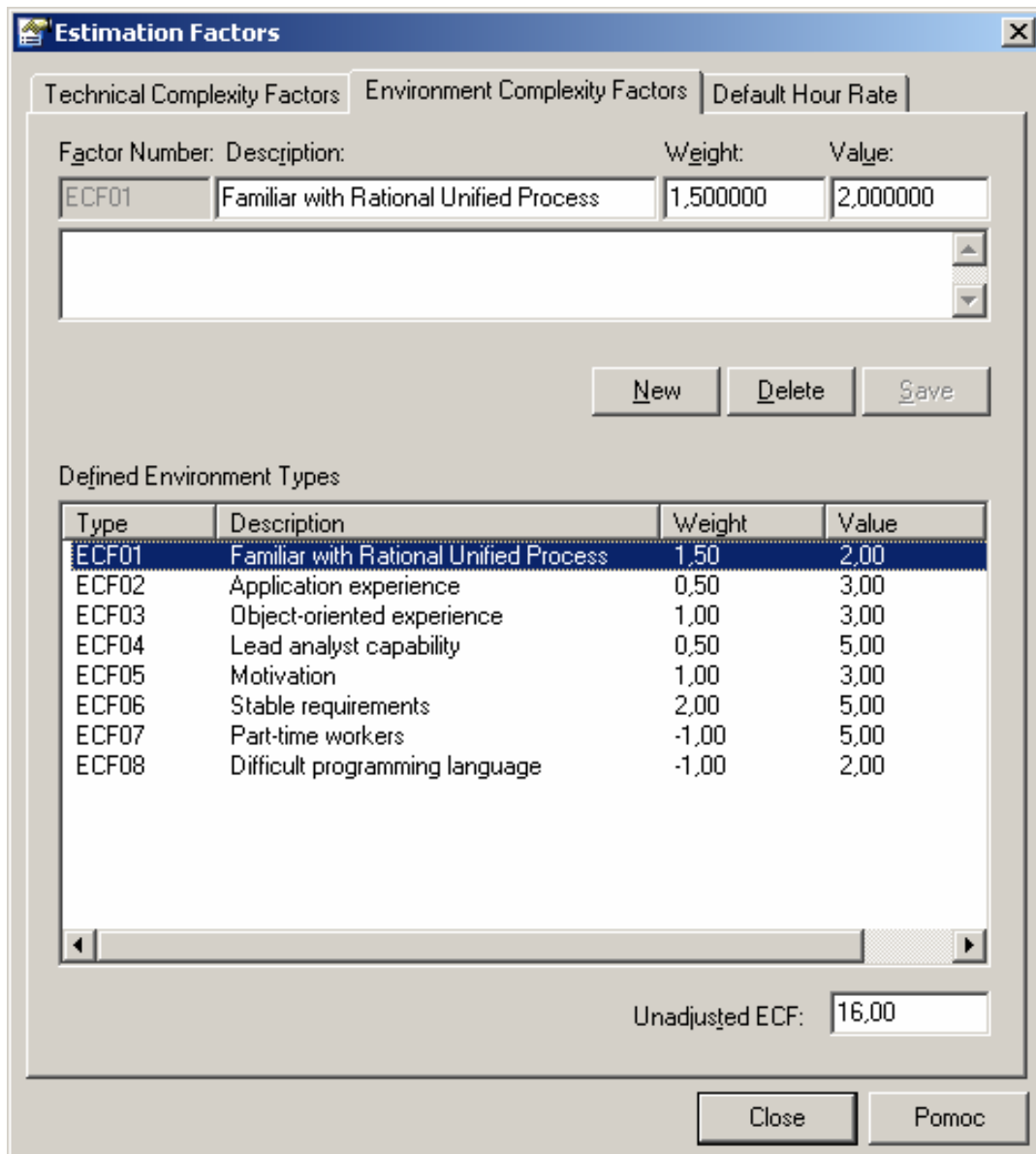


Figure 2. Window of estimation of factors which affect work effort when developing IT system in Enterprise Architect tool. Visible tab with a list of environmental complexity factors along with their weights and the estimated effect on the project

It is worth noting that Enterprise Architect calculates value of unadjusted ECF factor on the current basis, which is the sum of all products of multiplication of factors weights and their values of the impact on work effort when developing the system and the component of the formula allowing to determine ECF factor. The value displayed in the *Unadjusted ECF* factor field is thus determined on the basis of the following formula:

$$unadjustedECF = \sum_{i=1}^8 weight_i \cdot value_i$$

On the other hand, the impact of technical complexity factors TCF should be defined in the *Technical Complexity Factors* tab (see Figure 3). Similarly as in the case of determining the impact for ECF, one should define its impact on work effort subsequently for each TCF by introducing appropriate value into the *Value* field. Similarly, also in this section the value of unadjusted TCF is determined on the current basis, which is displayed in the *Unadjusted TCF* field.

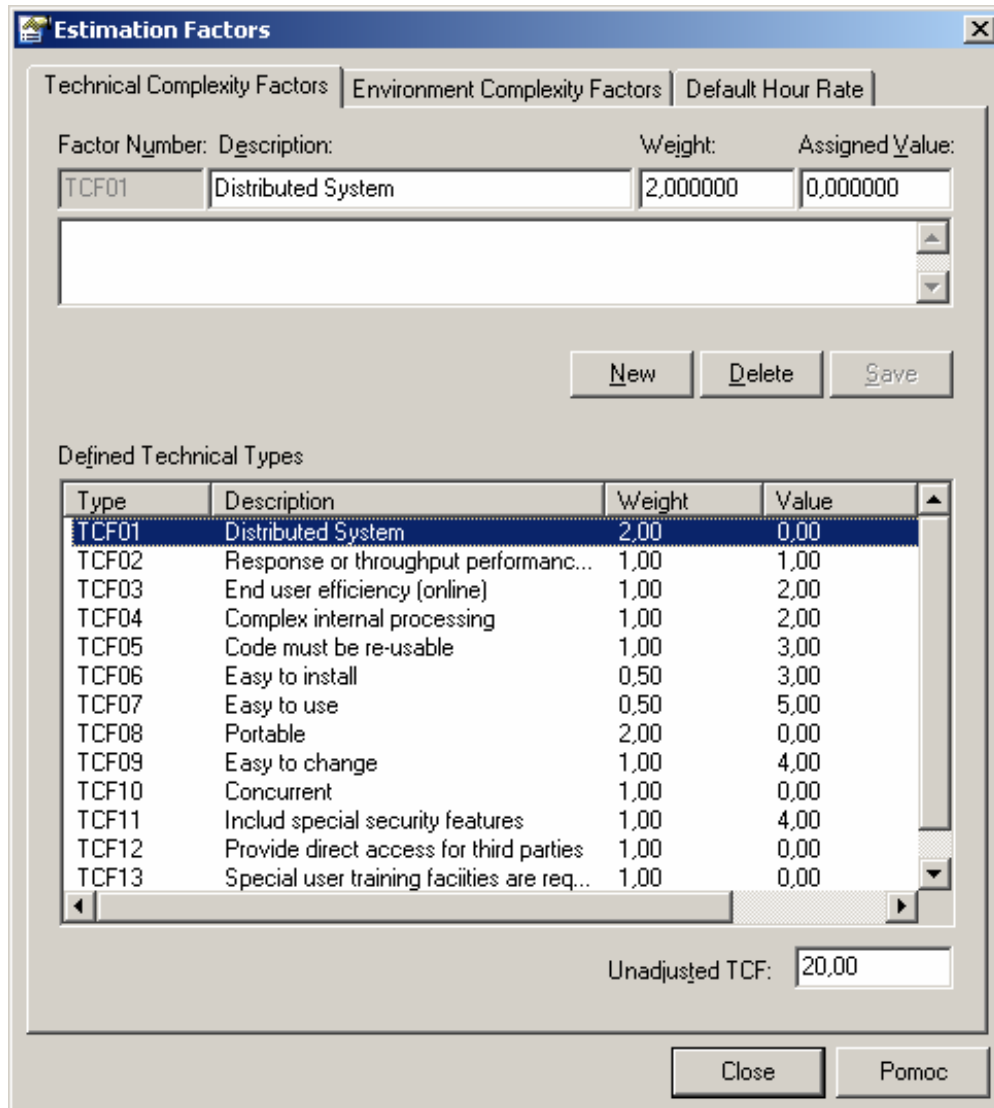


Figure 3. Window of estimation of factors which affect work effort when developing IT system in Enterprise Architect tool. Visible tab with a list of technical complexity factors along with their weights and the estimated effect on the project

After the end of evaluating the impact of environmental complexity factors and technical complexity, one can straightaway define two more important parameters.

First, we can set the value for a parameter known as productivity factor PF. We remember that productivity factor PF converts one point of use case into the

number of man-hours, the author of the UCP method proposed value of this parameter at the level of 20. In Enterprise Architect too, in the *Default Hour Rate* tab of the *Estimation factors* window (see Figure 4) this value is introduced to the field named *Duration*.

Another bound parameter is connected with remuneration per hour of work of a person developing the system. The field named *Hourly Rate* corresponds to that parameter. In the discussed example it was the value of 40 USD (USD currency is just an example).

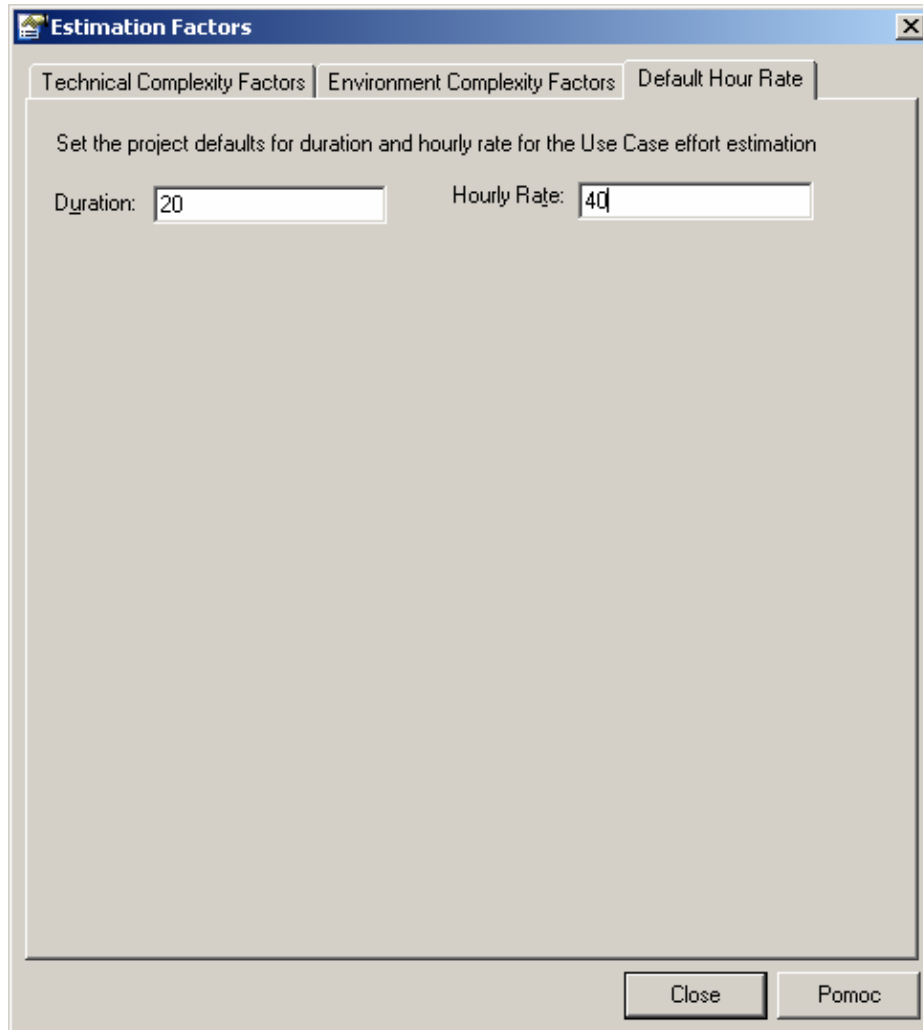


Figure 4. Window of estimation of factors which affect work effort when developing IT system in Enterprise Architect tool. Visible tab for the purposes of defining values associated with productivity parameter and remuneration per hour

We remember that classification of actors complexity of the system was one of the elements affecting work effort of the development of the system. Therefore, we need to classify each actor to one of three classes of complexity. In the window of properties of each actor we need to choose the appropriate value for the complexity parameter from among: easy, medium or difficult.

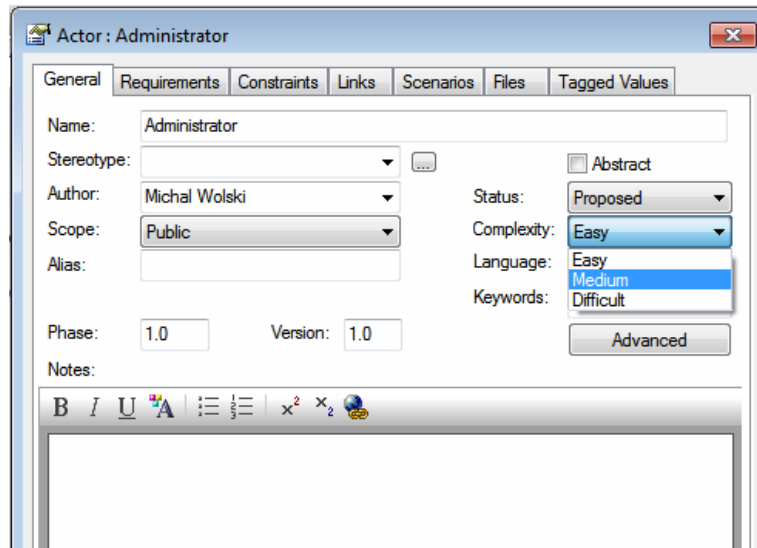


Figure 5. Defining actor complexity in Enterprise Architect tool

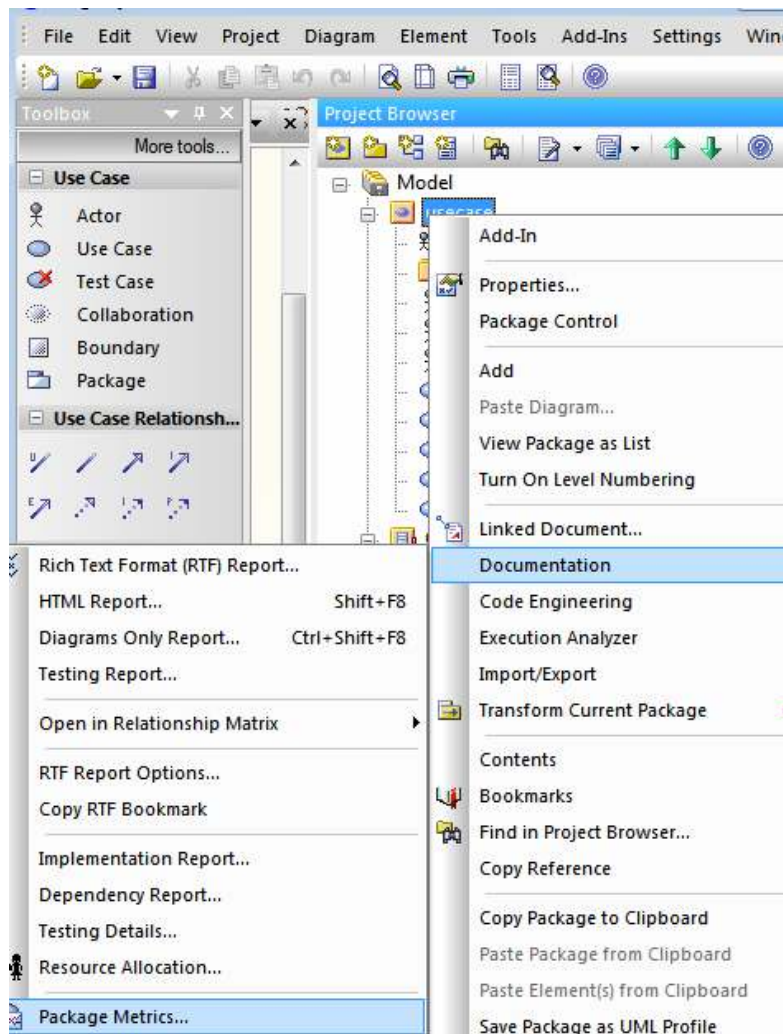


Figure 6. Activation of the tool for Documentation in Enterprise Architect

When all critical, from the point of view of the use case points method, elements of the model as well as factors are defined and classified, one can start working with the tools which will determine the work effort and costs related to creation of our system. For this purpose, one should, in the Project Browser, select the package containing the elements of the model which are to be estimated. Here, reference is made to actors and use cases. In our case it will be the package named *Use Case Model*. It contains the *Actors* package where we have placed all actors of the system and which contains a *Primary Use Cases* package in which we have placed use cases of our system [6]. On the other hand, environmental and technical complexity factors relate to the specific nature of the project and relate to file of the project created in Enterprise Architect and they will be automatically taken into account in the process of determining UCP. In this way we will determine work effort of the development of the system. For selected *Use Case Model* package (see Figure 6) select *Documentation* option in context menu and then *Package Metrics* option or select Project in menu and *Package Metrics* (see Figure 7).

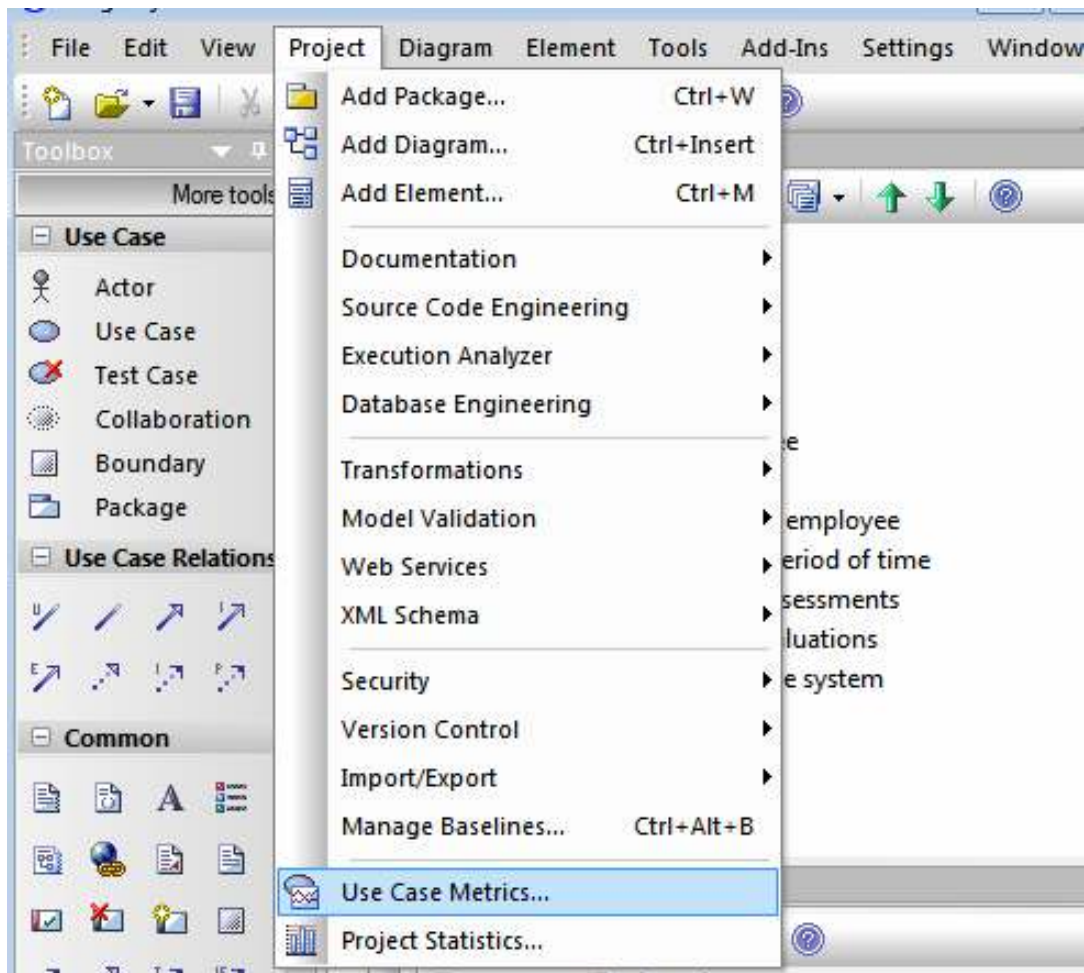


Figure 7. Activation of the tool for Documentation in Enterprise Architect

In opened *Use Case Metrics* window (see Figure 8), in *Use Cases* section we can find a list of the elements which are estimated: use cases and actors. It contains, among others, name of the package from which elements related to UCP estimation come as well as a list of these elements. Any element of the list is described with name of the package in which it is located, name of the element, type of the element, complexity expressed by weight as well as version number (stage).

Use Case Metrics

Use Cases
 Root Package: usecase
 Phase like: *
 Keyword like: *
 Bookmarked: All
 Use Cases: 5
 Include Actors:

Reload

Technical Complexity Factor
 Unadjusted TCF Value (UTV): 20
 TCF Weight Factor (TWF): 0.01
 TCF Constant (TC): 0.6
 TCF = TC + (TWF x UTV): 0.8

Environment Complexity Factor
 Unadjusted ECF Value (UEV): 16
 ECF Weight Factor (EWF): -0.03
 ECF Constant (EC): 1.4
 ECF = EC + (EWF x UEV): 0.92

Package	Name	Type	Complexity	Phase
usecase	PU.5 Log into the system	UseCase	5	1.0
usecase	PU.4 Display evaluations	UseCase	10	1.0
usecase	Manager	Actor	3	1.0
usecase	Hotel's Employee	Actor	3	1.0
usecase	PU.3 Manage assessm...	UseCase	10	1.0
usecase	PU.2 Add new period ...	UseCase	5	1.0
usecase	Administrator	Actor	3	1.0

Ave Hours per Use Case: 44
 Easy: 72 Med: 145 Diff: 218

Unadjusted Use Case Points (UUCP) = Sum of Complexity: 44

Total Estimate
 Use Case Points (UCP) = UUCP * TCF * ECF = 44 * 0.8 * 0.92 = 32 UCP
 Estimated Work Effort (hours) = 20 * 32 = 640 Hours
 Estimated Cost = EWE * Default hourly Rate = 640 * 40 = 25600 Cost

Buttons: Re-Calculate, Report, View Report, Default Rate, Close, Help

Figure 8. *Use Case Metrics* window along with its elements and parameters related to use case points method and evaluation of work effort when developing system modeled in Enterprise Architect tool

Guideline

By default, list of elements in Enterprise Architect (version 8.0) that are subject to estimation contains only use cases. In order to activate actors of the system as well, one should, in *Use Case Metrics* window select the *Include Actors* option and then click *Reload* button in order reload all elements that will be used for the purposes of UCP estimation. After completion of these activities, the list of the elements which are subject to estimation should be supplemented with actors of the system.

Subsequent sections *Technical Complexity Factor* and *Environment Complexity Factor* contain accordingly values of constant factors contained in these formulas for the purposes of determining technical complexity factor TCF and environmental complexity factor ECF, as well as their final values.

Section *Total Estimate* contains final results associated with the value of use case points UCP, the estimated work effort expressed in man-hours (*Estimated Work Effort*) and estimated costs related to creation of the system for the assessment of employees.

There is also a possibility to realize other variants of the estimation by only modifying in a proper way values of selected parameters which are displayed in editing fields and re-calculate the result by clicking *Re-calculate* button.

An useful option is the possibility to generate the report from the process of estimation with the use of use case points method. *Report* button is used to generate detailed report in RTF file format, while *View Report* button is used to display the report.

3 Conclusion

To sum up, the obtained result is identical with the calculations made in the article entitled "Example of the Application of the Use Cases Points Method", which confirms implementation of the methodology of use case points described in article entitled "Theoretical Aspects of Projects Estimation Using the Use Case Points Method". It is also worth noting that the result has been obtained immediately from Enterprise Architect without arduous calculations.

4 References

1. Sergey Diev, (2006). *Use cases modeling and software estimation: Applying Use Case Points*, ACM Software Engineering Notes, Volume 31, Number 6.
2. Mohagheghi Parastoo, Bente Anda and Reidar Conradi, (2005) *Effort estimation of Use Cases for incremental large-scale software development*, International Conference on Software Engineering (ICSE), 303-31.
3. L. Laird, M. Brennan, (2006) *Software Measurement and Estimation: A Practical Approach*, Wiley-Interscience.
4. Vinsen Kevin, Diane Jamieson and Guy Callender (2004) *Use Case Estimation - The Devil is in the Detail*, 12th IEEE International Requirements Engineering Conference (RE'04), 10-15.
5. <http://www.sparxsystems.com.au/products/ea/index.html>
6. W. Dąbrowski, A. Stasiak, M. Wolski, (2007). *Modelowanie systemów informatycznych w języku UML 2.1 w praktyce*, MIKOM, Warszawa.