Software Quality Assessment On Web Server Software

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ABSTRACT

Quality software is expected by the user, the better the quality of the software more and more users who use it. These goals can be achieved by performing assessment of quality of software with one of the quality ISO-9126 model according to the characteristics of the apache web server software. In this research the software will note the quality of the web server software is by assessing the extent to which the software can meet the needs of users by functionality. Then created a software quality assessment matrix that contains the valuation factors and sub factors of quality by using method Weigth Summation models (WSM) and to use the method of weighted Rank Order Centroid (ROC). By processing data from input of respondents against the characteristics of software by using a questionnaire.

Keyword : ISO-9126, *apache, Weigth Summation Model, Rank Order Centroid.*

1. INTRODUCTION

Is a web server software provide services data that serve received a request http or example http from clients that known with a web browser and sent back the results in the form of web pages which are generally shaped html documents.

The use of the most common the web server is to a web site puts, but in practice expanded its use as a place of data storage nor to run a number of application. A page of a web site can be made up of a beam, texts, pictures, video and other contenders usually users through a web browser service asked over a beam or web pages that are found on a web server then the server as manager service will be turning respond to by sending a yard and a supporter of the documents needed or refuse the request was if a page asked for should not available.

An apache http server or sever / www of the apache web server is a web that can run in many operating systems such as unix , bsd , linux , windows , novell and other useful platform netware serve and run web site .Protocol used for serving facilities and is using the web www http .Apache have such advanced features that can be configured error message , autentifikasi based on data bases and others .The apaches also supported by a number of the user interface based on a graph (gui) that allows the handling of the server be easy .

Some organization , as iso standard and ieee try to make and model of combining the quality of software and sub-faktor linking factor .Some of the study also proposes metric software as an instrument for measuring the source code the program , architecture and the performance of software .Until now the assessment process device badger remains a problem with many models open because the agreement and have not yet clear the relationship between software as well as the relationship between quality models and model of metric .

One of the yardstick the quality of software that there is a model iso-9126 , made by the international organization for standardization (iso) and the international electrotechnical commission (iec) .Iso-9126 model defines the quality of a software product , a model , characteristic quality , and metric related to that used to evaluate and set the quality of a software product .

Iso-9126 model defines the quality of a software product , a model , characteristic quality , and related metric used to evaluate and set the quality of a product software .In this case needs to be done about the quality of research software good factors web server software itself in terms of users.

1.1 Characteristics Of A Web Server

Apache is one web software server that having the characteristics of different from software web server other .After analysis was conducted based on interviews , observation and documentation from software apache there are some characteristics that need attention of the soft parangkat of them

a. Common Gateway Interface
Form of communication where client able to send a feedback to servers and server process input the location and take them back to client in this case it should be noted some respects from the side of its sophistication in a web software server so as to give suitable outcome expected by the user.

b. Reverse Proxy
Reverse proxy on duty to perform caching web pages have been in previous request .Reverse a proxy running in port 80 to serve request http , but reverse a proxy not substitute for the functions of a web server , but it will also

continue request to the web http server to in sports , after a web server has been completed the process its request , a web server will restore back to reverse a proxy .What deserves consideration is how reverse a proxy can work optimally by the needs of each user

c. *Virtual Host*
Virtual hosts in Apache is a great way to organize a lot of websites or URLs in one engine or one IP. Virtual hosts can be used after installing the package-package for Apache and most importantly the web server is running properly. So please note the ability and worthiness to be able to provide the functionality and then with the results provided are in accordance with the function that is executed. While the feasibility of whether tolerance can handle the failure or error experienced by software.

d. *Secure Socket Layer*
Add secure socket layer into the Apache requires a fairly complicated procedure but the hassle is a very important goal, namely maintaining data from hackers. To protect this data to note the reliability of secure socket layer to protect the data then how big both secure socket layer can tolerate failure for the error that occurs when used on certain conditions.

e. *Personal Home Page*
Personal home page is the most programming languages used today, is widely used to program web site, create a web site into a dynamic and interactive and no possibility to use for other usage. In this case in terms of the security are more susceptible because your resouce used can be accessed by each user for example for database connectivity and then note the version of PHP does all functions run in accordance with the requirements when using the personal version of the home page.

1.2 ModelISO-9126

The quality of the software can be in value through measurements and specific methods, as well as through testing-software testing. One of the benchmark software quality is ISO-9126, created by the International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC). ISO 9126-defines the quality of software products, models, characteristics of quality and related metrics used to evaluate and define the quality of a software product. The standard ISO-9126 has been developed in an attempt to identify the key quality attributes for computer software.

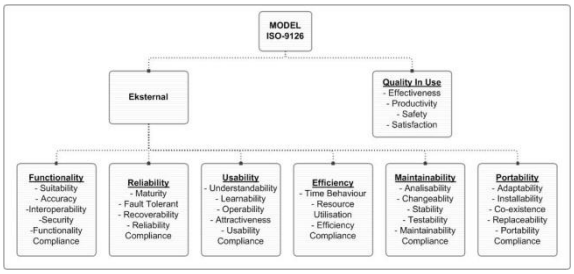
1.2.1 Model ISO-9126 Eksternal

In this model can be used to measure the quality of a software system by measuring the behavior of which is from a part of it. External metrics can only be used during the testing phase of the process life cycle and during the operational phase.

1.2.2 Model ISO-9126 Quality In Use

Quality size used should be based on data that reflect the results of the users interact with the software. This makes it possible to collect data on specific objectives. In addition there is also a model quality in use on model ISO-9126 which will be used in this research which is one of the model quality in the form of a user's view of software.

Figure 1. Model ISO-9126



2. THE CONTENT OF RESEARCH

2.1 linkage

At this stage adjustable between ISO-9126 models with the characteristics of the software to do an interview or can manually according to the documentation of the software:

Table 2. Linkages Between Characteristics With ISO 9126-External Model

Faktor	Sub-Faktor	Characteristics				
		Common Gateway Interface	*Reverse Proxy*	*Virtual host*	*Secure Socket Layer*	*Personal Home Page*
Functionality	*Suitability*		✓	✓	✓	✓
	Accuracy	✓	✓	✓		✓
	Interoperability	✓				✓
	Security				✓	✓
	Functionality Compliance					
Reliability	*Maturity*	✓	✓	✓	✓	✓
	Fault Tolerance					
	Recoverability					

Faktor	Sub-Faktor	Characteristics				
		Common Gateway Interface	*Reverse Proxy*	*Virtual host*	*Secure Socket Layer*	*Personal Home Page*
	Reliability Compliance				✓	
Usability	*Understandability*	✓	✓	✓		✓
	Learnability		✓	✓		✓
	Operability	✓	✓	✓	✓	✓
	Attractiveness				✓	
	Usability Compliance					
Efficiency	*Time Behaviour Resource Utilization Efficiency Compliance*		✓			✓
Portability	*Adaptability*					
	Installability	✓	✓	✓	✓	✓
	Co-existence					
	Replaceability					✓
	Portability Comliance					

For Model ISO-9126 Quality In Use not based on characteristics but only of a response or the user experience on the web server software.

Table 3. Linkages Between Characteristics with Model ISO-9126 Quality In Use

Faktor	Metrik
Effectiveness	*Task Completion*
	Error Frequency
Productivity	*Task Time*
	Task Efficiency
	Economic Productivity
	Productive Proportion
	Relative User Efficiency
Safety	*User health and safety*
	Safety of people affected by use of the system
	Economic damage
	Software Damage
Satisfaction	*Satisfaction Scale*
	Discretionary Usage

2.3 Kuesioner

In the formation of the questionnaire to each question based on the metric model of ISO-9126 because each has a different objective metrics against the assessment of each of the sub factors. Then to calculate the average rating for each criteria or questions used formula is the average (mean) as follows:

$$\bar{x} = \frac{\sum_{i=1}^{n} xi}{n} \quad (1)$$

Where :

$\bar{x}$ = average value
xi = value criteria ke-*i*
n = the number of respondents

Following are the results of the calculation of questionnaires using the formula the average (mean):

Table 4. Results of Questionnaire Data processing ISO 9126-External

Sub-Faktor	Processing Results				
	Common Gateway Interface (CGI)	*Reverse Proxy*	*Virtual host*	*Secure Socket Layer (SSL)*	*Personal Home Page (PHP)*
Suitability	-	6,47	5,57	5,83	6,43
Accuracy	3,6	4,33	3,83	-	2,77
Interoperability	5,67	-	-	-	3,33
Security	-	-	-	3,4	4,37
Functionality Compliance	-	-	-	-	-
Maturity	3,27	2,73	2,47	4,8	3,07
Fault Tolerance	-	-	-	-	-
Recoverability	-	-	-	10,8	-
Reliability Compliance	-	-	-	-	-
Understandability	5,5	5,5	5,83	-	5,33
Learnability	-	72,3	64	-	8,53
Operability	-	6,27	6,1	20,5	8,23
Attractiveness	5,5	-	-	0,93	-
Usability Compliance	-	-	-	-	-
Time Behaviour	-	6,67	-	-	-
Resource Utilization	-	-	-	-	1,7
Efficiency Compliance	-	-	-	-	-
Adaptability	-	-	-	-	-
Installability	6,43	6,37	6,7	6,67	7,1
Co-existence	-	-	-	-	-
Replaceability	-	-	-	-	0,62
Portability Comliance	-	-	-	-	-

Following are the results of the calculation of questionnaires against models ISO 9126 Quality In-Use

Table 5. Results of Questionnaire Data processing-ISO 9126 Quality In Use

Faktor	Metrik	Processing Results
Effectiveness	*Task Completion*	4,37
	Error Frequency	4,3
Productivity	*Task Time*	2,77
	Task Efficiency	5,47
	Economic Productivity	3,27
	Productive Proportion	5,63
	Relative User Efficiency	3,7
Safety	*User health and safety*	5,27
	Safety of people affected by use of the system	36,3
	Economic damage	0,2
	Software Damage	0,13
Satisfaction	*Satisfaction Scale*	0,87
	Discretionary Usage	0,8

2.4 Weighting

Method of weighting Rank Order Centroid (ROC) is based on the degree of importance or priority of criteria. According to Jeffreys and Cockfield (2013) gives heft to the ROC technique on each criterion corresponds to rank which starts based on priority levels. To determine the rules given that is where does it weigh is the weights to the criteria as follows:

if

$$C_{r1} \geq C_{r2} \geq C_{r3} \geq \cdots \geq C_m$$

then

$$W_1 \geq W_2 \geq W_3 \geq \cdots \geq W_n$$

Furthermore, if k is a lot of criteria, then

$$W_1 \frac{1+\frac{1}{2}+\frac{1}{3}+\cdots+\frac{1}{k}}{\mathrm{k}}$$

$$W_2 \frac{0+\frac{1}{2}+\frac{1}{3}+\cdots+\frac{1}{k}}{\mathrm{k}}$$

$$W_3 \frac{0+0+\frac{1}{3}+\cdots+\frac{1}{k}}{\mathrm{k}}$$

$$W_k \frac{0+\cdots+0+\frac{1}{k}}{\mathrm{k}}$$

In general the weighting ROC can be formulated as follows.

$$Wk = \frac{1}{k}\sum_{i=1}^{k}\left(\frac{1}{i}\right) \qquad (2)$$

2.5 Calculation of the Sub factors

To find the value of the sub-factor calculation is done based on the metric model of ISO-9126. For each of the metrics that will be used can be seen in the following table:

Table 6. Metric ISO 9126-External Model

Faktor	Sub-faktor	Metrik
Functionality	*Suitability*	*Functional adequacy*
	Accuracy	*Computational accuracy*
	Interoperability	*Data exchangeability (Data format based)*
	Security	*Access controllability*
Reliability	*Maturity*	*Failure density against test cases*
	Recoverability	*Restore effectiveness*
Usability	*Understandability*	*Completeness of description*
	Learnability	*Effectiveness of the user documentation and/or help system*
	Operability	*Error correction in use*
	Attractiveness	*Interface appearance customisability*
Efficiency	*Time Behaviour*	*Waiting time*
	Resource Utilization	*Transmission capacity utilisation*
Portability	*Installability*	*Ease of installation*
	Replaceability	*Continued use of data*

And here are the results of the calculations for ISO-9126: External

Table 7. Calculation of Results the Sub factors External to ISO-9126

Characteristics	Sub-Faktor	No Criteria	Maks Value	Averange	Sub-Faktor Value
Common Gateway Interface	*Accuracy*	1	10	3,6	0,36
	Interoperability	2	10	5,67	0,57
	Maturity	3	10	3,27	0,33
	Understandability	4	10	5,5	0,55
	Operability	5	10	5,5	0,55
	Installability	6	10	6,43	0,64
Reverse Proxy	*Suitability*	7	10	6,47	0,65
	Accuracy	8	10	4,33	0,43
	Maturity	9	10	2,73	0,27
	Understandability	10	10	5,5	0,55
	Learnability	11	100	72,3	0,72
	Operability	12	10	6,27	0,63
	Time behaviour	13	10	6,67	0,67
	Installability	14	10	6,37	0,64
Wir	*Suitability*	15	10	5,57	0,44

Characteristics	Sub-Faktor	No Criteria	Maks Value	Averange	Sub-Faktor Value
	Accuracy	16	10	3,83	0,38
	Maturity	17	10	2,47	0,25
	Understandability	18	10	5,83	0,58
	Learnability	19	100	64	0,64
	Operability	20	10	6,1	0,61
	Installability	21	10	6,7	0,67
Secure Socket Layer	*Suitability*	22	10	5,83	0,42
	Security	23	10	3,4	0,34
	Maturity	24	10	4,8	0,48
	Recoverability	25	15	10,8	0,72
	Operability	26	30	20,5	0,68
	Attractiveness	27	1	0,93	0,93
	Installability	28	10	6,67	0,67
Personal home Page	*Suitability*	29	10	6,43	0,36
	Accuracy	30	10	2,77	0,28
	Interoperability	31	10	3,33	0,33
	Security	32	10	4,37	0,44
	Maturity	33	10	3,07	0,31
	Understandability	34	10	5,33	0,53
	Learnability	35	12	8,53	0,71
	Operability	36	10	1,7	0,43
	Resource Utilization	37	4	1,7	0,43
	Installability	38	10	6,2	0,62
	Repleceability	39	10	4,37	0,73

For ISO-9126 Quality In Use don't have the sub factors as well as ISO-9126 External which has sub-factors of each factor is itself

Table of 8. The calculation result Metric ISO-9126 Quality In Use

Metrik	No Criteria	Maks Value	Average	Nilai Metrik
Task Completion	40	6	4,37	0,73
Error Frequency	41	20	4,3	0,43
Task Time	42	4	2,77	0,69
Task Efficiency	43	7	5,47	0,78
Economic Productivity	44	5	3,27	0,65
Productive Proportion	45	7	5,63	0,80
Relative user Efficiency	46	5	3,7	0,74
User health and safety	47	10	5,27	0,47
Safety of people affected by use of the system	48	60	36,3	0,39
Economic damage	49	1	0,2	0,8
Software Damage	50	1	0,13	0,87
Satisfaction Scale	51	1	0,87	0,87
Discretionary Usage	52	1	0,8	0,8

2.6 The calculation Factor

For calculating the Weighted Summation methods use factor models (WSM), namely to change the optimization of multi-objective optimization into single-objective. This single objective function formed from the summation of each objective function multiplied by a coefficient ai pembobot wi.

$$f(x) = \sum_{w=1}^{n} a_i w_i \qquad (3)$$

Where :

a = the value of criteria
w = weighting criteria
n = the amount of data

Table 9. The results of the calculations are ISO-9126 External

Characteristics	Faktor	Sub-Faktor	No Kriteria	Average	Sub-Faktor Value	Weight	Faktor Value
Common Gateway Interface	*Functionality*	*Accuracy*	1	3,6	0,36	0,25	0,52
		Interoperability	2	5,67	0,57	0,75	
	Reliability	*Maturity*	3	3,27	0,33	1	0,33
	Usability	*Understandability*	4	5,5	0,55	0,5	0,55
		Operability	5	5,5	0,55	0,5	
	Portability	*Installability*	6	6,43	0,64	1	0,64
se p	*Functionality*	*Suitability*	7	6,47	0,65	0,75	0,59

Characteristics	Faktor	Sub-Faktor	No Kriteria	Average	Sub-Faktor Value	Weight	Faktor Value
		Accuracy	8	4,33	0,43	0,25	
	Reliability	*Maturity*	9	2,73	0,27	1	0,27
	Usability	*Understandability*	10	5,5	0,55	0,11	0,68
		Learnability	11	72,3	0,72	0,61	
		Operability	12	6,27	0,63	0,28	
	Efficiency	*Time behaviour*	13	6,67	0,67	1	0,67
	Portability	*Installability*	14	6,37	0,64	1	0,64
Virtual Host	*Functionality*	*Suitability*	15	5,57	0,44	0,75	0,43
		Accuracy	16	3,83	0,38	0,25	
	Reliability	*Maturity*	17	2,47	0,25	1	0,25
	Usability	*Understandability*	18	5,83	0,58	0,11	0,63
		Learnability	19	64	0,64	0,61	
		Operability	20	6,1	0,61	0,28	
	Portability	*Installability*	21	6,7	0,67	1	0,67
Secure Socket Layer	*Functionality*	*Suitability*	22	5,83	0,42	0,75	0,4
		Security	23	3,4	0,34	0,25	
	Reliability	*Maturity*	24	4,8	0,48	0,25	0,66
		Recoverability	25	10,8	0,72	0,75	
	Usability	*Operability*	26	20,5	0,68	0,25	0,87
		Attractiveness	27	0,93	0,93	0,75	
	Portability	*Installability*	28	6,67	0,67	1	0,67
Personal home Page	*Functionality*	*Suitability*	29	6,43	0,36	0,27	0,39
		Accuracy	30	2,77	0,28	0,06	
		Interoperability	31	3,33	0,33	0,15	
		Security	32	4,37	0,44	0,52	
	Reliability	*Maturity*	33	3,07	0,31	1	0,31
	Usability	*Understandability*	34	5,33	0,53	0,28	0,72
		Learnability	35	8,53	0,71	0,61	
		Operability	36	1,7	0,43	0,11	
	Efficiency	*Resource Utilization*	37	1,7	0,43	1	0,43
	Portability	*Installability*	38	6,2	0,62	0,75	0,69
		Replaceability	39	4,37	0,73	0,25	

Table Hasil Perhitungan ISO-9126 *Quality In use*

Faktor	Metrik	No Kriteria	Maks Value	Average	Nilai Metrik	Weight	Faktor Value
Effectiveness	*Task Completion*	40	6	4,37	0,73	0,75	0,65
	Error Frequency	41	20	4,3	0,43	0,25	
Productivity	*Task Time*	42	4	2,77	0,69	0,09	0,78
	Task Efficiency	43	7	5,47	0,78	0,26	
	Economic Productivity	44	5	3,27	0,65	0,04	
	Productive Proportion	45	7	5,63	0,80	0,46	
	Relative user Efficiency	46	5	3,7	0,74	0,16	
Safety	*User health and safety*	47	10	5,27	0,47	0,15	0,76
	Safety of people affected by use of the system	48	60	36,3	0,39	0,06	
	Economic damage	49	1	0,2	0,8	0,27	
	Software Damage	50	1	0,13	0,87	0,52	
Satisfaction	*Satisfaction Scale*	51	1	0,87	0,87	0,25	0,82
	Discretionary Usage	52	1	0,8	0,8	0.75	

2.7 The Assessment Table

Based on the assessment of the model of ISO-9126 results for the quality of the software can be seen in the following table:

Table 10. Quality Assessment

Level Type	Level Value
Tidak Baik / Rendah	0 - 0,33
Baik / Menengah	0,34 – 0,67
Sangat Baik / Tinggi	0,68 - 1

2.7 Final Results

Based on the discussion of the answers of the respondents against external quality factors and the factors of quality in use on Apache web server software, then the average results obtained from processing of the respondents ' answers and then do the calculations to find the value of the sub factors against based on characteristics of software after it's done the calculations again to find the factors of value per each of the sub factors by using method of Weight Sum Model (WSM) and weighted using Rank Order Centroid (ROC). Then for the final results of the automated calculation is obtained as follows:

Table 11. Final results of the software quality ISO 9126-External

Characteristic	Characteristic Value	Weight	Final Result
Common Gateway Interface	0,58	0,04	0,70
Reverse proxy	0,65	0,26	
Virtual Host	0,60	0,09	
Secure Socket Layer	0,76	0,46	
Personal Page Home	0,63	0,16	

3. FINISHING

Conclusion

From the calculations that have been made to the assessment of the quality of apache web server software, and the result of the calculation can be drawn the following conclusions:

1. Based on the research that has been done to come by characteristics in Apache Web Server software with dependencies with the model of ISO-9126.

2. From the results of the assessment of where these values illustrates that the Good software/medium when used for user needs either the support technically via a website in serving various types of data from text to graphics while the results of the quality assessment in use based on where that value is very Good in terms of satisfaction of use.

3. Based on the results of research and calculations for the quality of software retrieved values so that the user knows the values of factors and sub factors in the model of ISO-9126.

3.1 Suggestion

And for the future, given the following advice:

1. To study the kinds of software are advised to choose other characteristics contained in the corresponding software.

2. To test the model of the same quality are advised to use other types of software in order to determine the extent of the model is completely meet the needs of its users.

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