Tutorial: Object-Oriented Software Product Metrics

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1. ABSTRACT

In this tutorial the concept of measuring is discussed along with the statistical rationale underlying the data that need to be collected to calculate meaningful measures of object-oriented software products. A taxonomy for current object-oriented software measures is presented and current measures are classified according to this taxonomy. Current measures are evaluated as to strengths and weaknesses.

1.1 Keywords

Object-oriented software, measures, metrics.

2. A TUTORIAL: Object-Oriented Software Product Metrics:

2.1 The concept of measuring

2.1.1 Reasonable characteristics of a measure

2.1.2 Weyuker's measure properties

2.2 Measure versus metric

2.2.1 Mathematical concept of a metric

2.2.2 Reasons for standards

2.2.3 A measures suite (desirable and reasonable properties of a suite of measures)

2.2.4 Measurement scales

2.3 An overview of the object-oriented paradigm

2.3.1 Origins of the paradigm

2.3.2 Elements of the object-oriented approach

2.3.3 Terminology

2.3.4 Features of object-oriented products that are different from older conventional software

2.4 A taxonomy for object-oriented software product measures

2.4.1 The taxa

2.4.2 Rationale for these taxa: These taxa provide insight into potential areas of concern, such as depth of inheritance, cohesion, coupling, size of classes, and system structure.

2.4.3 Examples of current measures and how they are classified

2.4.4 Simple measures

2.4.5 Aggregate measures

2.5 Current state of the discipline of object-oriented software product measures

2.5.1 Traditional approaches

2.5.2 The nature of current research

    2.5.2.1 Small and large scale environments

    2.5.2.2 Validity issues

2.6 Discussion of advantages and disadvantages of current measures

2.6.1 Are we measuring what "we think" we are measuring?

2.6.2 The concept of "meaningfulness"

2.6.3 Statistical validity

2.7 Suggestions for collecting data for object-oriented software product measures

2.7.1 Use of checklists

2.7.2 Training of personnel

2.7.3 Checks for consistency and accuracy

2.8 Process measures

2.8.1 Common indicators of process maturity

2.8.2 Establishing a measurement process in the firm

> 2.8.2.1 The steps to take
>
> 2.8.2.2 Viewpoint analysis
>
> 2.8.2.3 Obstacles to the measurement process

2.8.3 Measuring staff effort

2.8.4 Estimating staff effort

3. REFERENCES

[1] Abreu, Fernando B. & Carapuça, Rogério. "Candidate Metrics for Object-Oriented Software within a Taxonomy Framework." Journal of Systems Software 26, 1 (July 1994), 87-96.

[2] Archer, Clark B. Measuring Object-Oriented Software Products: (CMU/SEI-CM-28). Software Engineering Institute, Carnegie Mellon University, Pittsburgh PA, 1995.

[3] Archer, Clark B. & Stinson, Michael C. Object-Oriented Software Measures: (CMU/SEI-95-TR-002). Software Engineering Institute, Carnegie Mellon University, Pittsburgh PA, 1995.

[4] Basili, Victor & Rombach, H. Dieter. "The TAME Project: Towards Improvement-oriented Software Environments" IEEE Transactions on Software Engineering 14, 6 (June 1988), 758-773.

[5] Booch, Grady. Object-Oriented Analysis and Design, 2nd Edition. Benjamin/Cummings, Redwood City CA, 1994.

[6] Conte, S.D.; Dunsmore, H.E.; & Shen, V.Y. Software Engineering Metrics and Models. Benjamin/Cummings, Menlo Park CA, 1986.

[7] Dahlbom, Bo and Mathiassen, Lars. "The Future of Our Profession." Communications of the ACM. 40, 6 (June 1997), 80-89.

[8] Fenton, Norman E. Software Metrics, A Rigorous Approach. Chapman & Hall, London, 1991.

[9] Henderson-Sellers, B. "The Mathematical Validity of Software Metrics." Software Engineering Notes 21, 5 (September 1996), 89-94.

[10] Li, Wei & Henry, Salley. "Maintenance Metrics for the Object Oriented Paradigm," pp. 52-60. Proceedings: First International Software Metrics Symposium. IEEE Computer Society Press, Los Alamitos CA, 1993.

[11] Lieberherr, Karl J. & Holland, Ian M. "Assuring Good Style for Object-Oriented Programs." IEEE Software 6, 5 (September 1989), 38-48.

[12] Weyuker, Elaine. "Evaluating Software Complexity Measures." IEEE Transactions on Software Engineering 14, 9 (September 1988), 1357-1365.