

## DRAFT 4: Metrics Package White Paper

### *OMG – Architecture-Driven Modernization Task Force*

This white paper is geared at creating a dialog and encouraging collaboration that will ultimately determine the need, approach and structure of an RFP calling for an Architecture-Driven Modernization (ADM) Metrics Package.

#### **Background**

The ADM Task Force was formed, under the Object Management Group (OMG), to develop standards to enable and promote the interchange of meta-data that represents existing software systems. In support of this goal, the ADM Task Force created a Roadmap<sup>1</sup> of standards that are either planned or under development. Two of these standards serve as the foundation for the remaining standards within the ADM Roadmap. These are:

- The Knowledge Discovery Meta-Model (KDM) Package
- The Abstract Syntax Tree Meta-Model (ASTM) Package

The KDM represents interchangeable meta-data from a systems perspective, but does not provide for the exchange of detailed actions at the statement level. The ASTM fully represents data and statement level actions as defined in the system source code to a granular degree. The KDM, ASTM and remaining Roadmap packages provide meta-data interchange formats for various modernization tools that collect this meta-data about existing systems and facilitate the analysis, visualization, refactoring and transformation of those systems.

The Metrics Package, on the other hand, supports each of these packages by providing quantifiable and specific indicators, in the form of counts, measures and computational results, about existing systems and the relationship of those systems to target architecture.

#### **Gaps in Software Metric Maturity**

The field of software metrics has historically been surprisingly myopic, having focused almost exclusively on a limited number of program-level metrics to the exclusion of a broader set of software metrics. For example, the McCabe Cyclomatic Complexity metric is useful when attempting to determine program testing and maintenance difficulty, but it is only a single metric based on program level complexity.

McCabe and the other commonly referenced metrics do not address or describe, for example, environmental counts such as job steps, system-wide data definition replication, program-to-program nesting levels, percentage of batch versus online interfaces, number and percentage of functions in a current system that map to a

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<sup>1</sup> See <http://adm.omg.org/ADMTF%20Roadmap.pdf>

target architecture, or the mapping of data usage between the current system and target architecture. These are merely examples of significant gaps in the metrics currently in use within the modernization industry.

Therefore, the ADM Task Force should take an active leadership role in not only enabling the interchange of metric meta-data, but in helping define useful metrics to be represented as meta-data or attributes of meta-data within various models. To that end, this white paper discusses concepts related to the purpose and creation of a Metrics Package within the context of the ADM Roadmap.

### **Objectives**

The main goal of the Metrics Package is to support other ADM Roadmap packages by providing a meta-model or enhancements to other meta-models that enable the interchange of quantifiable metrics derived from meta-data defined by other ADM packages or alternative sources.

For example, the Metrics Package would provide a meta-model and the related elements that define and enable the interchange of the total number of data groupings (i.e. records, segments or tables) within a system or across systems. Data grouping metrics would be easily derived from KDM meta-data for a system or collection of systems. In this case, the Metrics Package relies on the KDM Package.

Another example of how metrics may be applied to other packages involves the Analysis Package and data redundancy analysis across a system or systems. While the KDM may readily provide meta-data to determine the total number of data groups within a system, determining which data groups are redundant to other data groups could require analyses unique to the Analysis Package. The Metrics Package could quickly reflect data redundancy factors by providing metrics that reflect (1) the number of unique entities across a set of systems and (2) the number of redundant entities across a set of systems. Redundancy may be further expressed as a percentage factor. These metrics signal the need to explore the application of the Consolidation Scenario to these systems.

One obvious issue that arises based on the above stated goal is that the Metrics Package relies on and is subservient to other ADM packages. For example, data grouping metrics rely on the KDM Package while data redundancy metrics rely on the Analysis Package. Therefore, the Metrics Package must be established in such a way as to have a symbiotic relationship with each of the other ADM packages on which it relies.

Metrics Package objectives are as follows.

- Identify metrics that can support and complement other ADM packages.
- Allow the Metrics Package to evolve as other ADM packages emerge and evolve.
- Ensure that the Metrics Package clearly supports various ADM scenarios.

### **Metric Categories**

There is no way to fully define or predict all of the metrics that might be applicable to a broad based software environment as can be reflected in various AMD packages. However, the Metrics Package should minimally establish a framework of metric categories that incorporates the following.

1. Environmental Metrics (e.g., number of screens, programs, lines of code, etc.)
2. Data Definition Metrics (e.g., number of data groups, overlapping data groups, unused data elements, etc.)
3. Program Process Metrics (e.g., Halstead, McCabe, etc.)
4. Architecture Metrics (e.g., average call nesting level, deepest call nesting level, etc.)
5. Functional Metrics (e.g., functions defined in system, business data as a percentage of all data, functions in current system that map to functions in target architecture, etc.)
6. Quality / Reliability Metrics (e.g., failures per day, meantime to failure, meantime to repair, etc.)
7. Performance Metrics (e.g., average batch window clock time, average online response time, etc.)
8. Security / Vulnerability (e.g., breaches per day, vulnerability points)

These metric categories reflect a high-level summary of industry metrics that support the modernization process.<sup>2</sup> The Metrics Package should borrow from these sources as necessary so as to avoid reinventing the wheel.

The bottom line is that defining meta-data and meta-model elements to support these metrics cannot be done in the abstract. Therefore, certain metric categories and metrics should be established as part of the Metrics Package in order to fully understand meta-data requirements.

### **Requirements**

The basic requirement for this package is to ensure that it is synchronized with existing or planned packages. A second requirement as stated in the objectives section above is to ensure that the package is flexible enough to adapt to any useful metrics that a given vendor may wish to incorporate within the meta-model.

In order to create specific meta-models, elements within meta-models or more commonly anticipated, attributes to existing meta-models for the Metrics Package, it is anticipated that the RFP or submission will need to communicate the kinds of metrics envisioned to define related meta-data.

Further, the Metrics Package should be fluid enough to evolve as other packages are either deployed or enhanced. Key requirements needed to define the Metrics Package are as follows.

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<sup>2</sup> <http://www.comsysprojects.com/SystemTransformation/tmmetricguide.htm>

- Identify candidate ADM metrics and metric categories based on the need to support various ADM Scenarios.
- Define metric categories for the Metrics Package into which various metrics could be plugged.
- Provide a framework for how various metric categories would be represented within a meta-model environment.
- Establish a basic meta-model and extensions (as needed) to existing meta-models for metrics reliant on the KDM Package.
- Establish a basic meta-model and extensions (as needed) to existing meta-models for metrics reliant on the ASTM Package.
- Establish the framework needed to support other packages as deemed to be a priority by the ADM Task Force.
- Reflect the scope of systems from which metrics were derived.
- Metrics should reflect, where applicable, trend analysis.

### **Practical Applications of the Metrics Package**

Potential metrics gathered from KDM and ASTM meta-data provide quantifiable numbers that can be plugged into various project estimating models for a variety of ADM projects. As part of the RFP and / or response, examples of these estimating models may be used to communicate the metric category and scenarios that drive the use of these metrics.

For example, data definition redundancy metrics would facilitate estimating efforts for a scenario to migrate from flat file structures to a relational database. Cross-system data redundancy and functional analysis would similarly support a consolidation scenario. These are examples of the practical aspects of the Metrics Package as applied to ADM scenarios. Subsequent work should expand upon this analysis.

### **Relationship to Other ADM Roadmap Standards**

The Metrics Package should initially support the KDM and ASTM via meta-model extensions or additions. Subsequent packages that have not been defined to the same degree of detail would need to be addressed as well. The task force should clarify these relationships from a meta-model perspective.

<b>/ ADM Package Metric Category</b>	<b>KDM</b>	<b>ASTM</b>	<b>Analysis</b>	<b>Visualization</b>	<b>Refactoring</b>	<b>Transformation</b>
Environmental						
Data Definition						
Program Process						
Data Architecture						
Interface Architecture						
Structural Architecture						
Functional – Data						
Functional – Action						
Quality / Reliability						
Performance						
Security / Vulnerability						

## Exhibit 1: Metrics / ADM Package Mapping

One aspect of this involves mapping ADM packages to potential ADM metrics, within various metric categories. Exhibit 1 above depicts a conceptual mapping of ADM metric categories to the remaining six ADM packages.

For example, the Exhibit 1 intersection between the Transformation Package and the Functional – Action metrics would identify items such as functions in the current system but not in the target specification, functions in the target but not in the current system and various other metrics that support this package.

The mapping approach in Exhibit 1 would also facilitate the process of identifying various metrics as they pertain to a given ADM scenario. This would involve a clear and concise mapping of how each ADM package supports each scenario. This suggests that a more detailed follow-up Scenario Whitepaper is needed to more fully understand the impact and relationship between ADM packages and ADM scenarios.

The mapping in Exhibit 1 above should be completed during the Metrics Package RFP development. In addition, the source of KDM versus the ASTM metrics should be specified.

### **In Summary**

Because of the relationship between the Metrics Package and other ADM packages, the creation of this package will likely require some unique ideas from the task force. It is possible that the Metrics Package be absorbed as enhancements to other packages. On the other hand, there should be a common thread that ensures that all metric meta-data deployed across various ADM packages are consistently deployed.

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