

A Taxonomy and Evaluation Criteria for DMSMS Tools, Databases and Services

P. Sandborn¹, R. Jung², R. Wong³, J. Becker⁴, and the Common Use Tools Committee of the DMSMS Working Group

¹CALCE, University of Maryland

²NSWC Crane

³Karta Technologies

⁴DSPO

Abstract

This paper describes the creation of a taxonomy and evaluation criteria for organizing and assessing DMSMS tools, databases, and services. These activities are useful in the short term to assess the state of the present DMSMS management tools and the gaps that may be present within them; and necessary in the longer term to lay the ground work for constructing an ontology that will be necessary to achieve web-centric, enterprise-wide DMSMS management solutions.

Introduction

A significant problem facing many “high-tech” sustainment-dominated systems is technology obsolescence (DMSMS – Diminishing Manufacturing Sources and Materials Shortages), and no technology typifies the problem more than electronic part obsolescence, where electronic parts refers to integrated circuits and discrete passive components. This problem is especially prevalent in avionics and military systems, where systems often encounter obsolescence problems before they are fielded and always during their support life.

Many tools and databases have been developed that address various aspects of the DMSMS problem. These offerings include tools and databases that enable the identification of alternative and substitute parts, forecast part-specific obsolescence risks, consolidate part supply and demands, and treat various strategic planning approaches to DMSMS management. Recently, attempts have been made to share data across the DoD enterprise and across multiple part management tools and databases, [1]. In order to move these efforts toward the goal of creating a web-centric enterprise-wide DMSMS management solution an ontology will be required. An ontology is a common set of well defined concepts for use in shared understanding and consistent communication within a particular domain. The concepts are defined using: a) vocabulary (definitions), b) subclass hierarchy (taxonomy), and c) assigning and defining properties, relationships, and constraints.

This paper proposes a taxonomy for DMSMS tools data and services. A taxonomy and evaluation criteria are useful in the short term to assess the state of the present DMSMS management tools and the gaps that may be present within them; and necessary in the longer term to lay the ground work for constructing an ontology that will be necessary to achieve web-centric, enterprise-wide DMSMS management solutions.

DMSMS Tool, Data and Service Taxonomy

A taxonomy is a classification according to a pre-determined hierarchy, with the resulting catalog used to provide a conceptual framework for discussion, analysis, or information retrieval. The taxonomy was developed based on the reactive, pro-active and strategic DMSMS management and planning activities that currently take place and that are envisioned in the future (note, the taxonomy was not constructed “around” the current tool, database and service offering, but rather, was constructed to reflect the range of activities necessary to manage DMSMS problems). The proposed taxonomy is shown in Figure 1.

The taxonomy is not (and does not contain within it) any assessment criteria or requirements, only subject categories. An attempt has been made to draw a line around the subjects that have specific knowledge of DMSMS issues and not allow the line to encompass all the activities involved in the design and management of a system, e.g., reliability analyses play an unquestionably important role, but are not explicitly part of the DMSMS tool/data space.

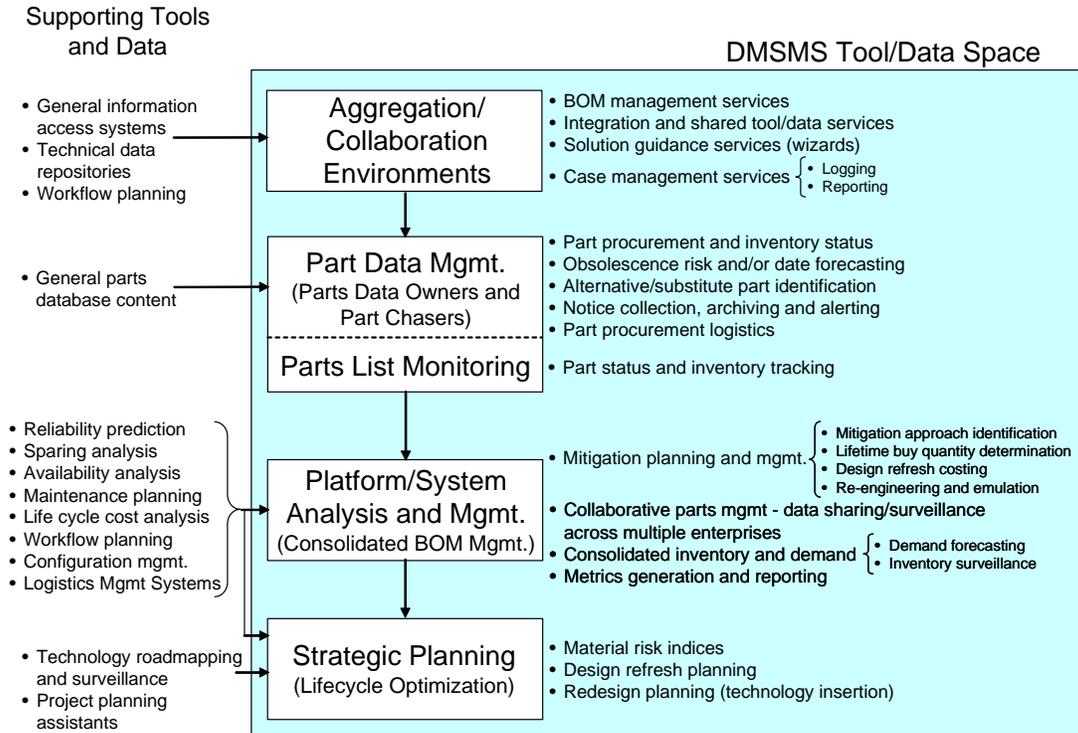


Figure 1 - DMSMS tool, data and service taxonomy.

The general taxonomy category definitions are:

Aggregation/Collaboration Environments - The “environment” (or infrastructure) within which the tools and databases that comprise the DMSMS management solutions reside. The environment provides a range of “services” that enable the use of a suite of tools and databases for performing application-specific analyses.

Part Data Management - The tools and databases that collect and manage data that supports the analysis of DMSMS issues. This category is dominated by electronic part databases that can be used during part selection and management for original part selection, alternative part identification, part procurement and individual part management.

Part List Monitoring - Part status tracking and inventory tracking for lists of parts or individual bills of materials treated independently from the application context.

Platform/System Analysis and Management - The use of DMSMS data combined with platform/system descriptive and lifecycle information to enable platform/system lifecycle management across multiple enterprises. These tools provide tactical planning/optimization at the platform/system level. This category includes application-specific management of multiple BOMs.

Strategic Planning - The use of DMSMS data, logistics management inputs, and technology/business forecasting/trending to enable strategic planning, lifecycle optimization, and long-term business case development and support.

Since the taxonomy and associated category definitions were not organized around the existing set of DMSMS tools, in some cases, some types of tools and databases fall neatly into specific categories, in other cases they spread over several categories.

Evaluation Criteria

The taxonomy has been expanded into a set of evaluation criteria that ranges from generic issues such as availability and pricing of the tool, database or service, to data update frequencies, treatment of uncertainties, and taxonomy-specific requirements. The evaluation criteria developed herein leveraged from earlier work by JCOMMS, [3], which evaluated selected DMSMS tools and databases using a limited set of evaluation criteria. The complete evaluation criteria are available at [2]. The evaluation criterion errs on the side of being overly detailed; the hope being that it represents a repository from which to draw criteria for performing specific evaluations.

A sample from the Part Data Management portion of the evaluation criteria follows:

Part Data Management - General

- What is the update frequency of the data?
- Is the currency of the data clearly identified?
- Part number formatting and cleansing (BOM scrubbing) – what part identification options are available? (NSN, OEM part numbers, NIIN, Cage, ...)
 - Is manufacturer acquisition history captured and used in part number recognition, i.e., has the manufacturer changed hands, who has bought who?
 - How are non-stock listed (non-NSN) parts handled?
 - Can part descriptions be synthesized if a real part number cannot be interpreted?
 - Does the BOM scrubbing functionality “learn”?
- What is the source of the data?
- Has the accuracy of the data been measured? (if so, how? what was the result?)
- Are there any disclosure/proprietary issues with any of the data?
- If there are disclosure/proprietary issues, how is access to confidential data controlled?
- What is the tool/database supplier’s taxonomy?
- Is the tool/database provider associated with particular part distributors or manufacturers? (i.e., is there any possible conflict of interest in the data)
- Are data conflicts resolved? I.e., when different sources of information disagree, is there a process for providing a status?
- How are data conflicts resolved? (what happens when multiple data sources disagree?)
- Breadth of coverage:
 - Are military parts included? (if so what and how many)
 - Are COTS parts included? (if so what and how many)
 - Are passive parts included? (if so what and how many)
 - Are foreign vs. domestic sourced parts identified? Is the source identified in the database?
 - Are die (and/or wafers) treated separately from packaged chips?
 - Are base materials, package bodies, and other critical process objects included?
 - Are lead vs. lead-free parts specifically treated?
 - “Lead free” parts?
 - “RoHS (Restrictions on Hazardous Substances) compliant parts?
 - Are Material Declaration Statements (MDS) parameterized?
 - How is the risk of no manufacturer part number change handled (tin-lead to lead-free)?
 - Can ASICs (Application Specific Integrated Circuits) be analyzed? (i.e., manufacturing capability and IP obsolescence)
 - Are Aftermarket sources considered?
 - If Aftermarket sources are considered, does the component status indicate whether they have finished OEM products, manufacturing capability or both?
 - Are Street/Distributor sources separate from Aftermarket sources?
 - Are AQEC (Aerospace Qualified Electronic Component) parts included?
 - Are thermally upratable parts identified? (more generally, higher screening requirements)
 - Are high risk of counterfeit parts identified? (or known instances of counterfeits flagged, source of the parts, quantity, how to identify)
 - Are electro-mechanical parts included? (if so, what)
 - Are non-electronic parts included? (if so, what)
 - Are card-level part numbers recognized?
 - Is process obsolescence treated?
 - Are software drivers and/or firmware included?
 - Is COTS software treated?

Part Procurement and Inventory Status

- How many parts have DMSMS status information?
- Is the original manufacturer's status separated from the "street"/distributor status/availability?
- Are there connections to parts availability from distributors?
- Is (recent) part history included?
 - low/high price
 - supply chain quantity
 - historical demand
- Is there any particular part sector focus (is the database stronger for one type of part than another)
- How are the results reported? (format)

Future Obsolescence Risk and/or Date Forecasting

- What is the form of the forecast (date, risk color, life-code, etc.)?
- What is the source of the data (or how is the forecast determined)?
- Is historical date obsolescence data available?
 - last order dates of previously obsolete parts
 - final ship dates of previously obsolete parts
 - introduction dates for parts
- Are uncertainties on forecasts estimated?
- Has accuracy of the data been measured? (if so, how? what was result?)
- Have historical accuracy metrics for the data forecasting been generated, i.e., matching old predictions to current obsolescence? If so, how many years of prediction history are available and what is the result of the comparison?
- Are connections to parts available from aftermarket suppliers (or is the likelihood that a part will be available from aftermarket suppliers) provided?
- How are the results reported? (format)

Alternative/Substitute Part Identification

- How are alternate/substitute parts identified? (what criteria are used to make or rank a match)
- Are there connections to parts available via emulation (are Sarnoff or other databases visible)?
- Are there connections to parts available from aftermarket suppliers?
- Query capability
 - Is exact part search available?
 - Are wildcard characters allowed in parts search?
 - Is parametric search available?
 - Are predefined and *ad hoc* queries supported?
 - Can manufacturer websites be queried in addition to internal databases?
 - Can a customer's internal databases and approved vendor list be connected with the system? Can I filter the search for alternative parts based on my approved vendor list?
- What happens when no match can be made to a part number? (are searches made for drawings of the part)
- What is the performance (speed) of the alternative/substitute part identification process?
- Connection to any type of DfX (Design For x) assessment?
- How are the results reported? (format)
- Are customized reports supported?
- Are there engineering options available besides alternate/substitute parts?
- New Technology Insertion recommendations?
- Ease of obsolescence report usage (readability, format, graphics...)

Notice Collection, Archiving and Alerting

- Is an archive of supplier notices available?
- What type of notices are available (PCN – Product Change Notice, PDN – Product Discontinuance Notice, recalls, etc.)
- Are alerts automated?
- If alerts are automated, how are they sorted?
- If alerts are automated, to whom do they go to?
- What filters can be used?
- Timeliness of obsolescence notifications and updating of database?

Part Procurement Logistics

- Are acquisition lead times included?
- If lead time is included, explain what kind of lead time(s) are tracked, i.e., administrative lead time (ALT) that incorporates the time to do contracting details and technical consultations, testing, etc, and/or production

- lead time (PLT) that incorporates the time to produce. Demonstrating that the tool provides this data requires ensuring that the correct lead times are captured.
- Is the price included?
 - If price is included, explain what variations are tracked. Price quotes may be dependent upon priority deliveries and quantity levels ordered among other factors. E.g., what is the unit of issue assumed?
 - Is there a contract vehicle? (how can you pay?) – are available contractual vehicles included (specify in comments)
 - Is there a Contract Line Item Number (CLIN) that covers the purchase?
 - Is the condition of the item specified?
 - Fully mission capable/ready for installation (RFI)
 - Partially mission capable; needs testing, calibration, some modification, software loaded, etc.
 - Non-mission capable; a carcass with the right part number but it's got to go to the depot facility to test and insure it's the right model number (i.e., anything bought off eBay)
 - How many are available?
 - From whom can I get it?
 - Is supply data provided?
 - If supply data is provided, what is its source?
 - Is the manufacturing date of the item specified?
 - Is the shelf life of the item specified?
 - Is the tool capable of identifying selected applicable items down to their specific serial number?

Similar criteria are included in [2] for the other portions of the taxonomy shown in Figure 1.

The evaluation criterion has been implemented in a forms-based evaluation tool that can be used to compare existing tool, database and service offerings, and search for and prioritize gaps, [3]. The implementation of the evaluation criteria distinguishes between users and developers in how questions can be answered, and each evaluation criteria can be weighted by importance and scored independently.

Summary

The Common Use Tools Committee (CUTC) of the DOD DMSMS Working Group is currently using the evaluation criteria and its implementation to study over 20 different tools and databases in order to characterize the needs of the DMSMS community. Although the results of the CUTC's analysis will be for CUTC use only, the evaluation criteria and its implementation are publicly available today (see [2] and [4]) so that others can perform their own evaluations.

References

- [1] S. Dadey, "Shared Data Warehouse," *Proceedings of the DoD Diminishing Manufacturing Sources and Material Shortages (DMSMS) Conference, Exhibition & Workshop*, Charlotte, NC, July 2006.
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- [3] Information Handling Services (IHS) – Enterprise Solutions, *Data Sources and Tools Evaluation Report*, Version 2.0, Joint and Coalition Obsolescence Management Modernization System (JCOMMS) Technology Program, July 15, 2005.
- [4] Evaluation spreadsheets and associated documentation are available for download at: http://www.enme.umd.edu/ESCML/DMSMS_Eval_Spreadsheet-Developer.zip
http://www.enme.umd.edu/ESCML/DMSMS_Eval_Spreadsheet-User.zip.