The DACS Software Development Tools & Technology Information Clearinghouse (SDTATIC):

www.SDTATIC.com

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Presentation Agenda

• Purpose
• What is the DACS?
• What is the SDTATIC Clearinghouse?
• SDTATIC Features
• Model Based Development Tools Example
• How You Can Help

• Conference Survey (Q. 1-3)
Purpose of This Presentation

- Make you aware of SDTATIC
- Get your Feedback on the Clearinghouse
- Getting you involved
- What Else is Needed?
DACS - Data & Analysis Center for Software

- The DACS technical area of focus is Software Technology and Software Engineering, in its broadest sense.
- Central distribution hub for the latest software technology information sources.
- Wide variety of Technical Services to support R&D, development, testing, validation, and transitioning of Software Engineering technology.
- Administered by DTIC. Technically managed by AFRL
- [www.TheDACS.com](http://www.TheDACS.com) or iac.dtic.mil/dacs
SDTATIC
Clearinghouse

• SDTATIC provides DACS users, staff, Subject Matter Experts (SMEs) with a central and searchable source of information on software development tools and technology.

• At the clearinghouse, users will find a uniform description, characterization, and where available unbiased reviews of software development tools.

• These tools are categorized by a taxonomy

• Initial capability implemented
Software Development Tools

• A software development tool is an executable software product supporting developers during the software system life cycle.
  - A software development tool, as defined here, excludes defined manual techniques, procedures, and processes. It includes commercial as well as open and free tools.

• The focus of SDTATIC is on technology-oriented tools, as opposed to tools for managing and acquiring software.

• SDTATIC Strategy: Prototype with one tool category and expand to other categories
Sample Categories of Tools

- Architecture Tools
- Requirements
- Design
- Construction
- Testing
- Maintenance
- Open vs. Proprietary

- These are tool attributes

- Embedded Development
- Model Driven Software Engineering
- Software Assurance
SDTATIC Context

- Searchers
  - Taxonomy category weights, interests, tool classes, etc.
- Administrators
- Oversight Personnel
- Vendors
  - Tool Info
- Analysts, SMEs
  - Tool Info, Experience
- SDTATIC Gov’t Site
  - SDTATIC
  - Collaboration Technology
    - Workshops, Conferences
  - Tools DB
    - Search Results
  - Reports, e.g. Gap Analyses, Tool Class SOARs
- Gov’t Personnel, SPRUCE, SISPI, etc.
  - Searchers and Analyst Inputs
Taxonomy Overview

• Available on SDTATIC web site
• Defined as three-level hierarchy. First level:
  – Life cycle process
  – Functionality
  – Host or running platform
  – Target platform
  – Input type or language
  – Output type or language
  – Availability
• Taxonomy entry includes definition. Maintained wiki-style
Taxonomy Development

- Synthesizes existing taxonomies
- Life cycle decomposition
  - Based on ISO/IEC 15288:2008(E)
- Functionality from:
  - SWEBOK, Chapter 10
  - INCOSE (for requirements functionality)
- Target Platform
  - Extends Software Development Tools Directory
  - Extensions include Web-based and Middleware
Profiles are associated with the SDTATIC taxonomy
  – Used to prioritize tool requirements
  – Assign an importance to an item in the taxonomy (not important, somewhat important, important, very important)

Uses:
  – Define what is important to a user
  – Define what is important for a technology area (e.g., testing tools) or other grouping of tools
  – Identify stretch needs for gap analysis
Representing Tools in the Taxonomy

- Tools are evaluated against the taxonomy (not implemented, partially fulfilled, fulfilled)
- DACS will initially develop and maintain assessment
  - Inputs from users welcome
  - Inputs from SMEs welcome
- Side by Side Comparison

- Suggestions: Survey Q4
The SDTATIC Site
www.SDTATIC.com
User Capabilities for Finding Tools

- Browsing
- Searching
  - Near term: profile searching
  - Long term: natural language
    - “design tools that generate Java or C++”
- Ranking
  - Weighted rank order of tools based on profile priority
    - Similar to QFD Approach

SDTATIC Actions
- Browse SDTATIC Taxonomy
- Review a Software Tool
- Search Tools
- Register as a Subject Matter Expert
- Suggest a Tool

Survey Q5

SSTC
22 April 2009
Finding Technology Gaps

- **SDTATIC Gap Analysis Approach based on Quality Function Deployment (QFD)**
- Each column for each tool generates a weighted sum.
  - This weighted sum can be used to sort most relevant to least relevant tool
- Each row for each taxonomy category is summed.
  - Totals can be viewed as the extent to which the “market” addresses those features
  - Poorly scored features could be interpreted as “gaps”

- Survey Q6

<table>
<thead>
<tr>
<th>Feature</th>
<th>AndroMDA</th>
<th>Autogluon</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Life Cycle Process</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1.1 Project Planning</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1.2 Project Assessment and Control Processes</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1.3 Decision Management</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1.4 Risk Management</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1.5 Configuration Management</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1.6 Requirement Analysis</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1.10 Architectural Design</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1.11 Implementation</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1.12 Integration</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1.13 Verification</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1.17 Maintenance</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.0 Functionality</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.10 Code Generation</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.3.4 Atlas Transformation Language (ATL)</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>6.4 Programming Language</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

weighted sum: 70
Calling all SMEs

- **Subject Matter Experts (SMEs) on Tool Technology Areas**
- **SMEs on Individual Tools**
- **DACS will work with SMEs for high quality assessments**
  - Will contract with selected SMEs
- **We will contact you with user questions**
  - Provides you direct access to users

- **Survey: Q7**

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**SDTATIC Actions**

- [Browse SDTATIC Taxonomy](#)
- [Review a Software Tool](#)
- [Search Tools](#)
- [Register as a Subject Matter Expert](#)
- [Suggest a Tool](#)
Calling Software Development Tool Vendors

• SDTATIC will collaborate with tool vendors for high quality assessments
  – Tool vendor assessments will be shown separately

• We will either contact you or you can contact us.

• Survey: Q8 if you are a tool vendor

SDTATIC Actions
- Browse SDTATIC Taxonomy
- Review a Software Tool
- Search Tools
- Register as a Subject Matter Expert
- Suggest a Tool
Getting Your Input

• Capabilities exist to provide inputs/reviews on tools
• SDTATIC.com is a wiki
• SDTATIC Community Building
• Suggest Tools

• Survey: Q9

SDTATIC Actions
- Browse SDTATIC Taxonomy
- Review a Software Tool
- Search Tools
- Register as a Subject Matter Expert
- Suggest a Tool
SDTATIC Community Building

• Work with related projects, e.g.
  – DoD Best Practices Clearinghouse
  – International Council on Systems Engineering (INCOSE)
  – Software Assurance Metrics and Tools Evaluation (SAMATE)
  – Software Systems Stockroom (S3)
  – Systems and software Producibility Collaboration and Evaluation Environment (SPRUCE)

• Use collaborative technology (e.g., wiki)
• Surveys from DACS
• Sponsor workshops, conference tracks, etc.

• Survey: Q10
Other Services and Information From SDTATIC

• DACS/SDTATIC Team will Respond to Technical Inquiries on Software Development Tools, up to 4 hours, for Free

• Other Information
  – For Open Source, links to the source
  – Related documents
  – Conference links
  – Vendor links
Model-Driven Software Development

• Definition: Model-driven development is simply the notion that we can construct a model of a system that we then transform into the real thing... A model is a coherent set of formal elements describing something (for example, a system, bank, phone, or train) built for some purpose that is amenable to a particular form of analysis... Model-driven development automates the transformation of models from one form to another. (Mellor et al 2003)

• Synonyms:
  – Model-Driven Architecture (MDA)
  – Model-Driven Development (MDD)
  – Model-Based Development (MBD)
  – Model-Driven Software Engineering (MDSE)
MDD Process

Identify Domain Abstractions → Design and Implement Domain-Specific Modeling Language (DSML)

Implement model within DSML → Configure for target platform, application

Generate source

Languages, Metamodels
Models, Product Lines
Design Patterns, Libraries, Etc.
Applications
MDSE Raises Level of Abstraction

(Based on Kelly and Tolvanen 2008)
Origins

• Knowledge-Based Software Assistant (KBSA)
  – AFRL project
  – Project meetings became KBS Engineering (KBSE) conference
  – Now IEEE Conference on Automated Software Engineering
• Computer Aided Software Engineering (CASE) tools
  – Often Object-Oriented
  – Often with diagrams for user interaction
  – Functionality: Documentation, prototype simulation, code generation
• Object Management Group (OMG) and Unified Modeling Language (UML)
  – UML created by the “Three amigos”: Grady Booch, Ivar Jacobson, and James Rumbaugh
  – Model-Driven Architecture (MDA) is OMG project
Example MDD Tools

- AndroMDA – OMG MDA-compliant
- ArcStyle - OMG MDA-compliant
- Borland Together
- CA Gen
- CA Plex
- Generic Modeling Environment (GME)
- MetaEdit+
- Oslo
- Rational Software Architect
- Rational Software Modeler
- Telelogic Tau
- Telelogic Rhapsody
Metamodeling Hierarchy

M3: Metamodel (aka Metametamodel)
    defines
    
M2: Domain-Specific Language (aka Metamodel)
    defines
    
M1: Model
    describes
    
M0: Instance

(Based on Stahl and Volter 2006)
OMG Standards for MDSE

- Model Driven Architecture (MDA)
- MetaObject Facility (MOF)
- Unified Modeling Language (UML 2.0)
- Object Constraint Framework (OCF)
- Query/View/Transformation (QVT)
- XML Metadata Interchange (XMI)
- Common Warehouse Metamodel (CWM)
- Metadata Interchange Pattern (MIP)
# Twelve UML Diagram Types in Three Categories

<table>
<thead>
<tr>
<th>System Structure</th>
<th>Class</th>
<th>Objects and their relationships in a logical view of the system</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Object</td>
<td>Objects and their relationships at a specific time</td>
</tr>
<tr>
<td></td>
<td>Component</td>
<td>Organizations and dependencies among software components</td>
</tr>
<tr>
<td></td>
<td>Deployment</td>
<td>Processors, connections between them, and the distribution of components across processors</td>
</tr>
<tr>
<td>Model Management</td>
<td>Package</td>
<td>Organizes elements of a system into related groups</td>
</tr>
<tr>
<td></td>
<td>Subsystem</td>
<td>Details of a subsystem, including aspects of its operation</td>
</tr>
<tr>
<td></td>
<td>Model</td>
<td>An innovation of UML 2.0</td>
</tr>
</tbody>
</table>
# Twelve UML Diagram Types in Three Categories (Cont’d)

<table>
<thead>
<tr>
<th>System Behavior</th>
<th>Use Case</th>
<th>Sequence</th>
<th>Activity</th>
<th>Collaboration</th>
<th>State Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Relationships and the flow of events between actors and a sequence of related transactions</td>
<td>Object interactions in a sequence</td>
<td>Flow of control (e.g., business workflow or between methods of a class)</td>
<td>Object interactions organized around objects and their links</td>
<td>For a given class, states and events that cause a state transition</td>
</tr>
</tbody>
</table>

An *interaction diagram* is a combination of a sequence and a collaboration diagram.
MDD Input Languages Example

Taxonomy Categories

4.4.7 Spring
4.4.8 Struts
5.0 Input Type or Programming Language
5.1 Metamodeling Framework
5.1.1 MetaObject Facility (MOF)
5.2 Domain Specific Language
5.2.1 Unified Modeling Language
5.3 Interchange Format
5.3.1 XML Metadata Interchange
5.3.2 Query/View/Transformation
5.3.3 Object Constraint Language
5.3.4 Atlas Transformation Language (ATL)
5.4 Programming Languages
6.0 Output Type or Language
6.1 Metamodeling Framework
6.1.1 MetaObject Facility (MOF)

MDD Importance

22 April 2009

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Further Information

Other Suggestions: Q11

SDTATIC Web Site:
http://www.SDTATIC.com/

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“Just because it’s SDTATIC, doesn’t mean things don’t change”
Backup
Metamodel Hierarchy Example

M3 (MOF)

M2 (UML)

M1 (User Model)

M0 (Run-time instances)

Class

Attribute

Class

Instance

Video

: Video

aVideo

+title: String

title="2001: A Space Odyssey"

(Based on UML 2.0 Infrastructure Specification 2003)
OMG Model Driven Architecture (MDA) Process

1. Build the Computational Independent Model (CIM)
2. Build the PIM
3. Transform the PIM into the PSM
4. Generate code from the PSM