The Tool Box of the System Architect

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Abstract

The toolbox of a systems architect is filled with a quite diverse collection of tools. We will discuss the "intellectual" tools, practical low-tech tools, a number of classes of computer assistance tools, and architecting related standards.
# Classification of Architecting Tools

## Noncomputer Tools
- **Human-experience-based methods**
- Techniques
- Patterns

## Low Tech Tools
- Paper
- Pen
- Yellow note stickers

## Facilitation
- Workshops

## Computer-Based Tools

### Borrowed Advanced Tools
- Spreadsheet
- Drawing
- Scripting
- Simulation

### General-Purpose Tools
- Excel
- Visio
- Python

### Organization Infrastructure
- Configuration management
- Product data management
- Change control

## Standards

### Process Oriented
- ISO 9000, CMM-I

### Concept Oriented
- IEEE 1471

### Artifact Oriented
- DoD/AF
- SysML

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TBSAtoolsMap
### 4 Quadrant Comparison of computerized and human tools

<table>
<thead>
<tr>
<th></th>
<th><strong>humans</strong></th>
<th><strong>tools</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>strength</strong></td>
<td>focus on overview</td>
<td>tool dominates</td>
</tr>
<tr>
<td></td>
<td>identify essentials</td>
<td>focus on details</td>
</tr>
<tr>
<td></td>
<td>understand relationships</td>
<td>no understanding</td>
</tr>
<tr>
<td></td>
<td>insight, intuition</td>
<td>fragmentation</td>
</tr>
<tr>
<td></td>
<td>synthesis</td>
<td></td>
</tr>
<tr>
<td><strong>weakness</strong></td>
<td>limited capacity</td>
<td>&quot;infinite&quot; storage capacity</td>
</tr>
<tr>
<td></td>
<td>erroneous behavior</td>
<td>&quot;infinite&quot; processing capacity</td>
</tr>
<tr>
<td></td>
<td>incomplete</td>
<td>complete</td>
</tr>
<tr>
<td></td>
<td>biased</td>
<td>neutral</td>
</tr>
<tr>
<td></td>
<td></td>
<td>no errors</td>
</tr>
</tbody>
</table>
Tools Support Processing of Large Amounts of Details

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KDAWSToolsDiabolo
From Data to Understandable Information

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TBSAdataFlow

The diagram illustrates the process of transforming raw data into understandable information. The process begins with collecting raw data from various sources such as design, suppliers, standards, regulations, partners, and customers. The raw data is then formalized, which can be expanded by automation support. The formalized data is analyzed, and intermediate data is created. Selecting and simplifying the intermediate data results in more detailed information. Interpreting and presenting the results and explanation provide less detail.

Keywords: design, suppliers, standards, regulations, partners, customers, collect, formalize, generate/instantiate, select & simplify, analyse, results and explanation, intermediate data, expanded data, by automation support.
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TBSApyramidDataFlow

Data Flow Mapped on Pyramid

- collect
- formalize
- repository
- generate/instantiate
- analyze
- select & simplify
- interpret & present

number of details:

- $10^0$
- $10^1$
- $10^2$
- $10^3$
- $10^4$
- $10^5$
- $10^6$
- $10^7$

system

multi-disciplinary

mono-disciplinary

generated/instantiated
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Formality Levels in Pyramid

The chart illustrates the relationship between the number of details and the formality levels. The chart is divided into three main sections:

1. **System**
   - Mono-disciplinary
   - Multi-disciplinary

2. **Communication-Oriented**
   - Less formal, uncertainties, unknowns, variable backgrounds, concerns

3. **Machine-Readable**
   - Well defined, repeatable, reusable
   - More formal, more rigorous

The chart shows that as the number of details increases, the formality level also increases, moving from mono-disciplinary to multi-disciplinary to machine-readable.