

Matrix Mapping Tool

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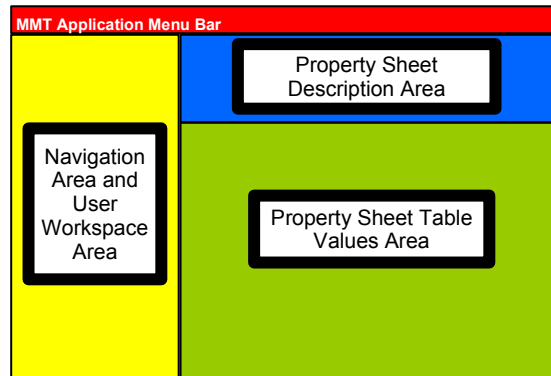
Background

The Matrix Mapping Tool (MMT) is a software application created by Virtual Technology Corporation (VTC) for the Department of Defense (DoD) that aids DoD officials in identifying assets and needs and acquiring and deploying weapons used by the armed forces, ranging from small arms to fully equipped aircraft carriers. “The MMT is a database with supporting software, which documents relationships between warfighting activities, the Uniformed Joint Task List (UJTL), materiel solutions (systems and technologies), and joint capability areas. It allows for a common set of reusable data to support portfolio management (functional and operational), analysis of capability gaps, and other studies where it is necessary to understand the relationships across the dimensions listed above.”¹

In July, 2005 VTC was working on the third stage of development of a desktop based version of the MMT. Because of the restriction on installing software on DoD computers, it was decided that a web based version of the software would be more practical in some environments. The web interface needed to retain all the functionality of the desktop application without any special browser plug-ins.

Introduction

The MMT database contains associations between systems (weapons and vehicles) and warfighting activities (eg. “destroy fixed surface targets”) . For example, an M16A2 is associated “create lethal effects” and “incapacitate human targets.” The web interface consists of a navigation and user workspace area, a property sheet description area, and property sheet table area. The navigation area is divided into “Navigate by...” areas, which contain tree controls that allow the user to browse the database by systems or by a set of activities. Information pertaining to the selected tree node (either a system or an activity) is displayed in the property sheet areas.



Technologies

The existing desktop application was coded in Java and used a single MS Access database to store systems, activities, relationships, and the user workspace. The backend of the web interface consists of an Apache Tomcat webapp that reuses much of the desktop application code so that improvements in the desktop application will be reflected in the web interface. The front end uses HTML, CSS for layout and styles, and JavaScript for the tree and for retrieving data from the server.

¹ <http://www.sosece.org/pdfs/1stSOSeceConf/abstracts/dahmann.pdf>

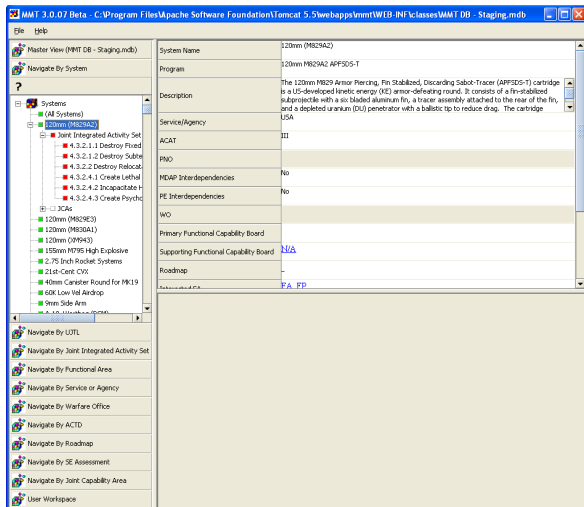


Figure 1: Desktop Application

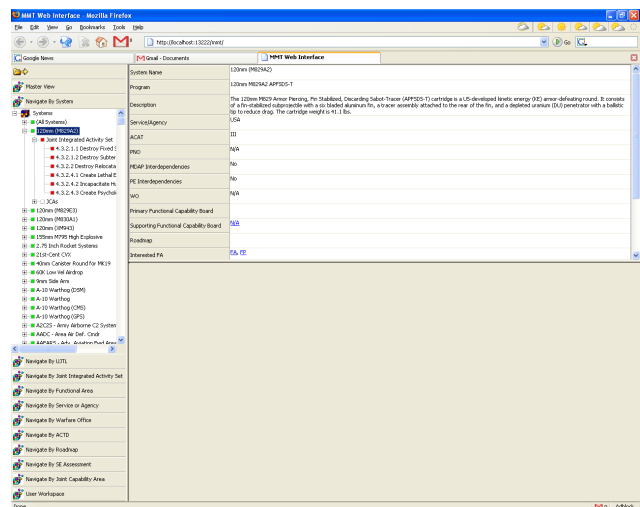


Figure 2: Web Interface

Tree Control

Each node in the tree is represented by a `Node` object in JavaScript. Each `Node` object may have zero or more children `Node` objects or may not yet have loaded children. When a request to expand a node is received, the script checks if its children are loaded. If not, a request is sent to the server and a red “loading...” notice is displayed. Otherwise, the script constructs an HTML representation of the nodes children. In Mozilla the HTML representation is created using string concatenation with the `+` operator, because it is an inexpensive operation. In Internet Explorer, string concatenation is slow, so the representation is created using an array and then the final string is created using the `join` method. This is similar to using a `StringBuffer` in Java. When nodes are collapsed, their `innerHTML` is stored to a variable in the `Node` object, then cleared, so that the node can be expanded quickly.

The `XMLHttpRequest` object is used to asynchronously load tree nodes. A `GET` request specifying the nodes name, id, and class is sent to the server, which responds with the node’s children represented in XML.

The server’s representation of tree nodes are shared across users to minimize memory usage and database queries.

Comparing Systems and Activities

One of the most useful features of the Matrix Mapping Tool is the ability to compare systems based on their associated activities. The comparables view provides a way to find similar systems and view the matched activities. Activities for a system can be assigned a weight from zero to one, and matched systems can be filtered based on functional area, service, acquisition category, and warfare office.

The screenshot shows the Matrix Mapping Tool web interface in a Mozilla Firefox browser. The main content area is titled 'Operational Activities For 21st-Cent CVX'. It features a table with columns for 'Number', 'Name', and 'Weight'. Below this is a section for '21st-Cent CVX Comparables' which includes a table with columns for 'System', 'Score', 'Matches/Weighted', 'Extra Activities', 'Matched', 'Service/Agency', 'ACAT', 'PNO', 'WO', and 'FA'. The interface also includes a left-hand navigation pane, an 'Inclusion Filters' panel on the right, and a 'Run Query' button.

| Number | Name | Weight |
|---------|--|--------|
| 1.1.1.1 | Determine Critical Friendly Force Information (CFFI) | 1.0 |
| 1.1.1.2 | Determine Priority Intelligence Requirements (PIR) | 1.0 |
| 1.1.2.1 | Assess Information Requirements | 1.0 |
| 1.1.2.2 | Prioritize Collection Requirements | 1.0 |
| 1.1.2.3 | Evaluate Collection | 1.0 |

| System | Score | Matches/Weighted | Extra Activities | Matched | Service/Agency | ACAT | PNO | WO | FA |
|--------------------------------|-------|------------------|------------------|---------------|----------------|-------|---------|---------------|-------------------|
| AADC - Area Air Def. Cntd | 52.5 | 170 / 300 | 8 | 170.0 / 300.0 | USN | III | N/A | N/A | C2,BA,FP,FA,FL,NC |
| CVN | 100.0 | 300 / 300 | 0 | 300.0 / 300.0 | USN | IC | PR0 161 | Naval Warfare | BA,FP,FL,C2,FA,NC |
| CN00 | 100.0 | 300 / 300 | 0 | 300.0 / 300.0 | USN | ID | PR0 223 | Naval Warfare | C2,BA,FP,FA,NC |
| ASAS | 34.67 | 104 / 300 | 0 | 104.0 / 300.0 | USA | | MT3 | N/A | C2,BA,FP,FA,NC |
| AOC WS - Air Operations Center | 33.61 | 103 / 300 | 1 | 103.0 / 300.0 | USAF | PHDAP | PR0 369 | N/A | BA,FP,FL,C2,FA,NC |
| AR05 | 44.92 | 141 / 300 | 4 | 141.0 / 300.0 | USAF | III | N/A | N/A | C2,BA,FP,FA,NC |
| ARL - Airborne Recon (Low) | 36.96 | 114 / 300 | 2 | 114.0 / 300.0 | USA | III | N/A | N/A | BA,FP,C2,FA,NC |
| CAC25 | 33.61 | 103 / 300 | 1 | 103.0 / 300.0 | USN | II | N/A | N/A | C2,BA,FP,FA,NC |
| CG-47 | 71.48 | 216 / 300 | 1 | 216.0 / 300.0 | USN | | | N/A | C2,BA,FP,FA,NC |
| CEC (USN) | 45.06 | 143 / 300 | 5 | 143.0 / 300.0 | USN | ID | PR0 592 | N/A | BA,FP,C2,FA,NC |
| DCGS-A | 40.48 | 123 / 300 | 1 | 123.0 / 300.0 | USA | PHDAP | PR0 309 | Air Warfare | BA,FP,C2,FA,NC |
| DCGS-MC | 54.27 | 180 / 300 | 11 | 180.0 / 300.0 | USMC | III | N/A | Air Warfare | C2,BA,FP,FA,NC |
| DDG | 67.48 | 204 / 300 | 1 | 204.0 / 300.0 | USN | ID | PR0 197 | Naval Warfare | FP,BA,C2,FA,FL,NC |
| DDG-51 | 69.48 | 210 / 300 | 1 | 210.0 / 300.0 | USN | IC | PR0 180 | N/A | BA,FP,C2,FA,NC |
| DJCG - Deployable Joint C2 | 55.9 | 188 / 300 | 13 | 188.0 / 300.0 | USN | IAM | N/D2 | N/A | C2,BA,FP,FA,NC |
| ERMP UAV | 45.62 | 140 / 300 | 2 | 140.0 / 300.0 | USA | | | Air Warfare | C2,BA,FP,FA,NC |

Figure 7: Comparables view for 21st Cent CVX

Conclusion

The Matrix Mapping Tool web interface is able to provide the same functionality as the desktop application without requiring the user to install any special software. Furthermore, the web application provides a similar looking interface as the desktop application so that users can easily switch between the two. There are still a few features of the desktop application that were not yet implemented, such as associating war fighting activities with user defined activities.