Taxonomic and Faceted Classification for Intelligent Tagging and Discovery in Net-Centric Command and Control

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Objectives

Motivation - Importance of discovery and tagging

Problem statement - NCE services classification

Two-pronged approach - taxonomic and faceted classification

Prototype of services discovery and tagging tool

Next steps
Motivation
Importance of discovery and tagging in the NCE

Assertions:
1) Success of NCOW depends upon ability to readily discover useful information and services in the NCE

2) Effective discovery depends on good semantic tagging

3) Good semantic tagging must be sound and intuitive

4) But, “sound” and “intuitive” are in the eye of the beholder

Problems:
1) How to resolve or finesse the conflicting perspectives?

2) How to provide tools that support NCE user without overwhelming?
Problem Statement
NCE services classification

Why use a structured classification approach?
- Some claim taxonomies and ontologies are (almost) irrelevant
  - Why not just Google everything?
- 3 responses
  - Structured knowledge facilitates domain understanding
  - Structure facilitates automated search and associated tools
  - Service catalog has inherent structure that can be leveraged

What structured classification approach for net-centricity?
- Requirements
  - Accommodate very large collection of services
  - Encompass many federated COIs
  - Provide traceability and justification for services
- Conclusion: one monolithic approach will not work
  - Lack of agreement
  - Diversity of communities and requirements
Two-Pronged Classification Approach

(Taxonomic and Faceted)

**Taxonomic classification**
- “Traditional” approach
- Based on *concept hierarchy* with *rules* aggregating unique distinguishing features of item
- Applies more to the “essence” of the item
- Can place item at 0–1 nodes in a particular taxonomy
- There can be multiple taxonomies

**Faceted classification**
- More recent approach
- Based on “facets”: categories isolating useful perspectives on an item
- Applies more to specific properties of the item
- Assigns 0–n *defined values* per facet to an item; can also add synonyms
- There can be multiple facet schemes
Proposed Strategy for NCE Services Classification

**Apply both approaches, as follows:**

**Taxonomic classification**
- Use to position services within communities of interest
- Use as basis for browsing and comparing services
- Incorporate “standard” DoD taxonomies based on user and COI demand
- Can be used to enable automated reasoning through hierarchical structure

**Faceted classification**
- Use facets to support a structured tagging approach
- Use to improve searches and refinements to searches
- Synthesize a proposed high-level faceted classification system for NCE Services
  - Based on fundamental categories
  - Incorporate other DoD knowledge and terminology
Taxonomic Classification
“Standard” DoD Taxonomy List

DoD Core Taxonomy*
CSFL (Common System Function List)*
Army Battlespace Command Knowledge System (BCKS) Reference Taxonomy
Geospatial Services Taxonomy
USAF Core Information Taxonomy
NCTC Architecture Reference Model Services Taxonomy

*Used in the prototype
Taxonomic Classification
DoD Core Taxonomy

Background and status
- “Baseline taxonomy for NCES discovery capability [services or information]”
- Developed by MITRE et al.
- Submitted to DoD Metadata Registry 1/11/2005

Description and structure
- Class/subclass hierarchy (214 classes)
- Each class is a concept of interest to DoD
- Each class has a (textual) description
- Each description has a source (e.g., GAO/AFMD2.1.1, InvestorWords.com, Merriam–Webster)
DoD Core Taxonomy: Structure

DoD Core Taxonomy
- Account
  - Action
    - Agreement
    - Asset
      - Capability
      - Environment
      - Event
    - Function
      - Guidance
      - Interval
      - Location
      - Organization
      - Person
      - Role
    - Support
      - Intangible-Asset
      - Tangible-Asset
    - Military
      - Acquisition
        - Budgetary
          - Environmental
        - Environmental Management
      - Force Application
    - Battlespace Awareness
      - C2
    - Defense and National Security
      - Health
      - Resource Management
      - Services Support
      - Environmental Management
    - Branches best aligning with services in **bold**
Taxonomic Classification
CSFL (Common System Function List)

- Background and Status
  - “System functions and associated definitions” supporting all aspects of Combat, Infrastructure, and Business activities
  - Developed by the Department of the Navy
  - Can be basis for service components in DoD EA SRM
  - A well-written, large collection of system functions

- Description and structure
  - Each function has a name, a description, and a domain (and sub-domains)
  - Leaf nodes can be cast as potential invokable services
Faceted Classification: “7 W’s” Framework

**Who** uses the service
- Notion of the service’s client or invoker
- Could also include service developer or “distributor”

**What** the service activity is
- Verb denoting the activity

**On What**
- Notion that the service must act on an input or object; tied to the service domain

**To Whom**
- Covers case where object is a person

**When** the service occurs or has an effect
- Typically a temporal performance measure

**Where** the service applies or has an effect
- Could be geographic (e.g., CONUS) or conceptual (e.g., relative to a battlespace)

**Why** the service is used
- Reference to authorities, responsibilities, regulations, guidance
Taxonomic Classification of a Service

Service Classifier: NCOW Services Classification

Request Medevac Service

Name: Request Medevac Service
Description: This service can provide medical evacuation of wounded personnel.

URL: http://flicka.itd.ida.org/3080/ncmedevac-service.xml
WSDD URI: http://flicka.itd.ida.org/3080/ncmy-wsdd.xml
DOMS URI: http://flicka.itd.ida.org/3080/ncmy-doms.xml

Classifications

Service Taxonomy Classifications

<table>
<thead>
<tr>
<th>Taxonomy</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>DoD Core Taxonomy Actions and Functions</td>
<td>Action &gt; Support Action &gt; Logistics Action</td>
</tr>
</tbody>
</table>

Faceted Classifications

<table>
<thead>
<tr>
<th>Focus</th>
<th>From Faceted Classification</th>
</tr>
</thead>
</table>

Search Taxonomies...

Faceted Classifications

<table>
<thead>
<tr>
<th>7 W's Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who</td>
</tr>
<tr>
<td>What</td>
</tr>
<tr>
<td>On What</td>
</tr>
<tr>
<td>To Whom</td>
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<tr>
<td>Where</td>
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<tr>
<td>When</td>
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<tr>
<td>Why</td>
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</tbody>
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Search for Services...
Faceted Classification of a Service

![Faceted Classification of a Service](image)
Service Discovery through Taxonomies
Service Discovery by Faceted Classification
Summary

Discovery and tagging in the NCE are critical

Combining taxonomic and faceted classification is a promising approach for improving discovery and tagging

- Supports multiple constituencies
- Is intuitive
- Is standards-based
- Improves search

Prototype functionality demonstrated
Next Steps

Integrate with intelligent software agent

Learning algorithm for suggesting appropriate tags

Facilitate evolution of taxonomies and tags for NCE Services