SHARE Repository Framework: Component Specification and Ontology

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Challenge – Improve Repository Capabilities

• Software, Hardware Asset Reuse Enterprise (SHARE) Repository
  – A library of combat system software and related assets, for use by eligible contractors for developing or suggesting improvements to Navy Surface Warfare Systems
  – Established August 2006 by PEO IWS under the Navy Future Combat Systems Open Architecture program

• Types of searches typically supported by repositories
  – Keyword search over metadata – dependent upon semantic assumptions
  – Browsable categories – becomes ineffective as size grows

• The goal of this research is to improve SHARE utility by expanding capabilities
Conceptual Vision

- Enable multiple search and discovery options that are less dependent on specific vocabulary.
- Three envisioned searches:
  - Fish Eye Graph
  - Semantic Search
  - Model-Based Search
- Current repository metadata does not support these searches
- Maintain traditional search options (e.g. keyword)

Fish Eye Graph
(Sarkar and Brown, 1993)
Repository Framework – Component Specification and Ontology

• Component Specification - a description or model of the items in the repository
  – “Typical” Metadata - information about an artifact that aids:
    • Discovery, by providing information to enable locating items of interest
    • Evaluation, by providing information to support a decision about whether or not to retrieve an item
    • Implementation, by providing information about how to use the asset when it is retrieved
  – Software Behavior Description – a searchable representation of the software asset’s behavior
• Ontology – a contextual model of the repository items that describes their relationships to aid in associating artifacts with user needs
Related Technologies

- Investigated various formal/semiformal approaches to representing each of these types of items.
- Advantages of going with web technologies
  - Coverage
  - Openness
  - Scalability
  - Ease of implementation

Semantic Web Stack

Formal Notations

```plaintext
AddBirthday
ΔBirthdayBook
name? : NAME
date? : DATE

BirthdayBook
  known : P NAME
  birthday : NAME ↔ DATE
  known = dom birthday

name? ∉ known
birthday' = birthday ⊔ {name? ↔ date?}
```
Metadata (Development Process)

• NSWC Dahlgren (SHARE Program Manager) provided initial metadata set for SHARE
• We developed an XML Schema based on this metadata
• Currently evaluating existing schema for inclusion of relevant elements for SHARE
  – DoD Discovery Metadata Specification (DDMS)
  – Communities Of Interest (e.g. M&S COI DMS)
  – Existing repositories (e.g. SourceForge, CPAN)
• Next steps:
  – Incorporate software behavior and ontology data into metadata
  – Refine use cases and apply to updated schema
  – Finalize schema
• Final product will be a complete metadata set (both required and optional elements) intended to describe each artifact in SHARE
Software Behavior Representation

- **Formal vs. Informal**
  - Examples
  - Pros and cons
- **Informal Approach - CSFL, CIEL, COAL taxonomies**
- **More formal approach - WSDL**
- May use informal approach for legacy and formal for new artifacts.
- Behavioral descriptions will be added to the metadata for each artifact.

**OWL taxonomy:**
Common System Function List (CSFL)
Relationships (Ontology)

- Multiple sources of context for repository artifacts
  - Artifact’s place in the Software Engineering Lifecycle
  - Original System Architecture (Aegis, SSDS, etc.)
  - Surface Navy Open Architecture reference architecture
  - Semantic relationships (ReSEARCH work)
- Ontologies represented in OWL-DL

Lifecycle-Artifacts Relationships
Way Forward

• This research will result in a framework for the repository that will enable tool development to aid in improved search and discovery.
• Completion of this phase expected July 08.
• Follow on work will be necessary to implement the framework into the SHARE repository tool.

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References

• SHARE Web Site located at [https://viewnet.nswc.navy.mil](https://viewnet.nswc.navy.mil)
Questions?