Acquisition Research Program:
Creating Synergy for Informed Change

SHARE Repository Framework: Component Specification and Ontology

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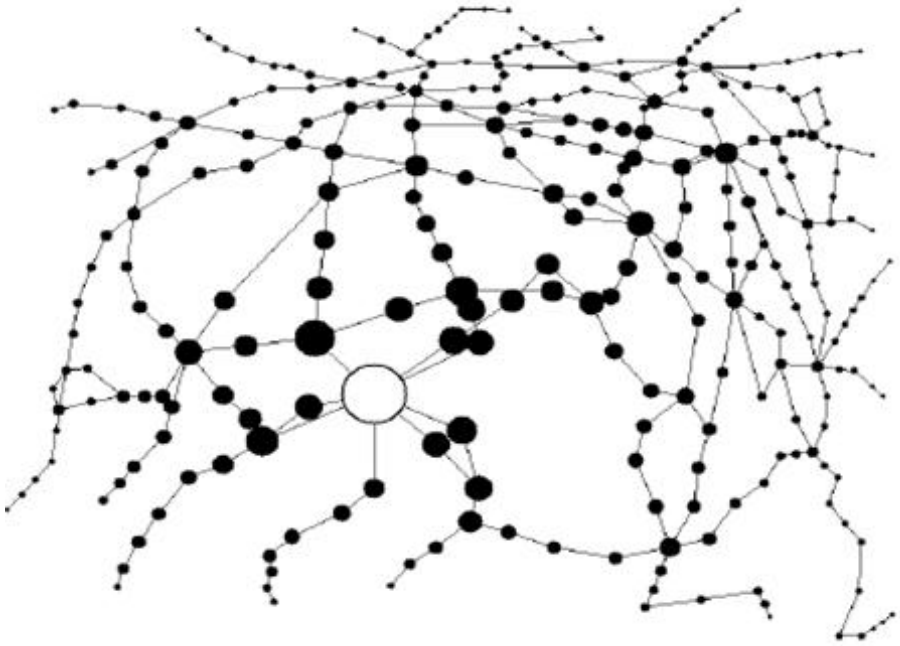
Challenge – Improve Repository Capabilities

- 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)



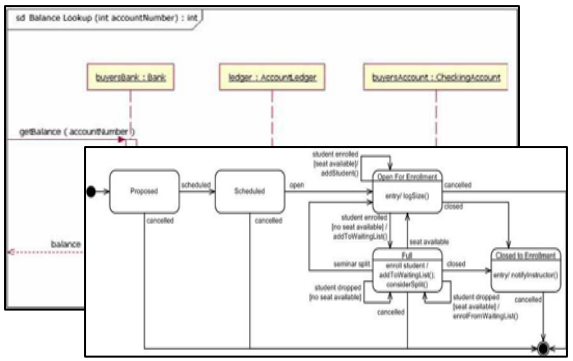
Fish Eye Graph
(Sarkar and Brown,1993)

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



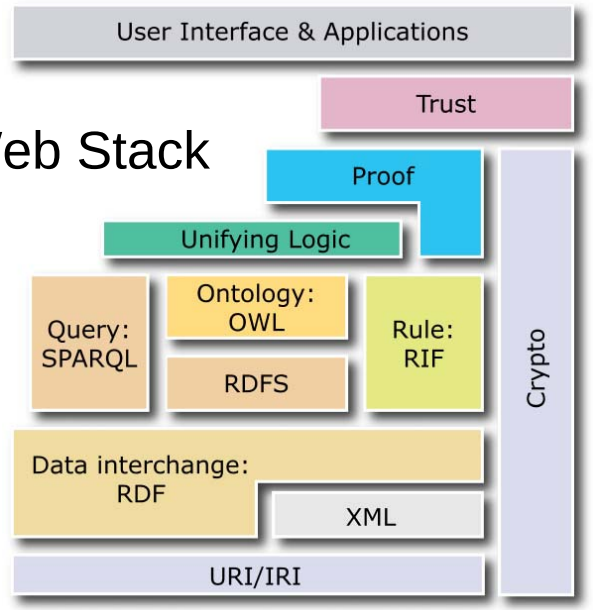
UML Diagrams

Formal Notations

$$\begin{array}{|l} AddBirthday \\ \Delta BirthdayBook \\ name? : NAME \\ date? : DATE \\ \hline name? \notin known \\ birthday' = birthday \cup \{name? \mapsto date?\} \end{array}$$

$$\begin{array}{|l} BirthdayBook \\ known : \mathbb{P}\, NAME \\ birthday : NAME \pfun DATE \\ \hline known = \mathrm{dom}\, birthday \end{array}$$

Semantic Web Stack



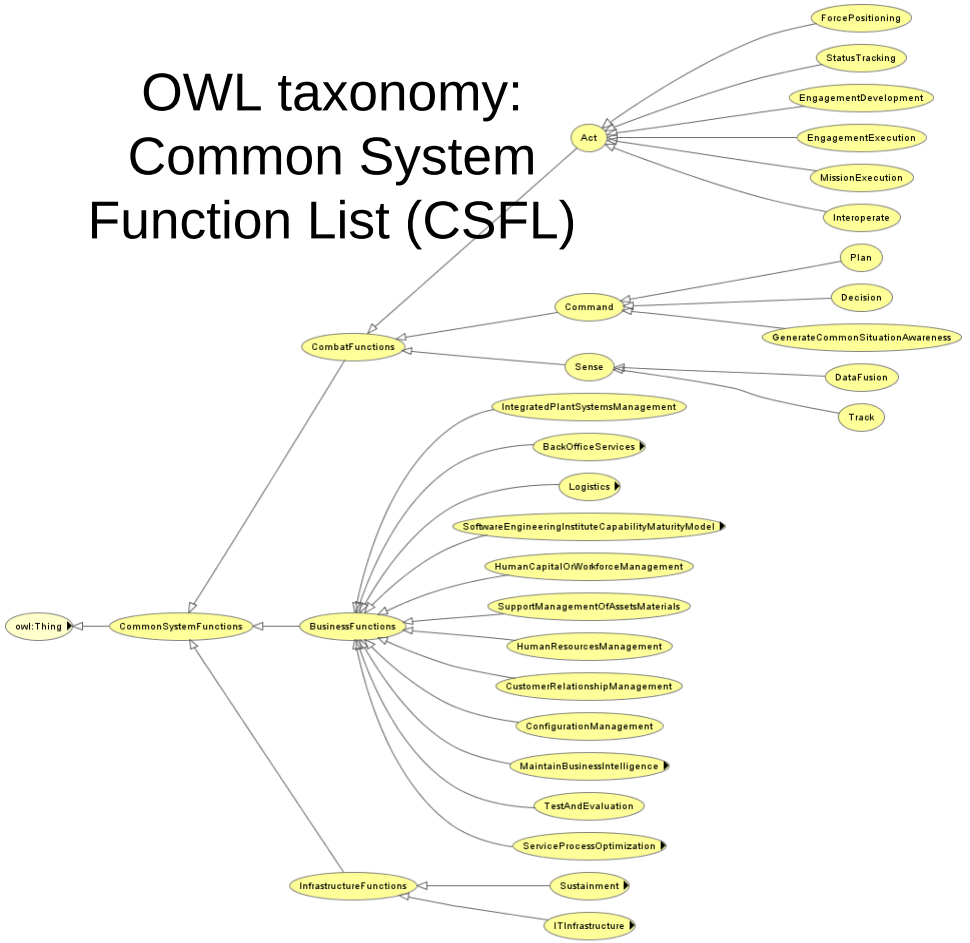
Metadata (Development Process)

- 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.

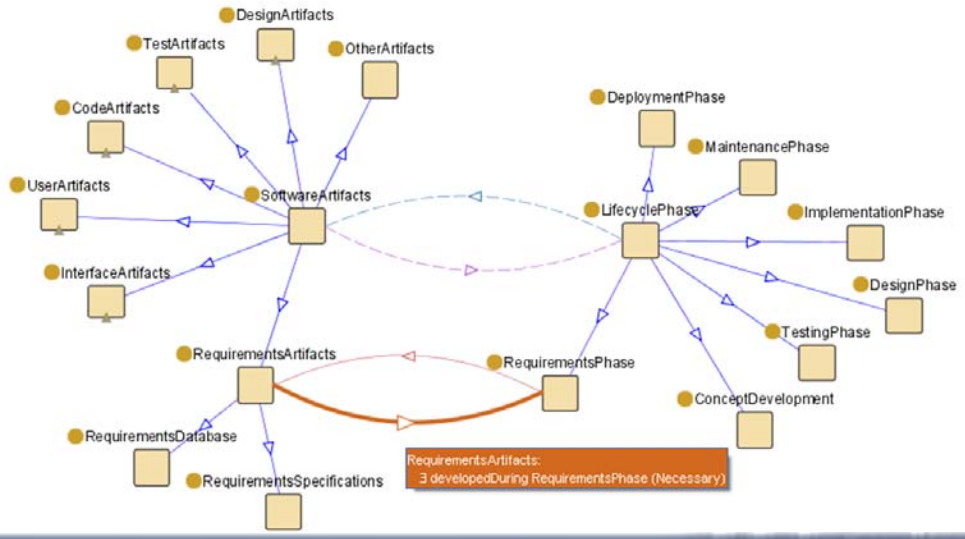
OWL taxonomy: Common System Function List (CSFL)



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

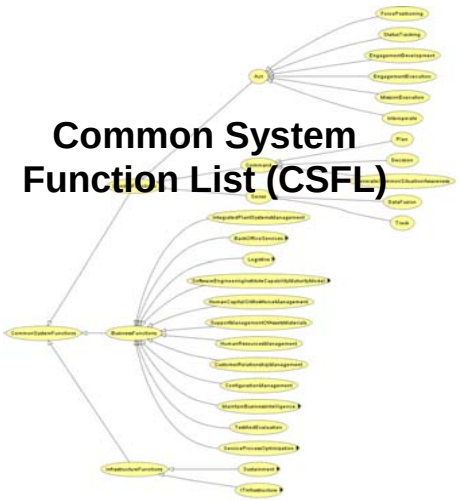
Lifecycle-Artifacts Relationships



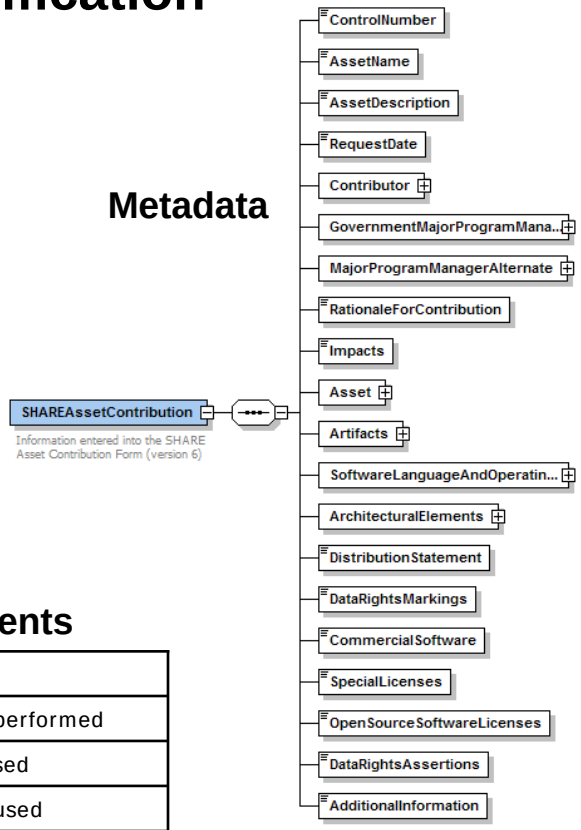
Tie it all together: Component Specification and Ontology

Component Specification

Common System Function List (CSFL)

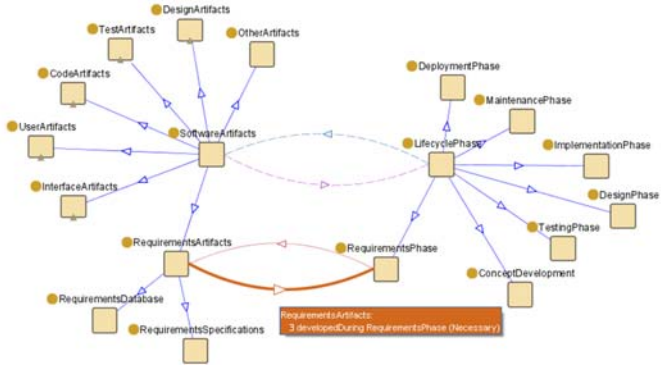


Metadata

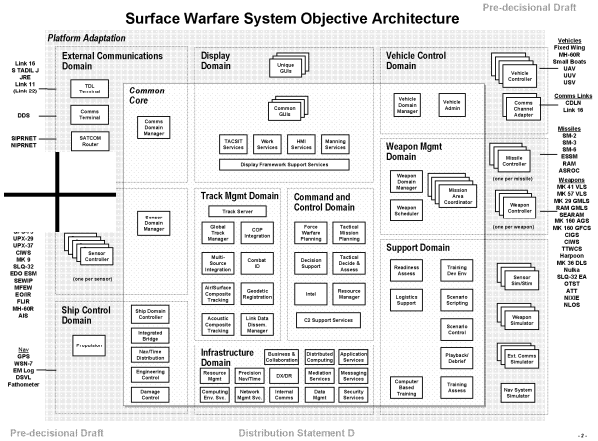


WSDL Elements

Element	Defines
<portType>	Operations performed
<message>	Messages used
<types>	Data types used
<binding>	Communication protocols



Ontology Representations



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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Questions?