The Semantic Interoperability Community of Practice (SICoP) of the Federal CIO Council

Brand Niemann
Co-Chair, Semantic Interoperability Community of Practice (SICoP)
Enterprise Architecture Team,
EPA Office of Environmental Information
Notice:
In today’s presentation, the part of Brand Niemann will be played by:

Ed Barkmeyer
Interoperability Program
NIST
Manufacturing Engineering Laboratory
Overview

- Who/what is SICoP?
- What are we doing?
  - White Papers
  - Annual Semantic Technologies for eGovernment Conferences
- Relationship to Enterprise Architecture and Service-Oriented Architecture
- Future Activities
Who we are

• The Semantic Interoperability Community of Practice (SICoP) is a group of individuals representing
  – a broad range of government organizations
  – industry and academic partners
  – no formal commitment from agencies or companies

• Objectives:
  – **semantic interoperability** as an **operational** characteristic of software used in Federal agencies.
  – **semantic data integration** among software and data repositories provided by the Federal Government
  – make the Semantic Web operational in members’ agencies.
Who we are formally

• SICoP is a Special Interest Group (SIG) within the Knowledge Management Working Group (KMWG) sponsored by the Best Practices Committee of the Chief Information Officers Council (CIOC) of the U.S. Government.

• Responsibility: provide findings and recommendations to the Best Practices Committee

• Approach:
  – meetings, tutorials, conferences, pilot projects, etc.
  – promulgating best practices.
Organization Structure for Semantic Harmonization

Collaborating on Semantic Harmonization: Organizational Relationships

- Industry Advisory Council (IAC)
- U.S. CIO Council
- OMB - FEAPMO

- Enterprise Architecture Special Interest Group
  - Architecture & Infrastructure Committee
    - Subcommittees: Governance Components Emerging Technologies
  - IT Workforce Connections
  - Best Practices Committee
    - SIGs and CoPs
      - Semantic Interoperability Community of Practice
  - Chief Architects Forum
How did SICoP come about?

• 2002: Semantic technologies discussed in CIO Council XML Web Services Working Group
• 2002-03: Semantic Technologies for eGovernment Pilot
  • See http://web-services.gov
• 9/2003: Semantic Technologies for eGov Conference
  • See http://www.topquadrant.com/conferences/tq_proceedings.htm
• 10/2003: CIO Council Knowledge Management Working Group recommends Community of Practice
  • See http://Km.Gov
• 2003-04: Semantic Technology Training Series TopQuadrant/U. Maryland and other presentations
• 4/2004: SICoP Kickoff Meeting
SICoP Accomplishments

• First Semantic Technology for eGovernment Conference
  – at the White House Conference Center, September 8, 2003
  – http://www.topquadrant.com/conferences/tq_proceedings.htm

• 2nd Semantic Technology for eGovernment Conference
  – September, 2004
  – 40 Defense and civilian agencies represented
  – 50 major contractors represented.

• White Papers
SICoP Partnerships

- Federal XML Working Group
- Government XML CoP
- Ontolog Forum
  - Joint effort to "semantify" the Federal Health Architecture (FHA)
- other communities of practice
Contours of Practice

Implementing Semantic Interoperability

Core Technologies
Use Cases
Transition Efforts
Ontology Developers
Organizational Support
Communities of Practice

Source: Leo Obrst
White Papers ("Modules")

• 1: Executive Summary: Semantic Technologies and the Vision of the Semantic Web
  • Jie-Hong Morrison, Computer Technologies Consultants, Ken Fromm, Loomia.
  • Published, 4 September 2004, at:

• 2: Exploring the Business Value of Semantic Interoperability
  • Irene Polikoff, TopQuadrant.

• 3: Implementing the Semantic Web
Semantics

- Semantics = a branch of linguistics that deals with the meaning of words and sentences
- Information Semantics = representation of meaning for computational systems and data
- Meaning changes by context and over time
Semantic Web

• an aggregation of websites and data stores
  – data with semantic markup
  – accessible semantic technologies and services

• Objective: improved response to information requests
  – better information relevance and confidence
  – automated rote search processes
  – intelligent reasoning and brokering agents

• critical infrastructure for the Semantic Web
  – conceptual frameworks
  – reference ontologies
  – well-understood contracts of interaction
Foundations of the Semantic Web

“The semantic web is not built on radical new technologies”

• established basis technologies
  – computer languages
  – information theory
  – (distributed) database management
  – model-based design
  – description logics

• “meaning” to software agents is based on well-defined formal structures stored with data
Semantic Interoperability

- a smaller problem than the Semantic Web
- use of semantic technologies and tooling to mediate data and meaning across contexts in a well-defined domain
- depends on reference models and dictionaries for the domain
Key components

• Technologies/languages
  – XML
  – RDF
  – OWL

• Reference “ontologies”
  – Taxonomies
  – Thesauri
  – Conceptual models (or schemas)
  – Logical theories
Ontology spectrum

weak semantics

strong semantics

Modal Logic
First Order Logic

Is Disjoint Subclass of with transitivity property

Logical Theory

Description Logic
DAML+OIL, OWL

Is Subclass of

Conceptual Model

UML

Is Subclass of

Semantic Interoperability

RDF/S
XTM

Has Narrower Meaning Than

Structural Interoperability

Extended ER
Thesaurus

ER

Syntactic Interoperability

DB Schemas, XML Schema

Taxonomy

Relational Model, XML

source: Daconta, Obrst, Smith

source: Daconta, Obrst, Smith
3 Dimensions of Semantic Computing

Adapted by Richard Murphy, GSA (and SICoP Member).
Relationship to Enterprise Architecture

• Three levels of interoperability
  – Organizational Interoperability:
    common goals, interacting business processes, collaborations
  – Technical Interoperability:
    common networks, middleware, representation
  – Semantic Interoperability:
    correct interpretation of exchanged information by recipient in context

• Semantic Interoperability is a major concern in the FEA Data Reference Model
Relationship to Service-Oriented Architecture

• Service-Oriented Architecture
  – information and services provided by Web services
  – service boundaries are explicit
  – services are autonomous
  – services share schema and contract
  – policy controls compatibilities

• Semantic interoperability
  – schema and contract have conceptual models
  – client and service share interpretation
  – compatibility by common interpretation
    (and conversion when technical schemas differ)
NIST/MEL Interoperability Program

• **Scope**
  – product and process engineering
  – manufacturing production and supply-chain operations

• **Standard schemas and service interfaces**

• **Testing**
  – standards conformance
  – interpretation consistency

• **Semantics**
  – ontologies for standard schemas and interfaces
  – tooling for ontology development and mapping
  – reasoners to support interpretation testing
Future SICoP Activities

• Mandates
  – The E-Government Act of 2002 (Categorization of Government Information)
  – The Federal Enterprise Architecture Data & Information Reference Model (DRM)
  – Selected Lines of Business (e.g., Data & Statistics and Federal Health Architecture)

• Activities
  – Individual E-Gov Initiatives and Agency Missions;
  – Coordination with Semantic Web Best Practices and Deployment Working Group
  – Semantic Technologies for eGovernment Conferences
SICoP Contacts

- Brand Niemann, EPA, SICoP co-chair
  - bniemann@cox.net, 1-202-236-6432
- Dr. Rick Morris, U.S. Army, OCIO (SICoP Co-Chair)
  - Rick.Morris@us.army.mil
- Harriet J. Riofrio, OASD NII DCIO IM (KMWG Co-Chair)
- Major contributors
  - Jie-hong Morrison, Computer Technologies Consultants, Inc.
  - Irene Polikoff and Ralph Hodgson, TopQuadrant, Inc.
  - Ken Fromm, Loomia, Inc.
  - Leo Obrst, The MITRE Corporation
  - Joram Borenstein, Unicorn Solutions, Inc.
  - Jeff Pollock, Network Inference, Inc.
  - Nancy G. Faget, U.S. Army Corps of Engineers
  - Mike Daconta, DHS
Websites

• CIO Council Knowledge Management WG
  http://www.km.gov

• Semantic Interoperability CoP (SICoP)
  http://www.web-services.gov
  (white papers, etc.)

• Collaboration site:
  http://colab.cim3.net
NIST Contacts

• Dr. Steven R. Ray
  – Chief, Manufacturing Systems Integration Division
  – Director, Manufacturing Interoperability Program
  – Steven.Ray@nist.gov, 1-301-975-3508

• Evan K. Wallace
  – Member, W3C Semantic Web Group
  – Chair, OMG Ontology SIG (Ontology Definition Metamodel)
  – ewallace@nist.gov, 1-301-975-3520

• Dr. Michael Gruninger
  – ISO Common Logic Model (SCL)
  – ISO 18629 Process Specification Language (PSL)
  – michael.gruninger@nist.gov, 1-301-975-6536

• Dr. Craig Schlenof
  – Automata service descriptions using OWL-S
  – schlenof@nist.gov