OWL-S Briefing

DAML Web Services Coalition

Presented by:
David Martin (SRI)

http://www.daml.org/services/
Objectives

• Status & roadmap
• Mini-Tutorial
• Gather requirements
• Invite / stimulate new contributions to Semantic Web Services
• Create a larger discussion around the hard problems
Top-level Outline

• Language status (40 min.)
  – OWL-S 1.0 (David Martin)
  – Security extensions (Grit Denker)

• Supporting products (Massimo Paolucci) (30)
  – Tools, demos, use cases

• Outreach & uptake (20)
  – Standardization efforts & strategies (Katia Sycara)
  – Users, workshops, books, papers (Terry Payne)

--- Break ---

• Open issues & challenges (Mark Burstein) (40)
• Roadmap for language evolution (David) (20)
DAML Services Coalition

**BBN:** Mark Burstein

**CMU:** Katia Sycara*, Massimo Paolucci*, Naveen Srinivasan

**De Montfort University:** Monika Solanki

**ICSI:** Srini Narayanan

**Maryland / College Park:** Bijan Parsia

**Nokia:** Ora Lassila

**SRI:** David Martin*

**Stanford KSL:** Deb McGuiness

**Southampton:** Terry Payne*

**Univ. of Toronto:** Sheila McIlraith*

**USC-ISI:** Jerry Hobbs

**Vrije Universiteit Amsterdam:** Marta Sabou

**Yale:** Drew McDermott

*Contributor to these slides*
Semantic Web Services Initiative (SWSI)

• Bring together US and European Semantic Web Services researchers
• Engage in collaborative standardization efforts
• Somewhat broader technology perspective
  – Semantic Web Services Language (SWSL)
    • OWL-S as a primary input
    • More attention to working with industry standards efforts
  – Semantic Web Services Architecture (SWSA)
    • WSMF as a primary input
Why Semantic Web Services?

500 million users
more than 3 billion pages

Static
WWW
URI, HTML, HTTP

Thanks to Dieter Fensel (U. of Innsbruck) for use of this material

David Martin for DAML-S Coalition 10/16/2003
Why Semantic Web Services?

Serious Problems in information
- finding
- extracting
- representing
- interpreting
- and maintaining

Static
WWW
URI, HTML, HTTP

Semantic Web
RDF, RDF(S), OWL

Thanks to Dieter Fensel (U. of Innsbruck) for use of this material
Why Semantic Web Services?

Static
- WWW
  - URI, HTML, HTTP

Dynamic
- Web Services
  - UDDI, WSDL, SOAP

Bringing the computer back as a device for computation

Semantic Web
- RDF, RDF(S), OWL
Why Semantic Web Services?

Bringing the web to its full potential

Dynamic

Web Services
UDDI, WSDL, SOAP

Static

WWW
URI, HTML, HTTP

Intelligent Web Services

Semantic Web
RDF, RDF(S), OWL

Thanks to Dieter Fensel (U. of Innsbruck) for use of this material
Top-level Outline

• Language status
  – OWL-S 1.0 (David Martin)
    • Profile, Process Model, Grounding: Overview, recent evolution, next steps for each
    • Release status
    • For more detail: ISWC Tutorial (Katia & Terry)
  – Security extensions (Grit Denker)

• Supporting products
• Outreach & uptake

--- Break ---

• Open issues & challenges
• Roadmap for language evolution
What is OWL-S?

• Ontology Web Language for Services

• An OWL ontology/language for (formally) describing properties and capabilities of Web services

• An approach that draws on many sources
  • Description logic
  • AI planning
  • Workflow
  • Formal process modeling
  • Agents
  • Web services

http://www.daml.org/services/
Layered Approach to Language Development

OWL-S: a major application of OWL
Future versions will build upon emerging layers (e.g. DAML-Rules)
OWL-S Objectives

Automation of service use by software agents

Ideal: full-fledged use of services never before encountered:
  Discovery, selection, composition, invocation, monitoring, ..

Useful in the “real world”

Compatible with industry standards
Incremental exploitation

Enable reasoning/planning about services
  e.g., On-the-fly composition

Integrated use with information resources

Ease of use; powerful tools
Automation Enabled by OWL-S

• Web service **discovery**
  Find me a shipping service that transports goods to Dubai.

• Web service **invocation**
  Buy me 500 lbs. powdered milk from www.acmemoo.com

• Web service **selection & composition**
  Arrange food for 500 people for 2 weeks in Dubai.

• Web service **execution monitoring**
  Has the powdered milk been ordered and paid for yet?
Key:

Grounding

Profile

Process Model

Development … Deployment … Use …

Verification

Simulation

Selection

Composition

Execution, Interoperation

Monitoring, Recovery

Publication

Discovery
Upper Ontology of Services

Ontology images compliments of Terry Payne, University of Southampton
Service Profile: “What does it do?”

High-level characterization/summary of a service

Used for

- Populating service registries
  - A service can have many profiles
- Automated service discovery
- Service selection (matchmaking)

One can derive:

- Service advertisements
- Service requests
Service Profile

Non Functional Properties

Functionality Description
Service Profile: Functionality Description

• Functional Specification of what the service provides in terms of **parameters**, subclassed as:
  – **preconditions**
  – **inputs**
  – **outputs**
  – **effects**

• Summarizes the top-level Process
Service Profile: NonFunctional Properties

- Provides supporting information about the service.
Service Profile: Styles of use

• Class hierarchical yellow pages
  – Implicit capability characterization
  – Arrangement of attributes on class hierarchy
  – Can use multiple inheritance
  – Relies primarily on “non-functional” properties

• Process summaries for planning purposes
  – More explicit
  – Inputs, outputs, preconditions, effects
  – Less reliance on formal hierarchical organization
  – Summarizes process model specs
  – Relies primarily on functional description
Exploiting Profile Hierarchies

Tie in with UDDI, UNSPSC, ...

DL Basis for matchmaking

Multiple profiles; multiple taxonomies
Profile: Recent Evolution

- IOPE Changes
  - Inputs, Outputs, Preconditions, Effects
  - Better integrated with Process Model
  - Relationship to Process Model clearer

- Better modularization
Profile: Issues

• Relationship to Process Model may need further clarification
• OWL is well-suited to characterizing & classifying services
• But greater expressiveness needed for many things (contracting & negotiation)
Upper Ontology of Services
Process Model: “How does it work?”

Process
- Interpretable description of service provider’s behavior
- Tells service user how and when to interact (read/write messages)

& Process control
- Ontology of process state; supports status queries
- (stubbed out at present)

• Used for:
  - Service invocation, planning/composition, interoperation, monitoring

• All processes have
  - Inputs, outputs, preconditions and effects
  - Function/dataflow metaphor; action/process metaphor

• Composite processes
  - Control flow
  - Data flow
Service Model / Process Model
Simple and Composite Processes

AcmeTruckShpng

ExpandedAcmeTruckShpng

Acme
Truck
Shipping
Service

expands

Confirm Shipping Region

N

truck available +
valid credit card

Y

Get Quote

Get Shipping Dates

Book Truck Shipment
Process Model: Recent Evolution

• Change to Processes-as-Instances
  – Pros
    • Simplified the means of expressing many things
    • Far more readable
    • More intuitive (for some of us)
    • PAC kept forcing us into OWL Full (or worse?)
  – Cons
    • Representation & reasoning of “execution traces” requires new work

• New IOPE constructs

• Simplification (IOPEs, deletion of synonyms)
Process Model: Next Steps

- New proposals for
  - Conditional (bundled) O/E
  - Faults
  - Nicer conditional statements
  - Synchronization constructs
  - More explicit messaging
  - Dataflow
  - Surface syntax
Process Model: Other issues

• Standardization efforts
• Grid / OGSA tie-in
• More clarity needed on options for expressing conditions/ effects
• Execution traces
• Process control (lifecycle) / monitoring
Upper Ontology of Services
Service Grounding: “How to access it”

- Implementation-specific
- Message formatting, transport mechanisms, protocols, serializations of types
- Service Model + Grounding give everything needed for using the service
- Builds upon WSDL
OWL-S / WSDL Grounding

• Web Services Description Language
  – Authored by IBM, Ariba, Microsoft
  – Focus of W3C Web Services Description WG
  – Commercial momentum
  – Specifies message syntax accepted/generated by communication ports
  – *Bindings* to popular message/transport standards (SOAP, HTTP, MIME)
  – Abstract “types”; extensibility elements

• *Complementary* with OWL-S
OWL-S / WSDL Grounding

OWL-S
- Process Model
  - Atomic Process
    - Operation
    - Inputs / Outputs
- Resources/Concepts
  - Message
  - Binding to SOAP, HTTP, etc.

WSDL

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10/16/2003
OWL-S / WSDL Grounding (cont’d)
OWL-S / WSDL Grounding (cont’d)

WSDL Document

- <message ...
- <part ...
- <message ...
- <part ...
- <operation ...
- <binding ...

Atomic Process

- inputX
- outputY

owl-property

owl-s-parameter

owl-s-process
Grounding: Recent Evolution

• Minor adjustments for Processes-as-Instances
• Proposal to correlate conditional outputs with WSDL fault messages
Grounding: Issues

Issue: waiting for WSDL

– May generate new WSDL requirements
  (e.g. for conditional inputs)
Review: Upper Ontology of Services
Global Issues

• How to use the language we have
  – Sometimes convoluted representations
  – How much DL-based reasoning do we need?

• How to go beyond the language we have
  – Modular approach
  – Does OWL Full use preclude extensions, and how significant is this?

• Compatibility with (commercial) Web Services

• Making the case for SWS
DAML-S/OWL-S Path of Evolution

Release 0.5 (May 2001)
  Initial Profile & Process ontologies

Release 0.6 (December 2001)
  Refinements to Profile & Process; Resources ontology

Release 0.7 (October 2002)
  Initial DAML-S/WSDL Grounding;
  Profile, Process Model refinements; more complete examples

Release 0.9 (May 2003)
  Grounding: greater generality, flexibility
  Initial work on expressing conditions, security
  More community support (contributions pages)

Release 1.0 (October 2003)
  DAML-S ➔ OWL-S completed
  Processes-as-instances
  New IOPE classes
  Initial version of surface syntax
  Profile reorganization
1.0 Beta Release

- Under construction
  - Core ontology files
  - Not all documentation is complete
- OWL-final
- Profile
- Process Model
- Grounding

www.daml.org/services/owl-s/1.0