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

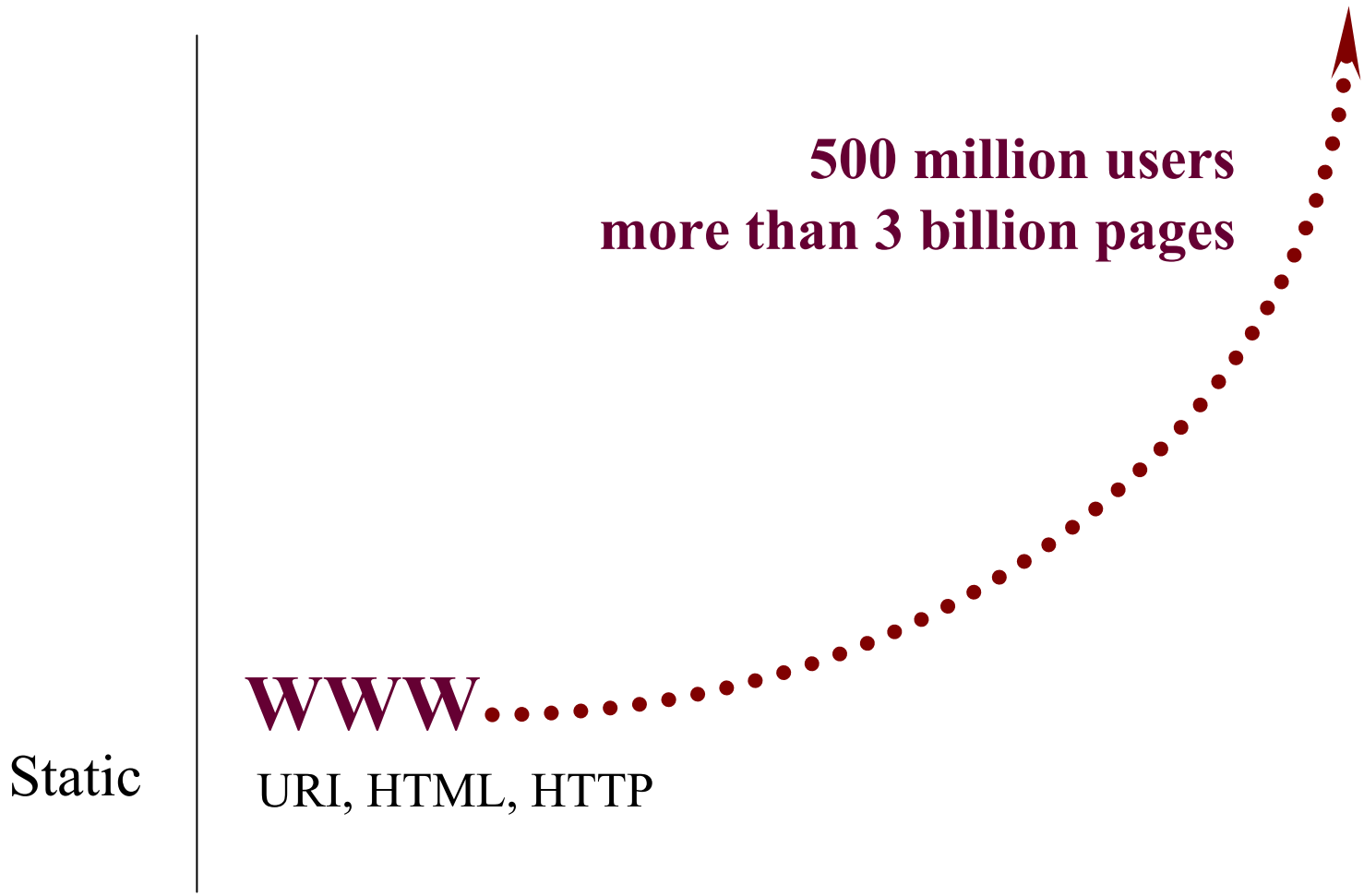
Yale: Drew McDermott

*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?



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

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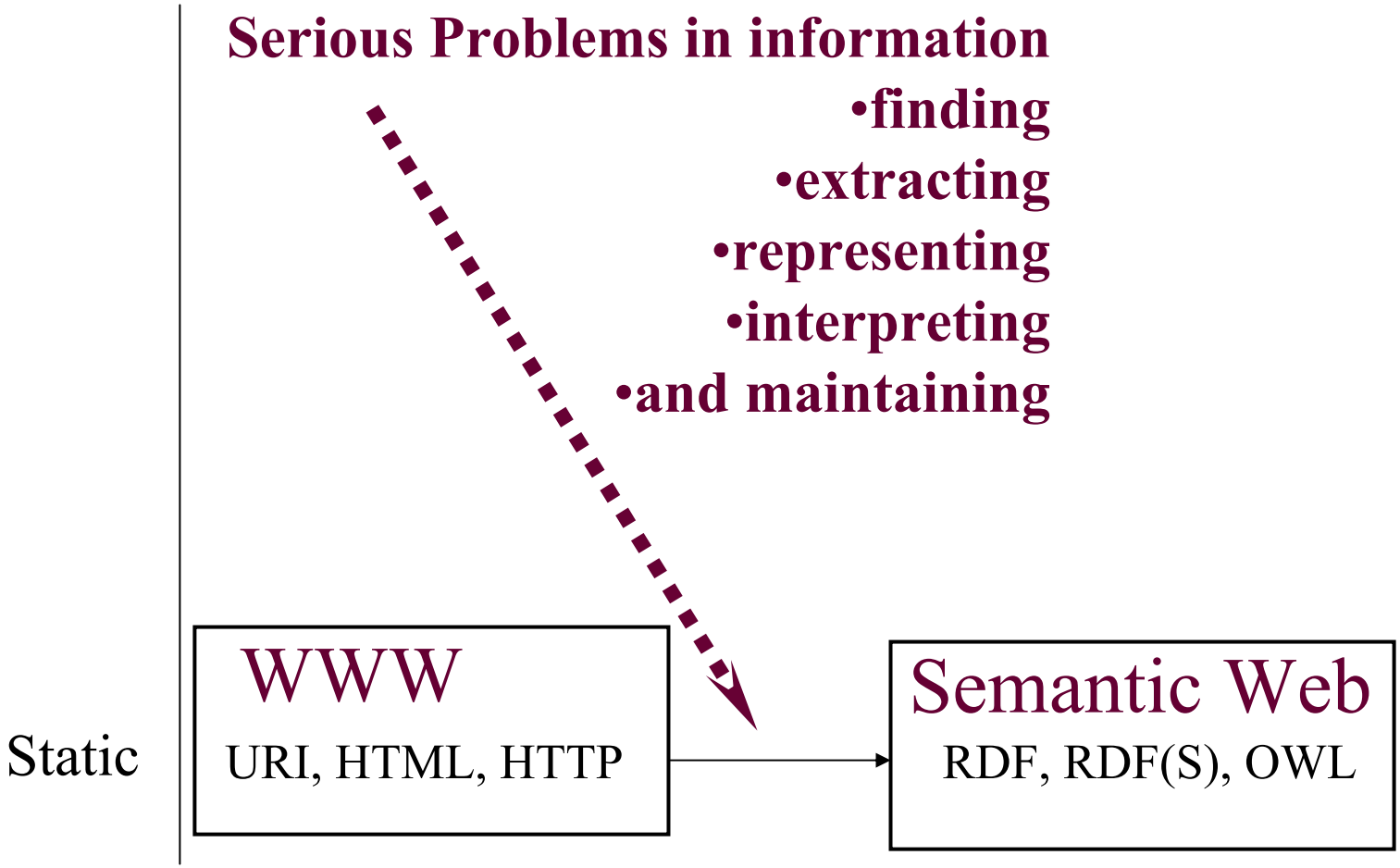

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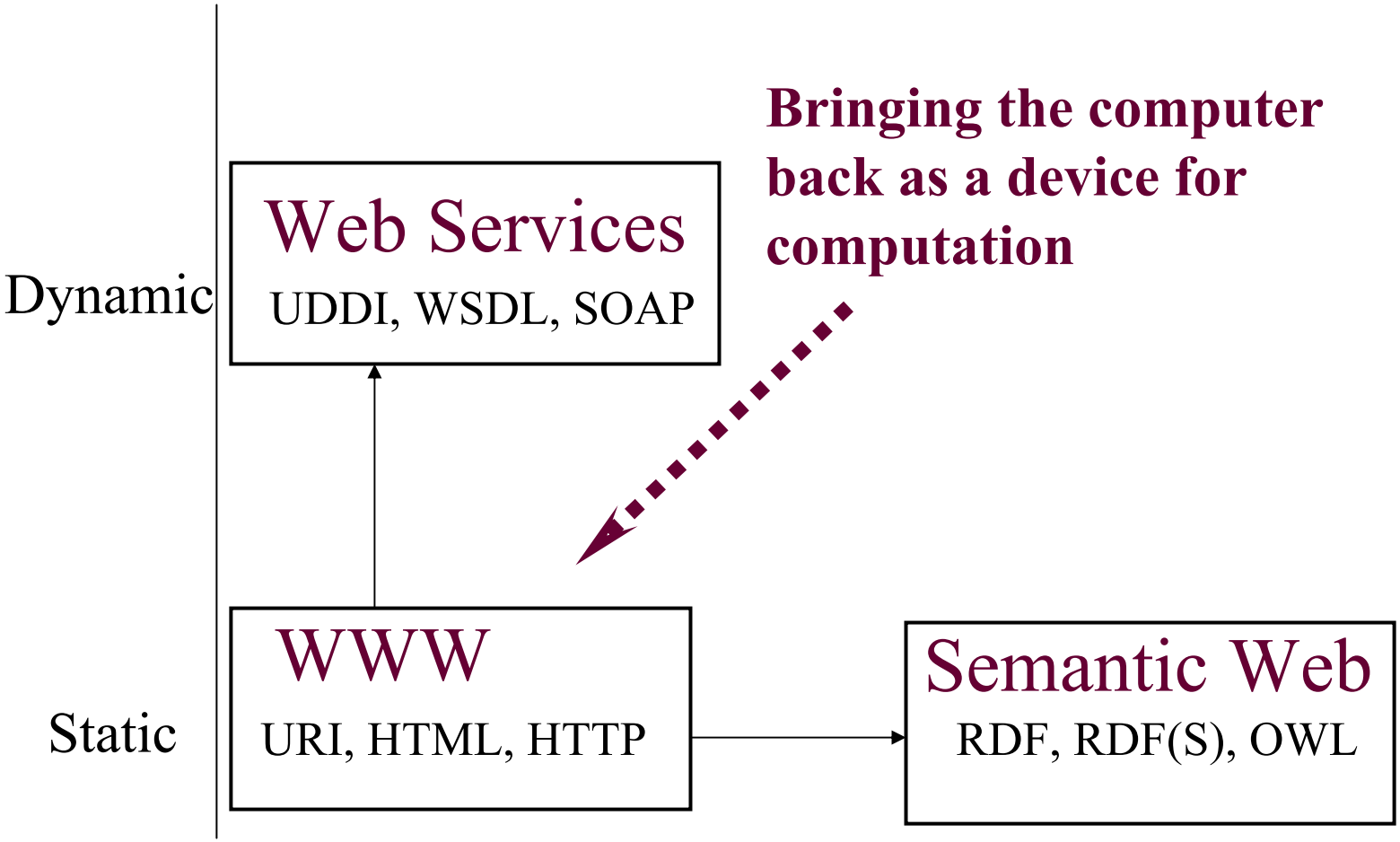

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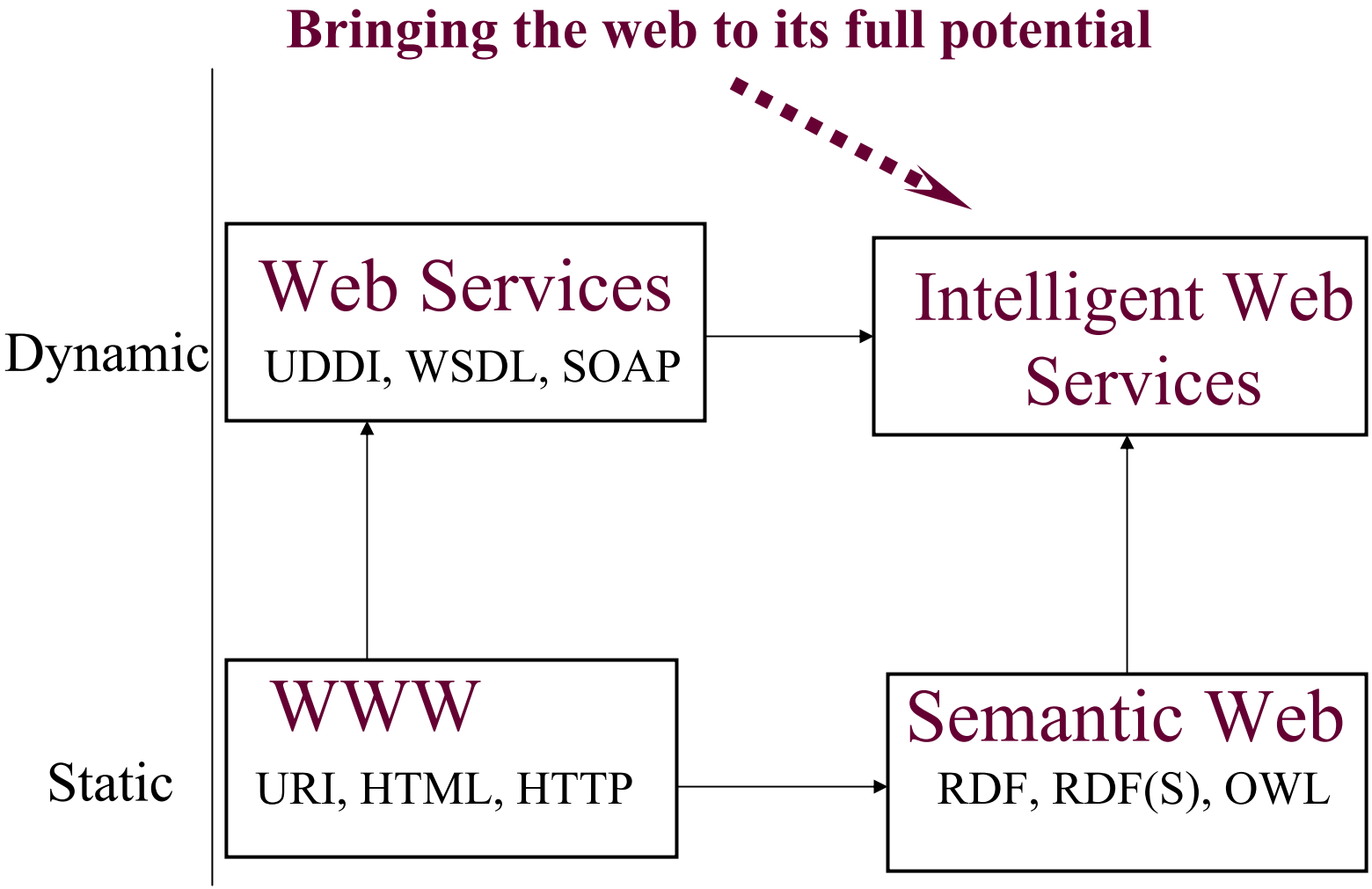

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Top-level Outline

- **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?

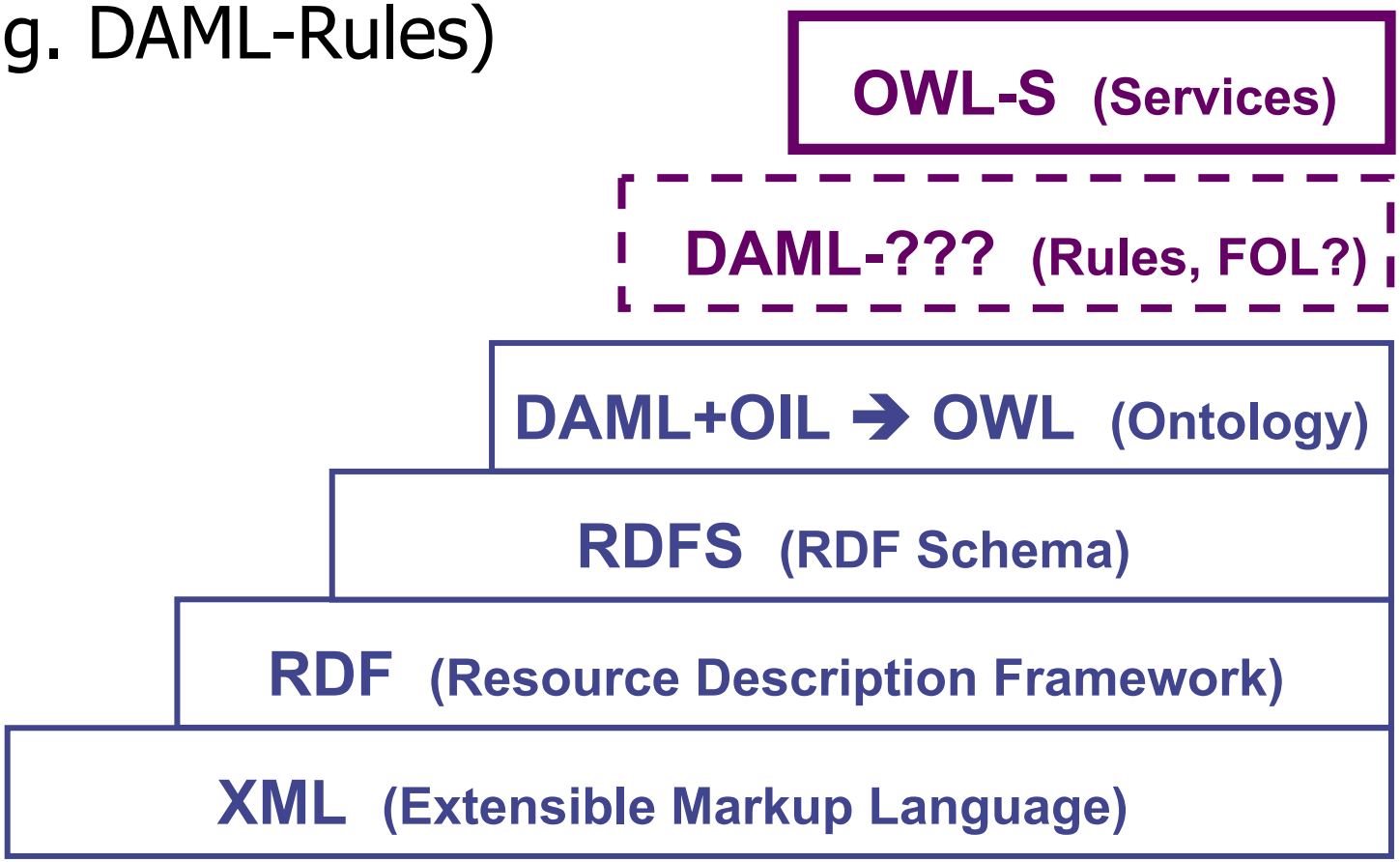
- Ontology Web Language for Services
- An OWL ontology/language for (formally) describing properties and capabilities of Web services
- An approach that draws on many sources
  - Description logic
  - AI planning
  - Workflow
  - Formal process modeling
  - Agents
  - Web services

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

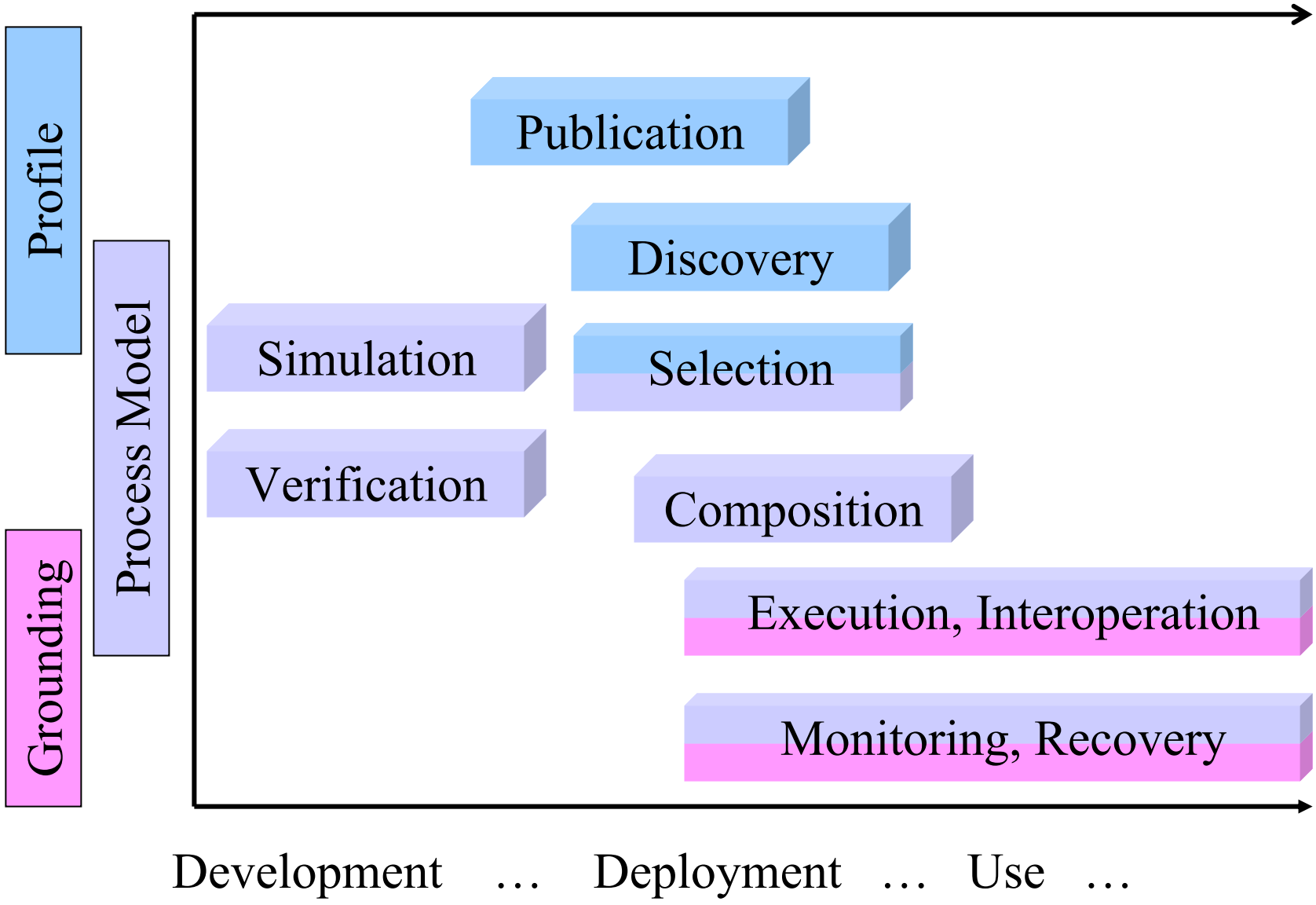
- Web service selection & composition

  Arrange food for 500 people for 2 weeks in Dubai.

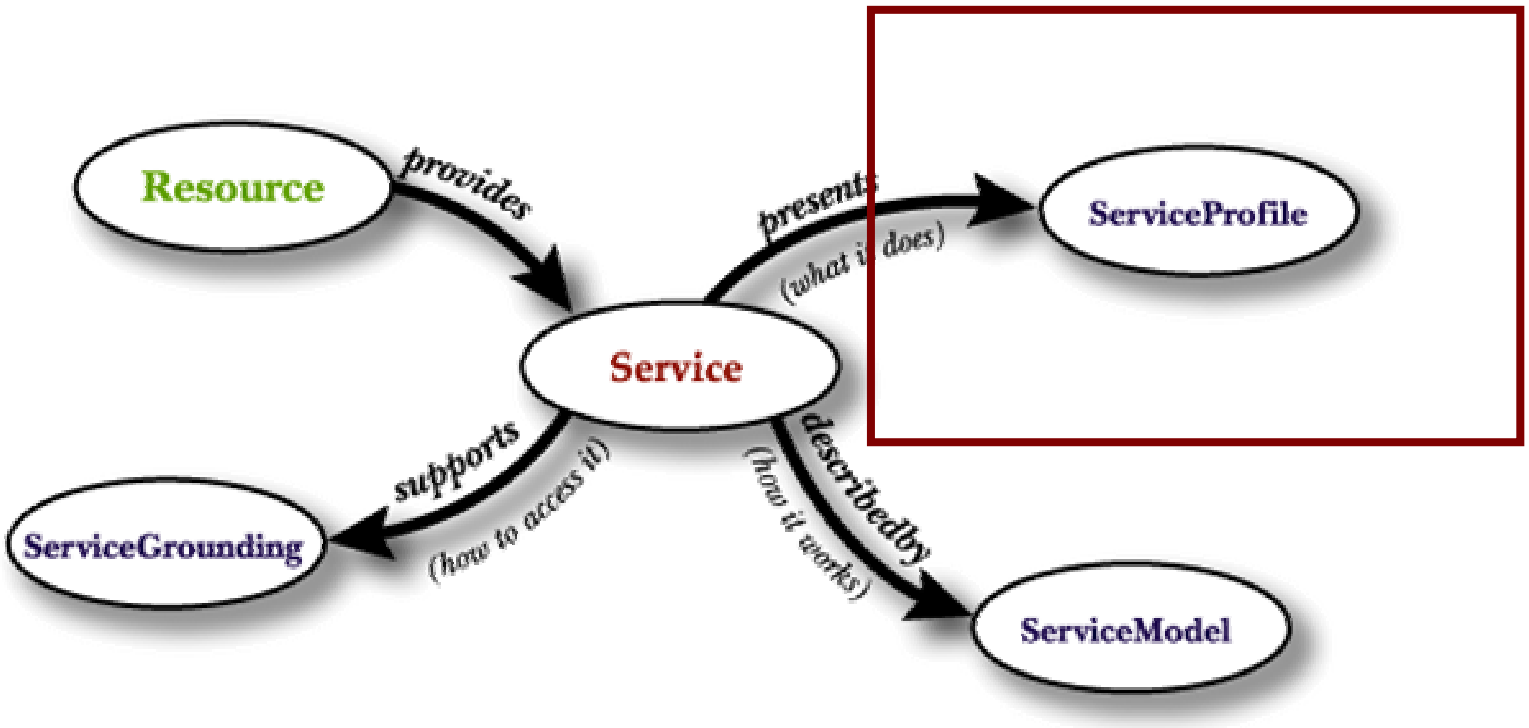
- Web service execution monitoring

  Has the powdered milk been ordered and paid for yet?

Key:


Profile
Process Model
Grounding
Publication
Discovery
Simulation
Selection
Verification
Composition
Execution, Interoperation
Monitoring, Recovery
Development … Deployment … Use …

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

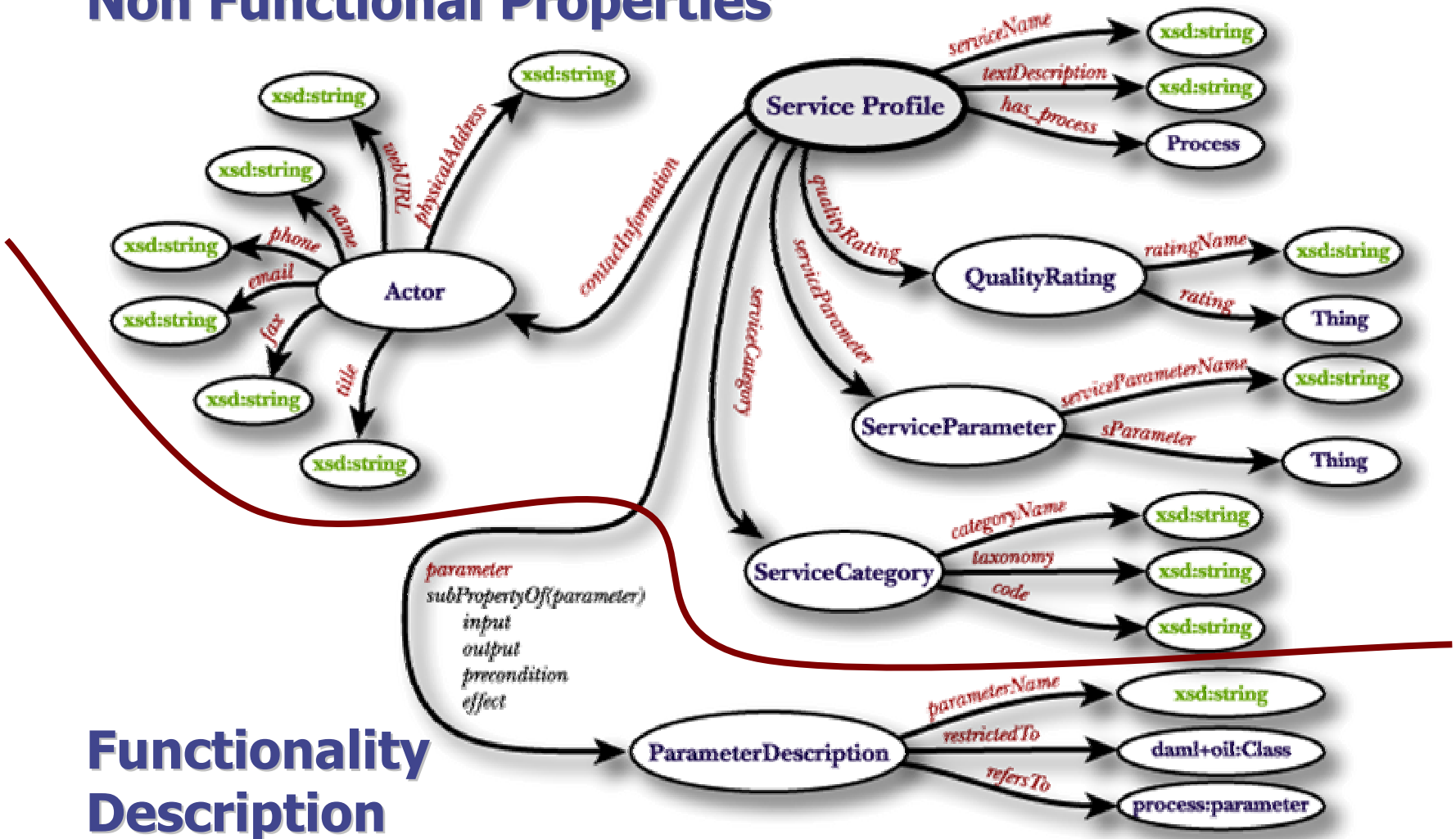
- Populating service registries
  - A service can have many profiles
- Automated service discovery
- Service selection (matchmaking)

One can derive:

- Service advertisements
- Service requests

Service Profile

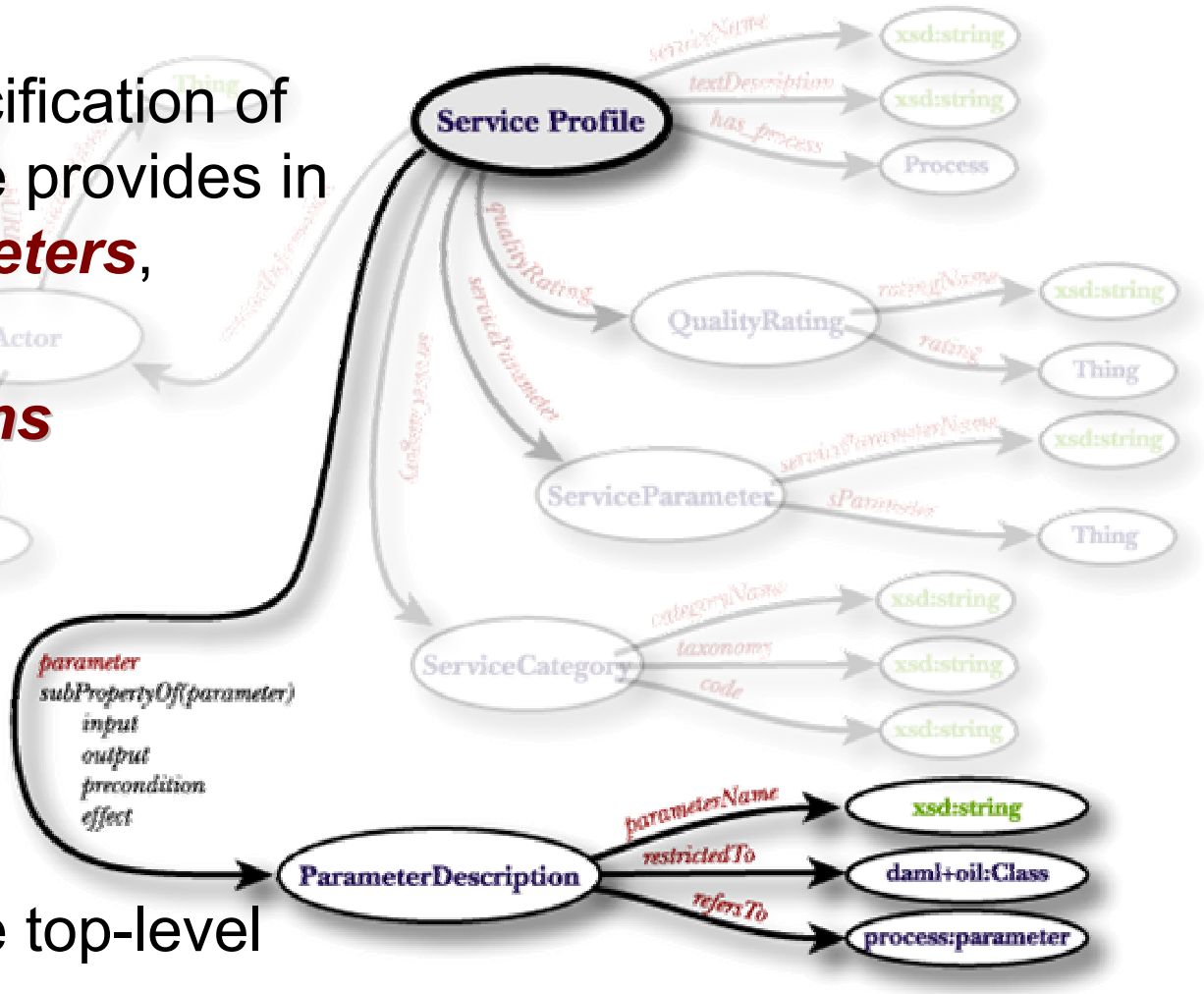
Non Functional Properties



Functionality Description

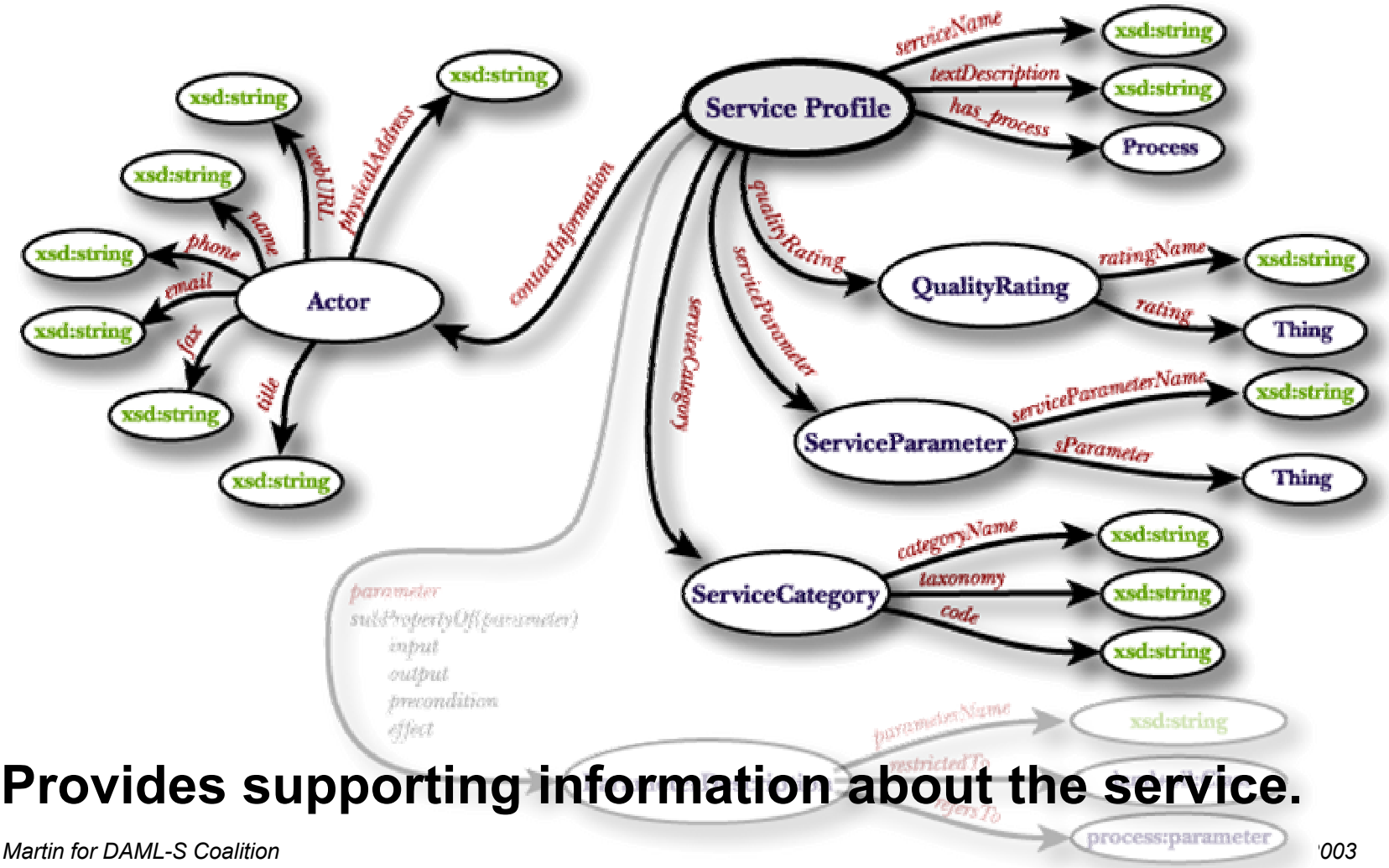
Service Profile: Functionality Description

- 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

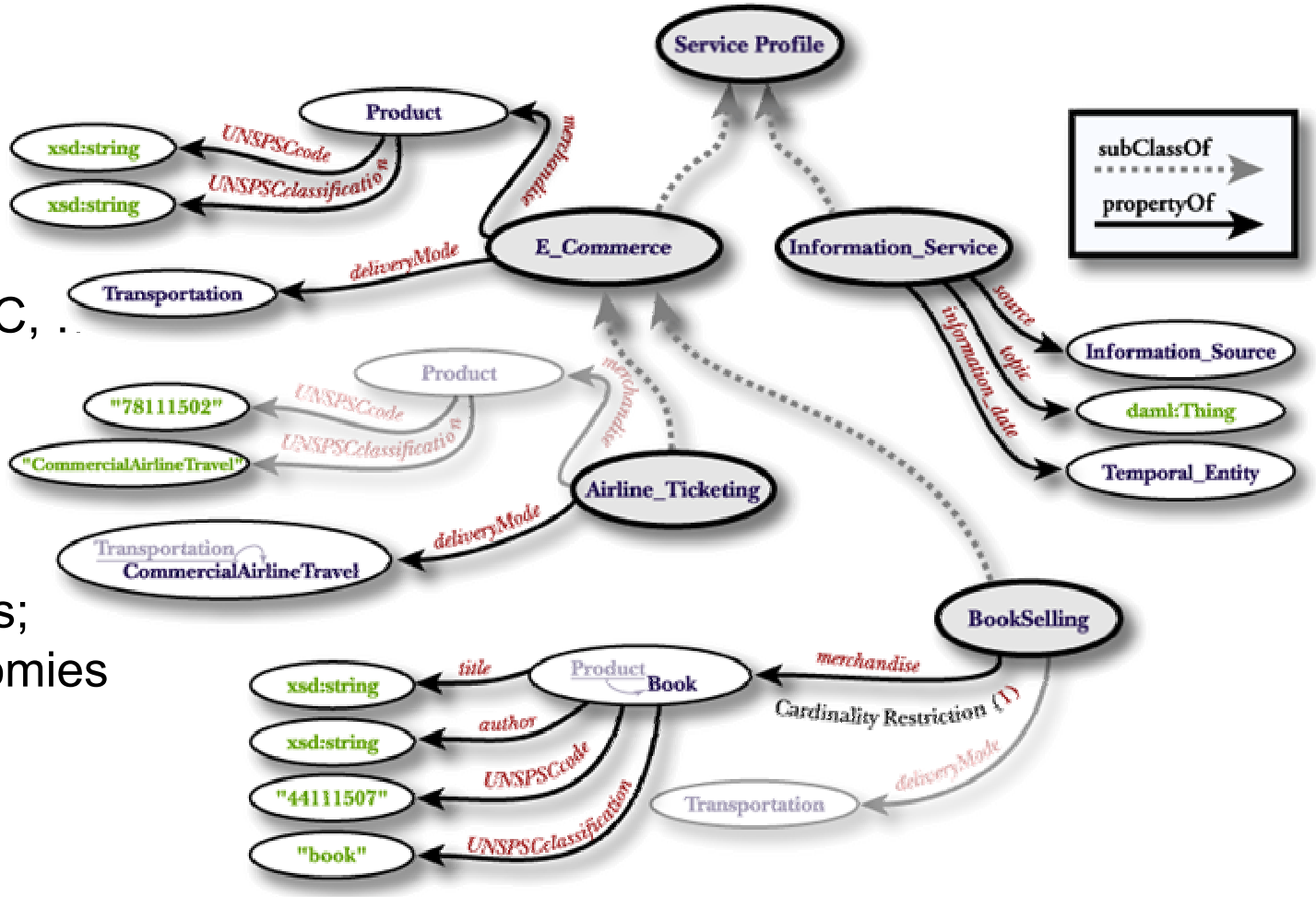
- Class hierarchical yellow pages
  - Implicit capability characterization
  - Arrangement of attributes on class hierarchy
  - Can use multiple inheritance
  - Relies primarily on “non-functional” properties
- Process summaries for planning purposes
  - More explicit
  - Inputs, outputs, preconditions, 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



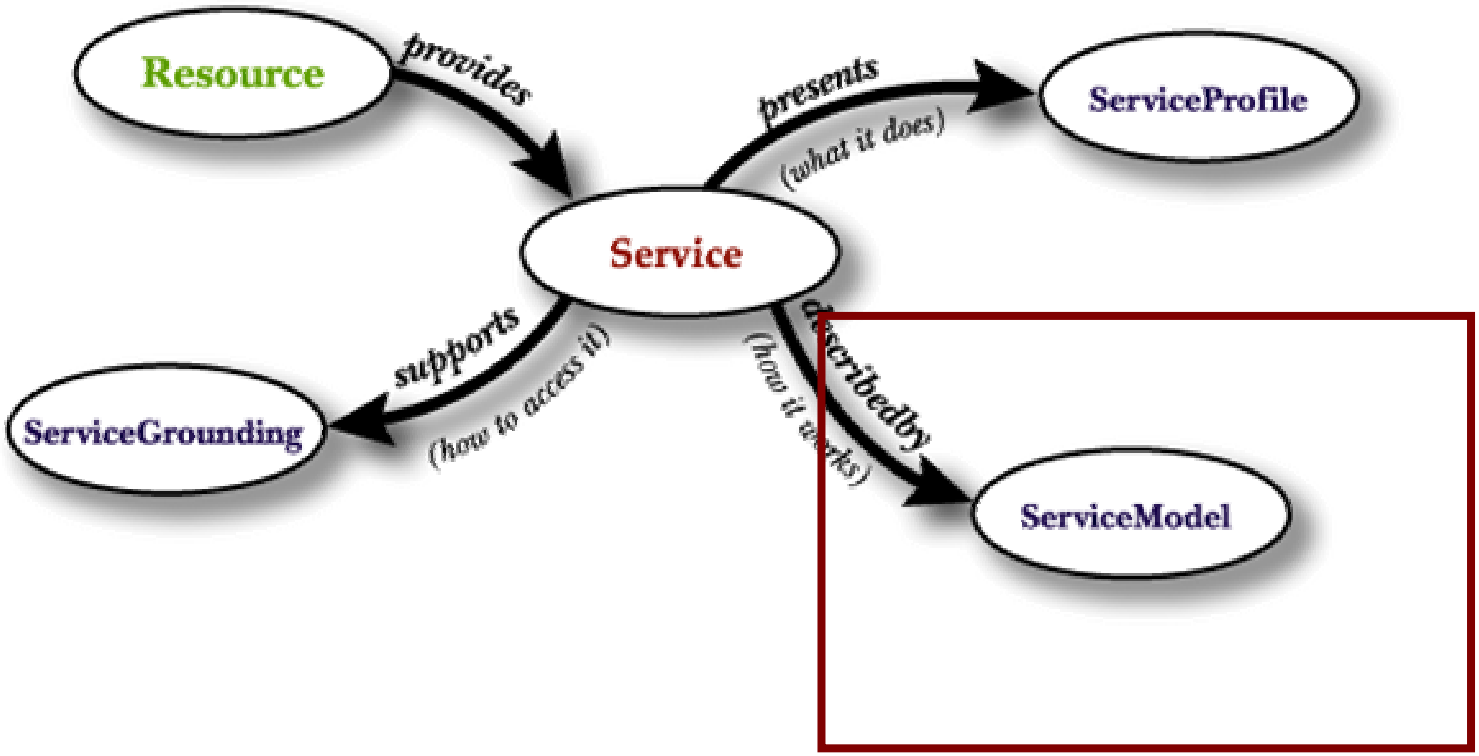
Profile: Recent Evolution

- 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



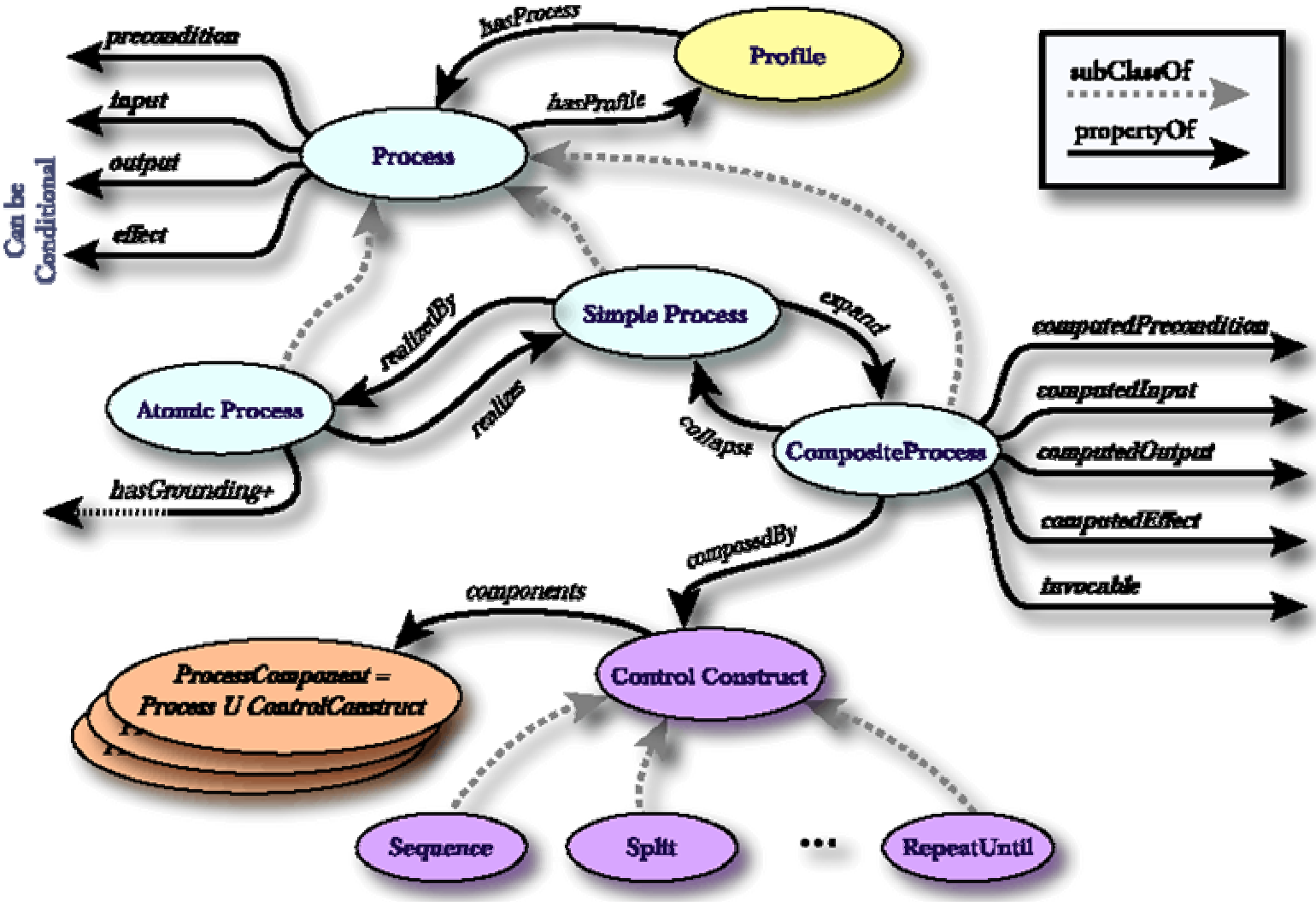
Process Model: "How does it work?"

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

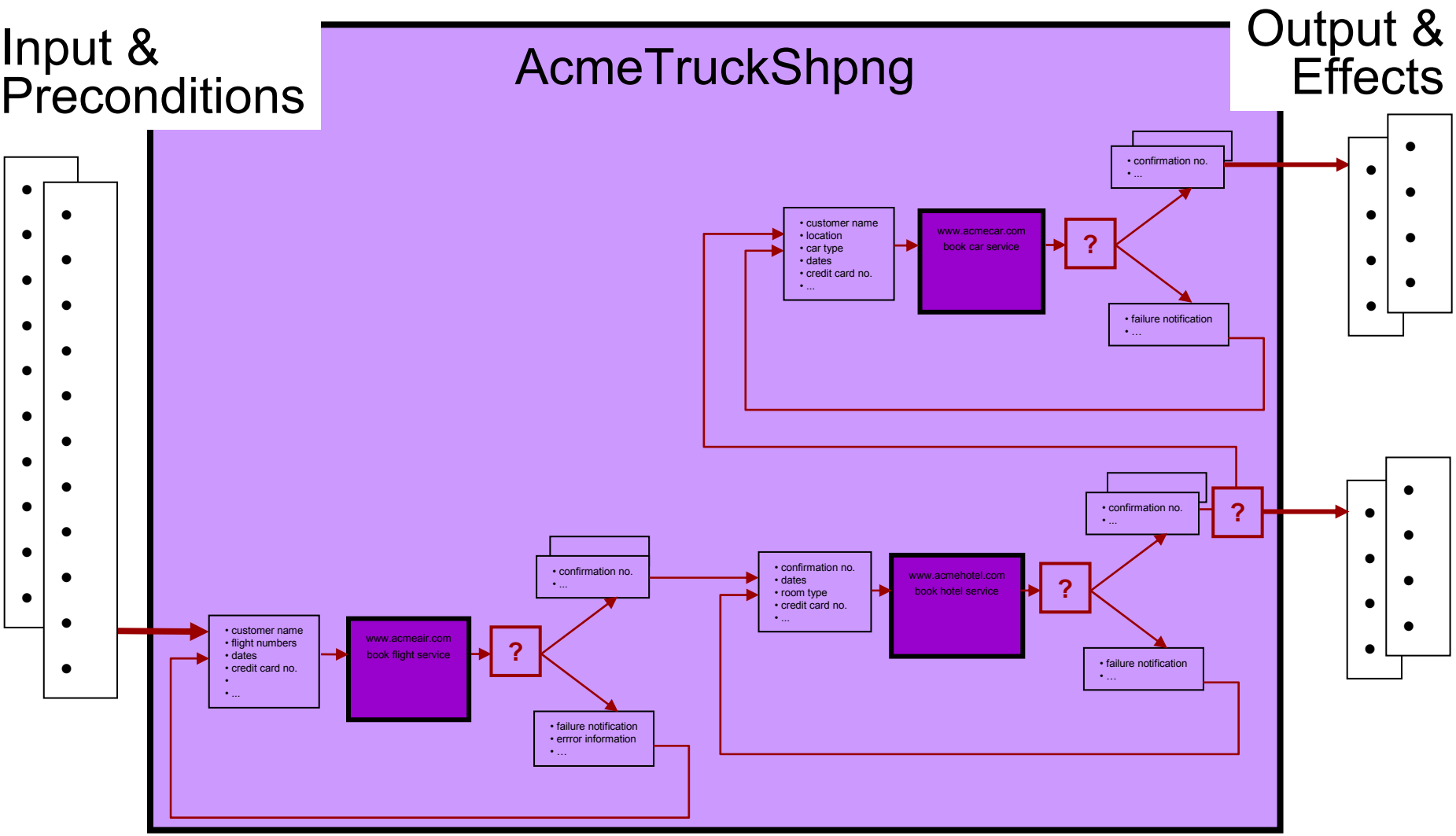
& Process control
- Ontology of process state; supports status queries
- (stubbed out at present)

- 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



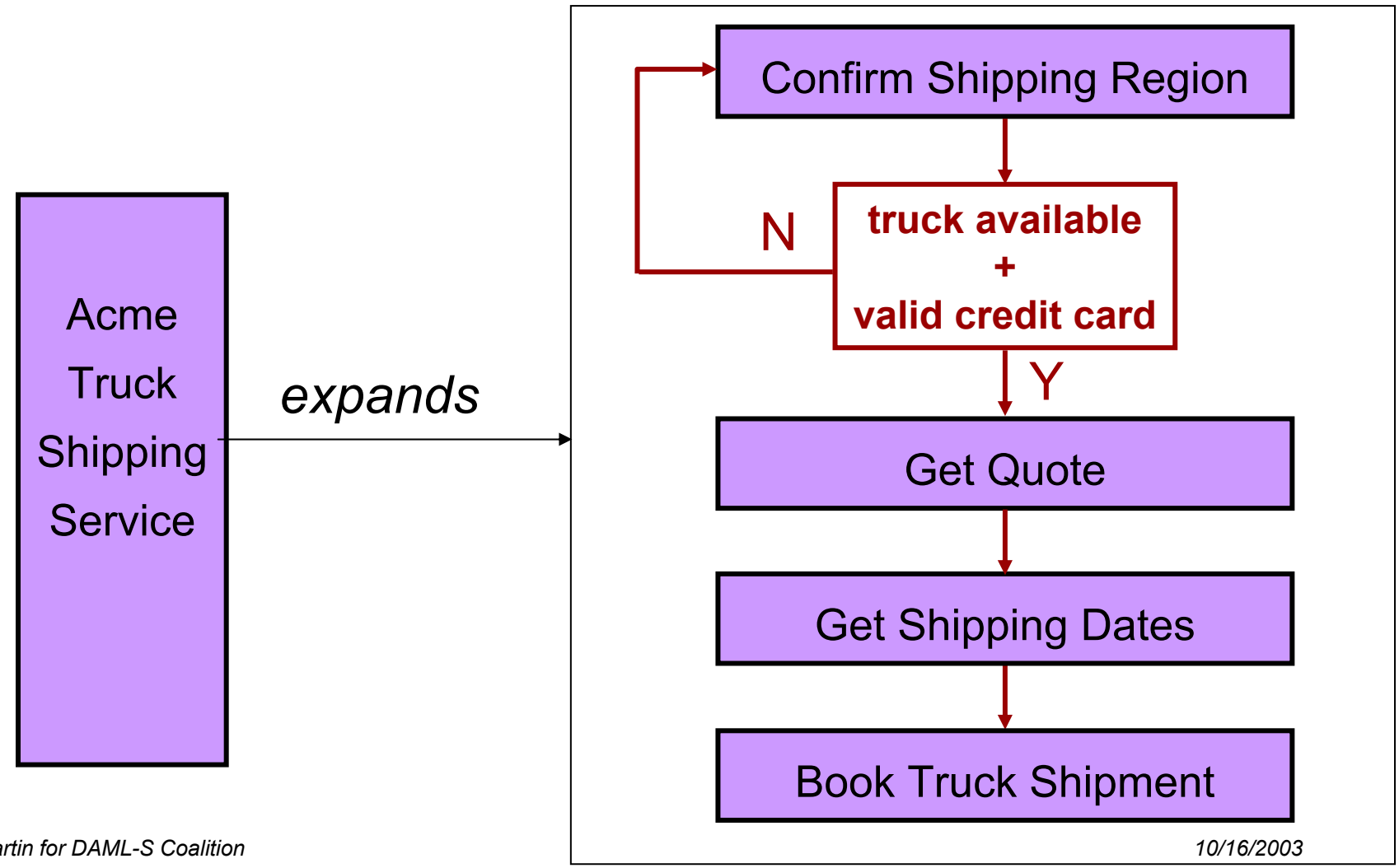
Composite Process



Simple and Composite Processes

AcmeTruckShpng

ExpandedAcmeTruckShpng



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)**

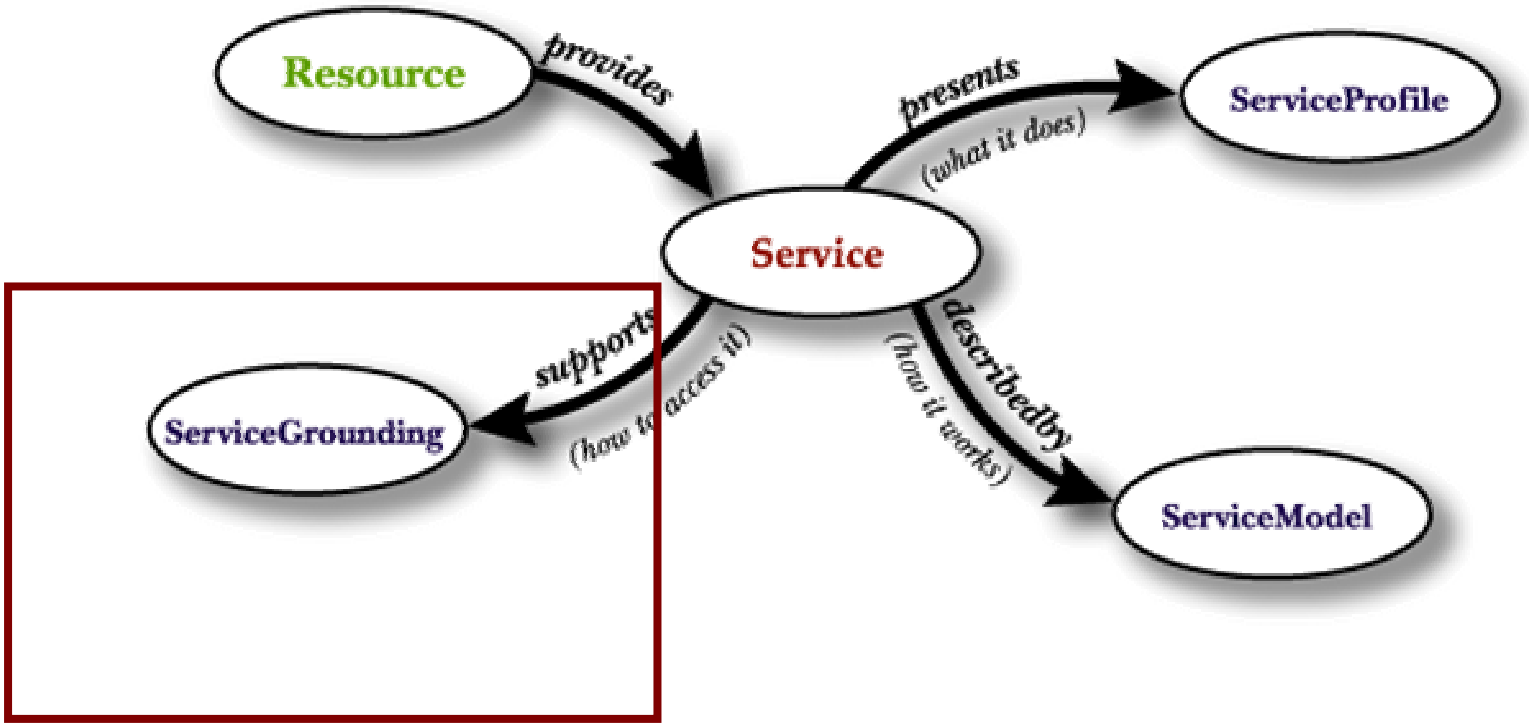
Process Model: Next Steps

- **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



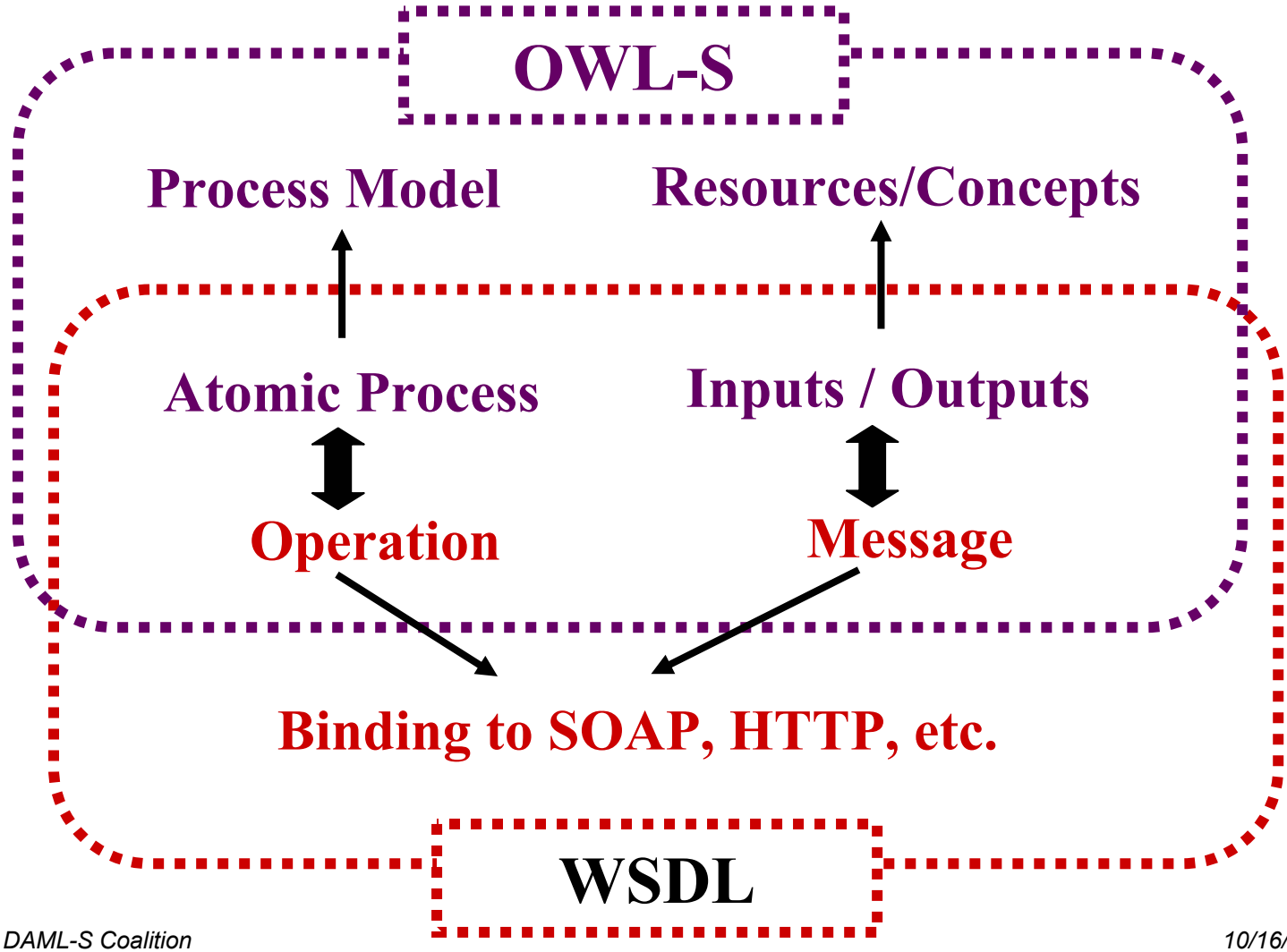
Service Grounding: "How to access it"

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

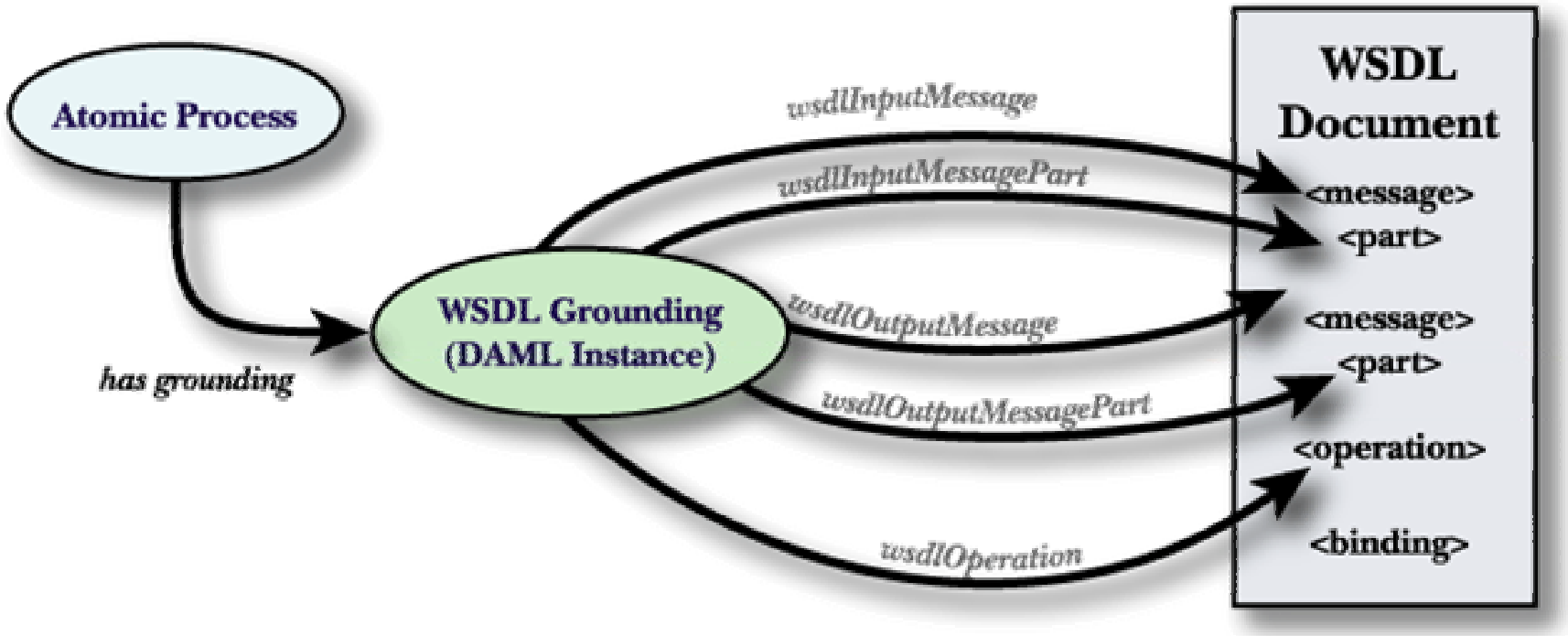
OWL-S / WSDL Grounding

- 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

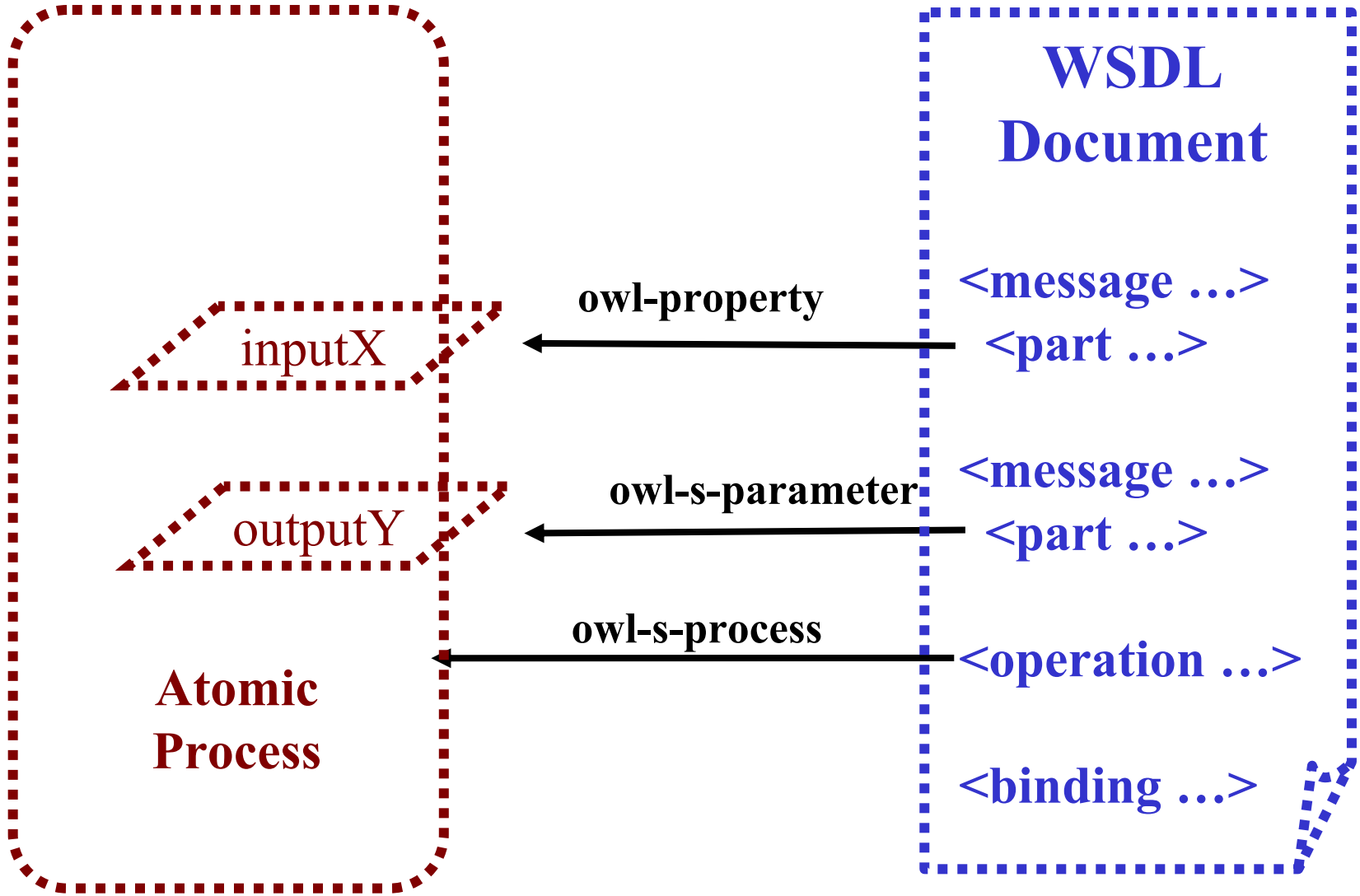
OWL-S / WSDL Grounding



OWL-S / WSDL Grounding (cont'd)



OWL-S / WSDL Grounding (cont'd)



Grounding: Recent Evolution

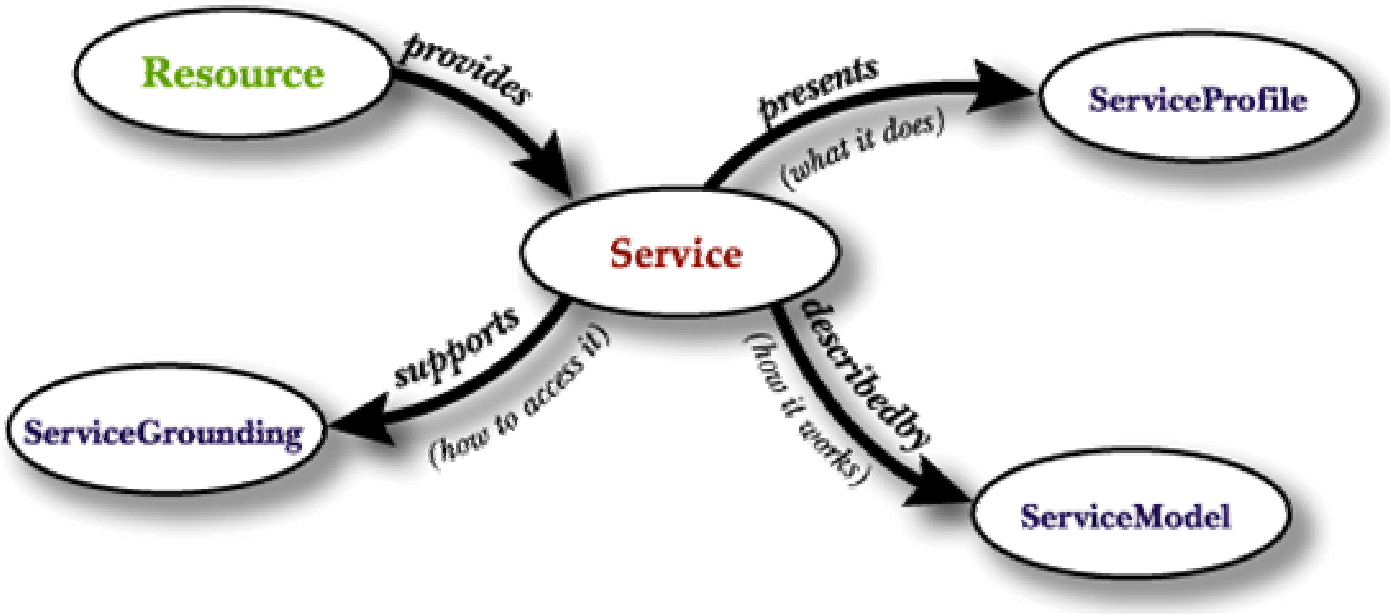
- Minor adjustments for Processes-as-Instances
- Proposal to correlate conditional outputs with WSDL fault messages

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