

Bringing Services to
the Semantic Web
and
Semantics to Web Services

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Outline

Motivation, Objectives, Requirements
Relevant Work
Initial Questions
Membership

Convergence on Services

- Commercial vendors, media, forecasters, etc.
 - *Intra*nets, not just *intemets*
- W3C Web services efforts
- Semantic Web community
 - DAML-S; WSMF & other EU efforts
 - ISWC: 10 services-related papers, 7 posters
- Grid computing (OGSA)
- Ubiquitous computing (devices)
 - Mobile access to services
- è A remarkable opportunity (and challenge)
 - Bringing “behavioral intelligence” to the Web

High-level Objectives

Bring semantics to (mainstream) Web services

Enable "intelligent" Web services

Design how Web services will work on the
Semantic Web

Provide a longer-term perspective to the Web
services standards community

Bring mature research (from several fields) to
Web services standards efforts

Technical Objectives (Mid-Term)

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

- Constraint satisfaction
- On-the-fly composition

Integrated use with information resources

- Databases, knowledge bases

Ease of use; powerful methodologies & tools

Technical Objectives (Longer-Term)

Verification of correctness of operation of a service

Automatic negotiation of service contracts

Non-cooperative services

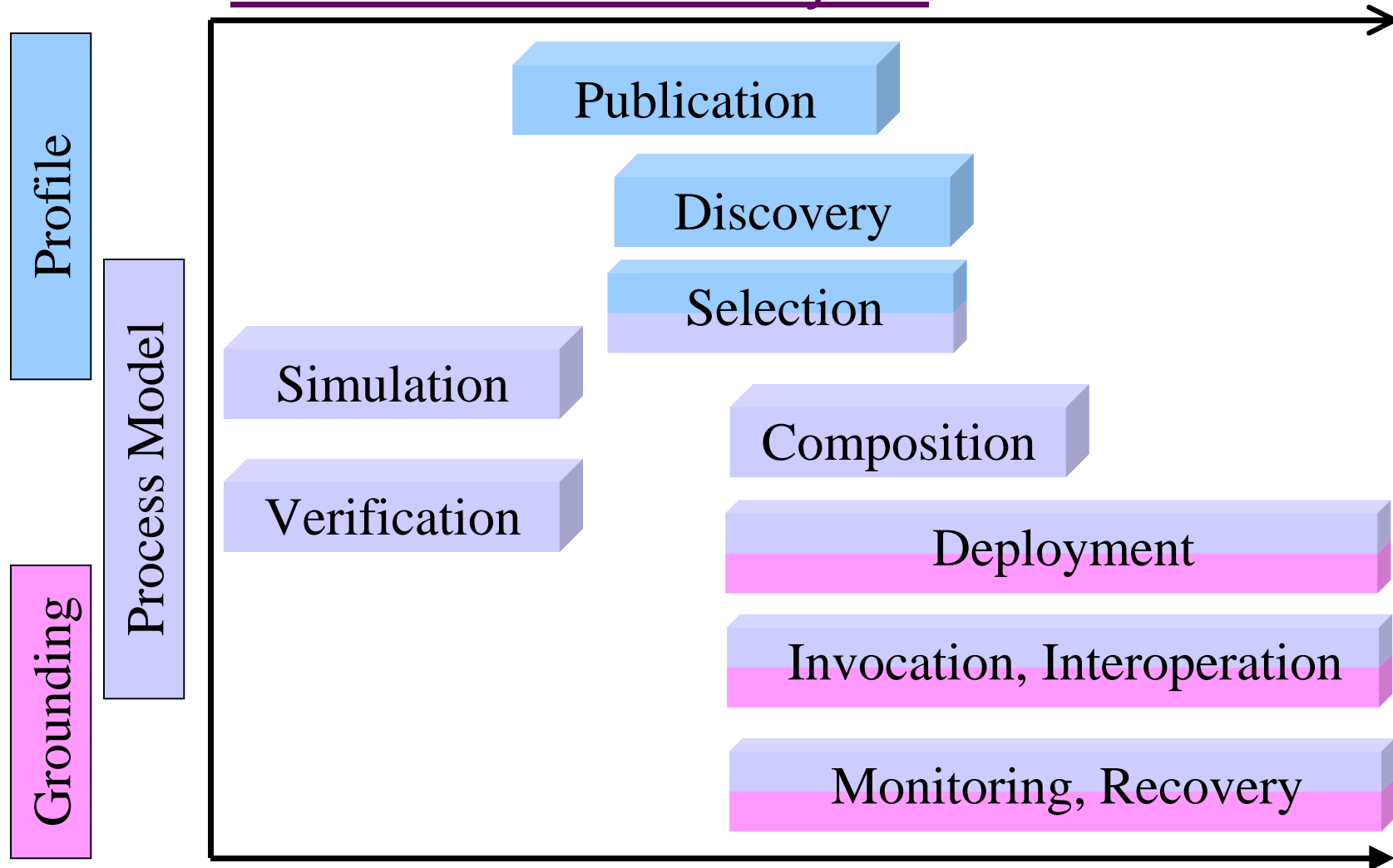
Enabling virtual enterprises

Automation Enabled by Semantic Web Services

- 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:

Web Service Lifecycle



Development ... Deployment ... Use ...

Technology sources

KR: Knowledge Representation, Logic

- description logics, DAML+OIL, OWL
- PSL

PL: Programming Languages

- theory (including operational semantics)
- design, tools
- software verification

P: Planning

- PDDL, HTN approaches

PM: Process Modeling & Execution

- process algebras, pi-calculus
- workflow
- industry process modeling efforts, BPML, WSFL, XLANG, BPEL4WS, ...

SE: Software Engineering

- Automated Software Engineering

SA: Software Agents

- BDI approaches
- Negotiation
- Non-cooperation, adversity

DB: Databases

- Transactions (CTL)

WS: Web Services

What are WS Semantics?

- Formal descriptions that enable automation of service creation, discovery, use, etc.
 - Supports reasoning
 - Verification
- Conceptual frameworks in which to formally analyze, verify
 - CTL, F-Logic, GOLOG, CTR, Pi Calculus, operational semantics, etc.

Which should we do?

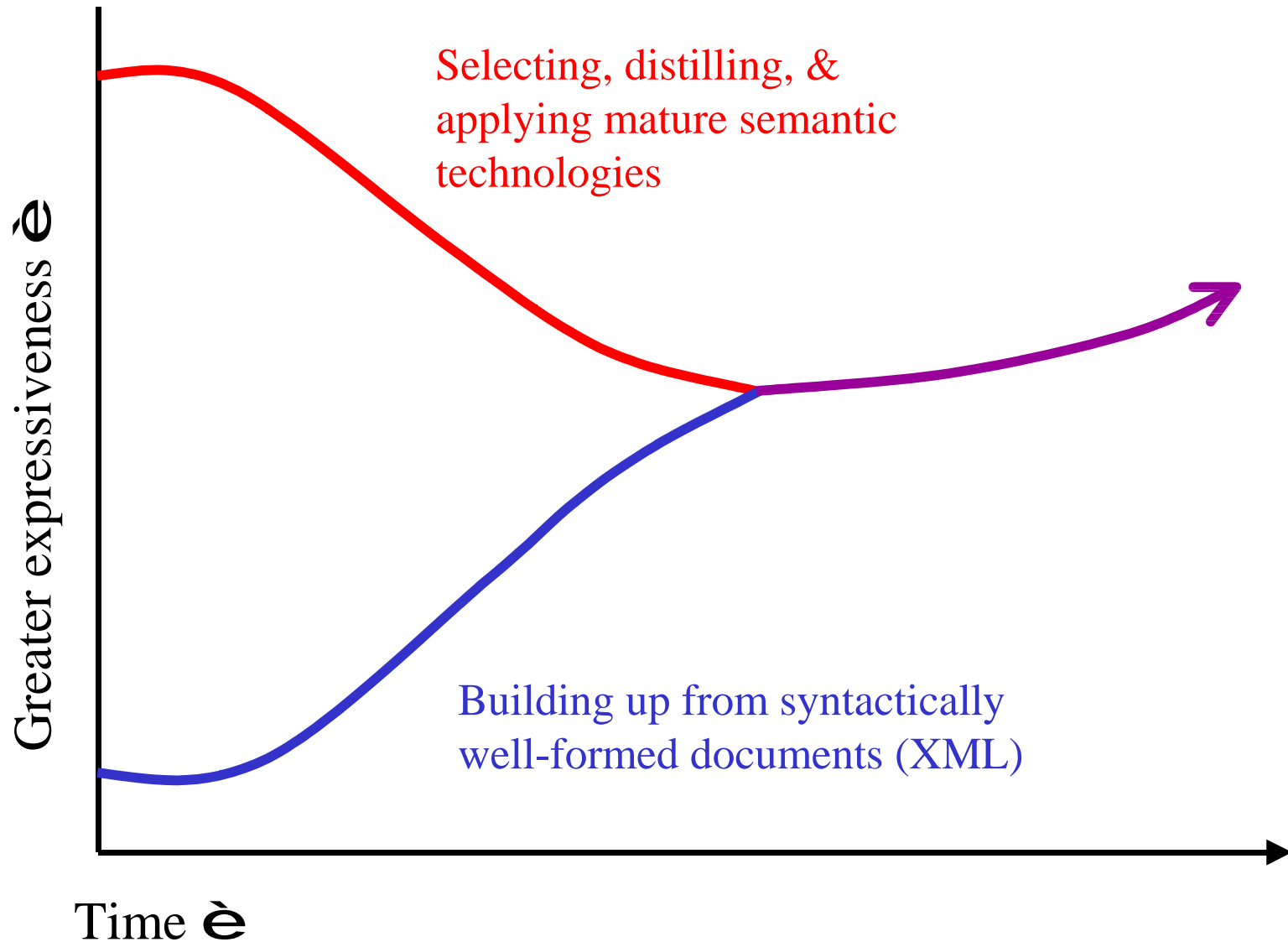
What are the roles of ontologies in SW Services?

- A natural way to express some aspects of service descriptions
 - Classifying services for purposes of advertising, discovery, matchmaking
 - But not so clear for process modeling
- Typing
 - In particular, of inputs and outputs
- “Data model” or “internal representation”
 - Interlingua
 - Useful for tools, etc.

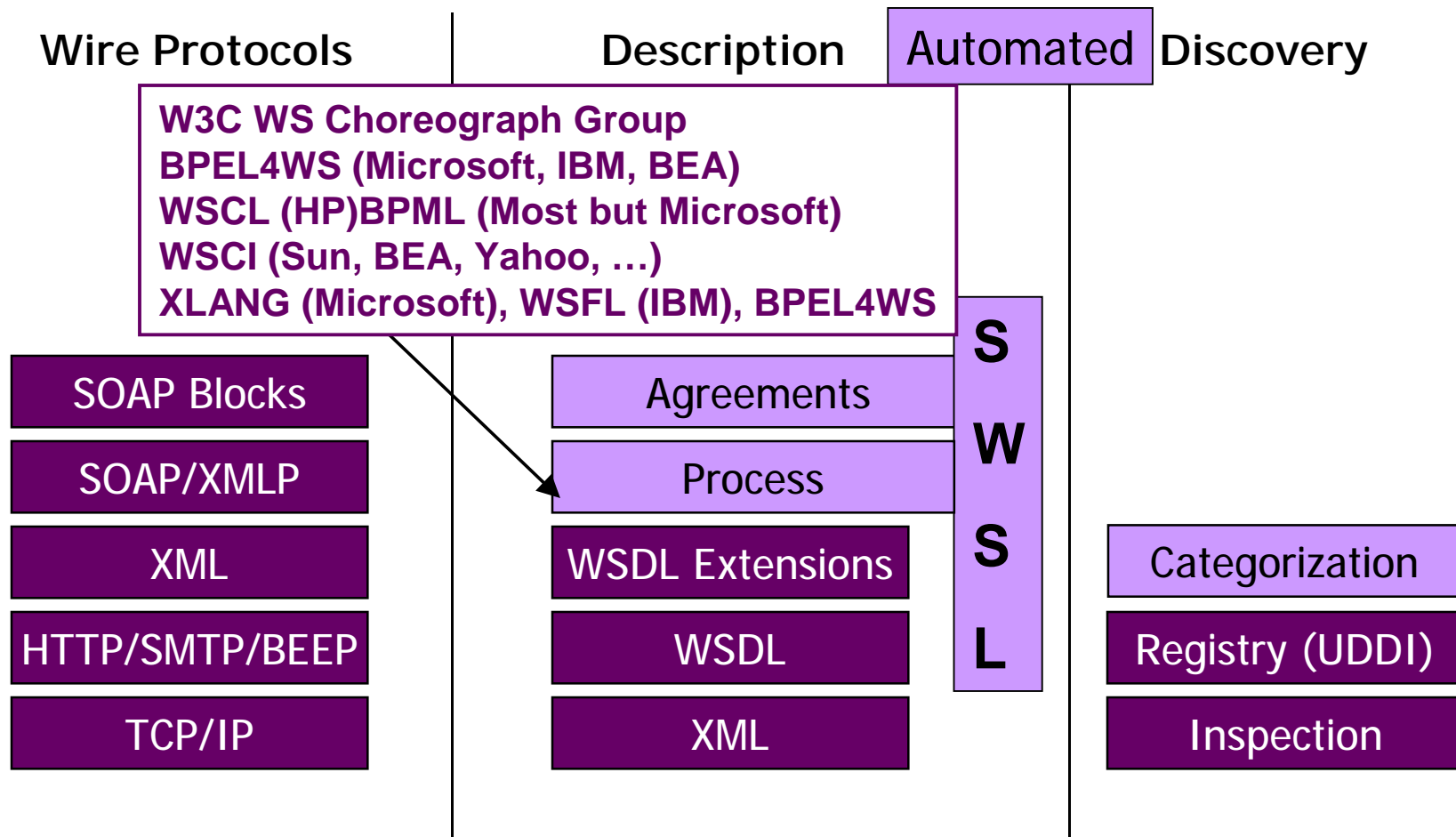
Other questions (Strategy)

- How do we impact mainstream computing?
 - Range of “strategies”
 - Membership, liaisons
- Is SOAP/SWDL/UDDI/BPEL4WS an appropriate foundation for SW Services?
- Will “adding semantics” to the above result in something
 - Distinctive?
 - Of high-value?
- Bridging the gap: commercial ζ è Semantic Web
 - Our contribution could be crucial

Converging with commercial efforts



Industry Trends: The Web Services Stack



Membership: areas of expertise

KR: Knowledge Representation, Logic

- description logics, DAML+OIL, OWL, Rules
- PSL

PL: Programming Languages

- theory (including operational semantics)
- design, tools
- software verification

P: Planning

- PDDL

PM: Process Modeling & Execution

- process algebras, pi-calculus
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Membership considerations

- Need to draw on wide range of expertise
- While keeping the committee manageably small
- Considering to add a “panel of experts”

Summary

The service paradigm will be a *crucial* part of the Semantic Web

SWSL will enable automatic *discovery, selection, invocation, composition, monitoring* of services (and more)

Key challenge: distill mature technologies and show path(s) to usage

SWSL should support service descriptions that are *integral* with other Semantic Web meta-data

We may have a crucial role in bridging the gap

We must start by clarifying our objectives & available strategies for achieving them

Acknowledgements

- Certain slides originated with Sheila McIlraith