



Laboratory for Applied Ontology

Institute of Cognitive Science and Technology  
Italian National Research Council

# Towards an Ontological Foundation for Services Science

Roberta Ferrario and **Nicola Guarino**

Institute of Cognitive Sciences and Technology  
Italian National Research Council

# The case of web services

---

- *C. Petrie, C. Bussler, The Myth of Open Web Services, IEEE Internet Computing 2008:*  
“run-time interoperability is **technically feasible only within service parks**, where [...] services are very constraint, and [...] the semantics will be common because the objects are common”  
“some interoperability among service parks might emerge, but could take a long time”
  
- *K. Sykara, Unthethering Semantic Web Services, IEEE Intelligent Systems 2007:*  
“current Web services proposals **don't enable the semantic representation of business relations, contracts, or business rules** in a machine-understandable way”, while “current business-process languages [...] are at a low abstraction level and don't provide formal business semantics”.



## The need for a global view of services

---

- Current SWS modeling formalisms focus on the *external interface*, advocating its strict separation from the internal view: roughly, a service is described in terms of its behavior (transfer function from an input state to an output state).
- Yet, business applications need to specify
  - *how* the service is performed at the business level, referring to *internal* details whose nature varies a lot from service to service
  - *when* the various processes involved in a service occur
- Business applications need to *monitor* and *evaluate* services quality with respect to their actual impact on the whole *service system*, which includes external events, objects, people, organizations... *and sensors* (context-aware services)
- SLAs need to refer both to *internal* and *contextual* details
- Well-known gap between business services and IT (SUPER project: a first step, but... assuming everything is *executable!*)



# The need for a foundational work

---

- Notion of service still relatively new in our economy:
  - Serious confusions and inconsistencies in terminology
- Semantic interoperability across services (already very difficult to achieve in the general case) risks to become a *myth*...
- ...unless we realize that our new home (the Internet of future) needs a highly interdisciplinary work, with solid foundations! [Petrie 2008]

Chesbrough & Spohrer, *A Research Manifesto for Services Science*.  
Communications of the ACM, 2006



## Some terminological issues

---

- What is a **service**?
  - An action
  - A generic type of action
  - The capability to perform some action
  - A computational procedure capable to perform some action
  - An agent in charge of performing an action
  - An agent ready to perform an action
  - The result of an action
  - The (subjective) value of an action
  - ...
- What is a **service provider**?
  - The authority which guarantees the presence of a service
  - The actual agent who executes the service actions (possibly on behalf of somebody else)
- ...



## Services vs. goods

---

- Services are not “anything we can buy, with no risk to drop it on our feet” – they are not *immaterial goods* [Hill 77]:
  - Goods are **transactable** and **transferable**
  - Services are transactable, but they are **not transferable**
- Why are they not transferable?

*because services are **EVENTS!***



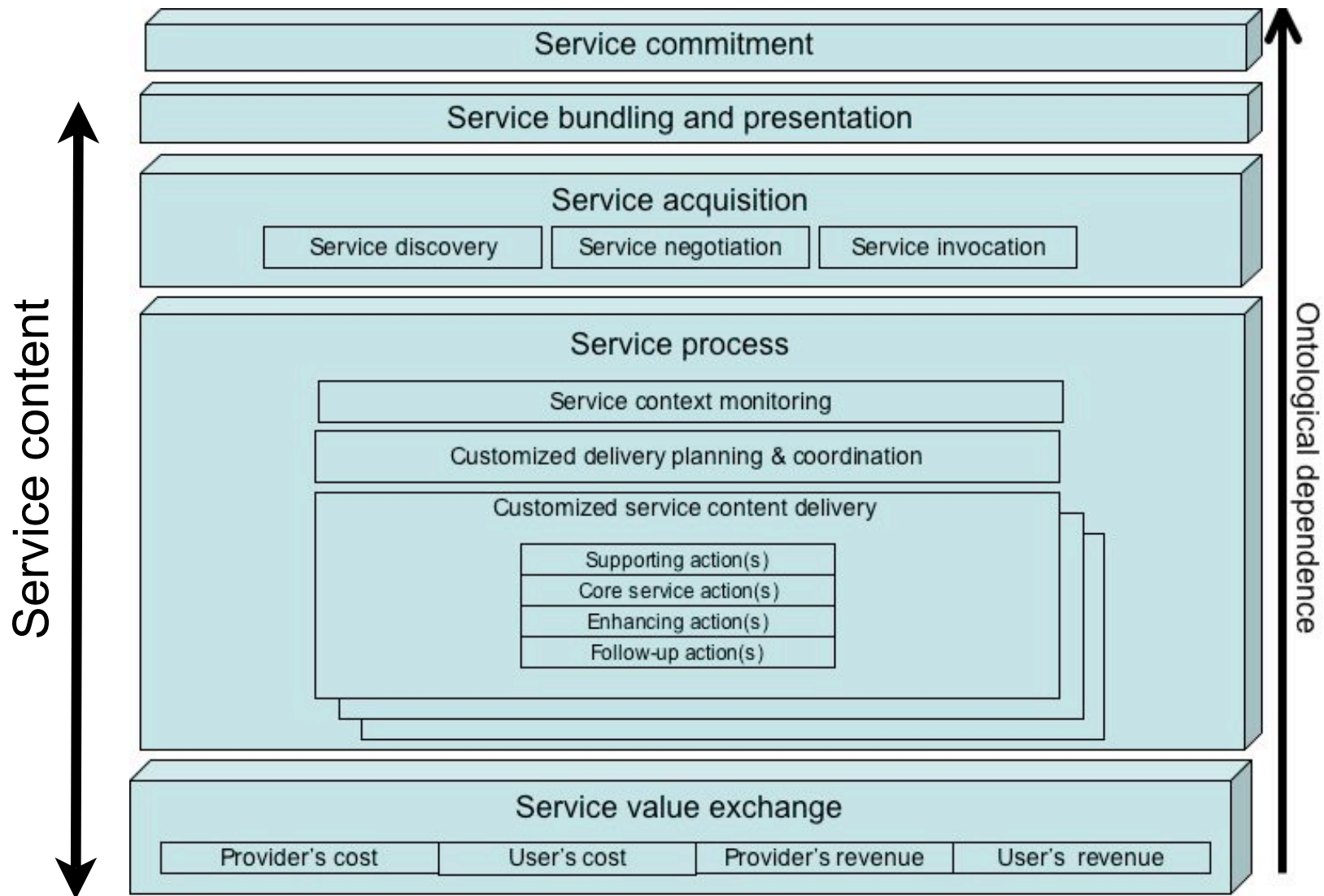
## Services as events: the basic idea

---

- How can you tell that a service is present, here and now?
- What do you *pay for*, when you invest in a service?

A service is an agent's availability to guarantee some action useful for somebody, upon prior agreement, in correspondence of certain events

A service is essentially a *promise* [O'Sullivan 2006]



The commitment imposes a set of constraints on the service content

# Alter's Service Responsibility Table

Provider Activity or Responsibility	Customer Activity or Responsibility	Problems or Issues
Loan officer identifies businesses that might need a commercial loan.		Loan officers are not finding enough leads
Loan officer contacts potential loan applicant.	Potential loan applicant agrees to discuss the possibility of receiving a loan.	
Loan officer discusses loan applicant's financing needs and possible terms of the proposed loan.	Potential loan applicant discusses financial needs.	Loan officer is not able to be specific about loan terms, which are determined during the approval step, which occurs later.
Loan officer helps loan applicant compile a loan application.	Loan applicant compiles loan application.	Loan applicant and loan officer sometimes exaggerate the applicant's financial strength and prospects.
Loan officer and senior credit officer meet to verify that the loan application has no glaring flaws.		20% of loan applications have glaring flaws.
Credit analyst prepares a loan write-up summarizing the client's financial history, providing projections of sources of funds for loan payments, etc.		10% rate of significant errors, partly because credit analysts use an error prone combination of several spreadsheets and a word-processing program. Much rework due to experience of credit analysts.
Loan officer presents the loan write-up to a senior credit officer or loan committee.		Meetings not scheduled in a timely manner. Questions about exaggerated statements by some loan officers.
Senior credit officer or loan committee makes approval decision.		Excessive level of non-performing loans. Rationale for approval or refusal not recorded for future analysis.
Loan officer informs loan applicant of the decision.	Loan applicant accepts or declines an approved loan.	25% of refused applicants complain reason is unclear. 30% of applicants complain the process takes too long.



## Examples: three kinds of real services

---

1. **Car Repair** - A guy who goes to the mechanic to have his car repaired [Hill]
2. **Hairdressing** - A guy who brings his kid to the hairdresser in order to have his hair cut [Hill revisited]
3. **E-Health** - A physician who queries and updates a health database [e-government]



## Service Description Tables: Example 1

	Agent	Goal/Recipient	Theme/Patient	Instrument	Location	Time
<b>Service Commitment</b>	Mechanic	PA (Chamber of Commerce)	Job content (remaing rows)	Subscription Act	Province/Region?	Starting from a fixed date before the opening of the garage and until the duration of the license
<b>Service Acquisition</b>	Customer	Mechanic	Car repair order	Estimate (?)	Garage	After opening and before actual repair
<b>Service Process</b>	Mechanic	Customer	Car	Mechanic's tools	Garage	Period in which the repair actually occurs
<b>Service Value Exchange</b>	Customer/ Mechanic	Mechanic/ Customer	Monetary means	Receipt	Garage, bank...	A certain time (usually) after that the car has been repaired

Co-reference needed! (DLs will have problems)



## Service Description Tables: Example 2

	<b>Agent</b>	<b>Goal/ Recipient</b>	<b>Theme/Patient</b>	<b>Instrument</b>	<b>Location</b>	<b>Time</b>
<b>Service Commitment</b>	Hairdresser	PA (Chamber of Commerce)	Job description	Subscription Act	Province/Region	Starting from a fixed date before the opening of the shop and until the duration of the license
<b>Service Acquisition</b>	Customer (father)	Hairdresser	List of the kinds of services required (shampooing, cut, hair drying)	List of prices (implicit negotiation)	Shop	A certain time after the opening of the shop and before the execution of the haircut
<b>Service Process</b>	Hairdresser	Kid	Kid's hair	Scissors and Comb	Shop	Period in which the haircut actually occurs
<b>Service Value Exchange</b>	Customer and Kid/ Hairdresser	Hairdresser/ Customer and Kid	Monetary means	Receipt	(usually) Shop	A certain time (usually) after that the kid's hair has been cut



## Service Description Tables: Example 3

	<b>Agent</b>	<b>Goal/ Recipient</b>	<b>Theme/Patient</b>	<b>Instrument</b>	<b>Location</b>	<b>Time</b>
<b>Service Commitment</b>	Health Ministry	Members of the Physicians Register	Service description	Deliberation of the Ministry	Office of the Ministry	A fixed date before the database is put online and during the whole lifetime of the DB
<b>Service Acquisition</b>	Physician	Database	List of the allowed operations (according to the physician's profile)	Terminal	Physician's house or office, hospital, internet point...	A certain time after the database has been put online and before the execution of the query
<b>Service Process</b>	Information System/ Physician	Physician/ Information System	Information about the patient	Terminal	Physician's house or office, hospital, internet point...	Period in which the query and update take place
<b>Service Value Exchange</b>	Physician/ Information System	Information	Information System/ Physician	Data Records		A certain time (usually) after that the kid's hair has been cut



# Main Results

---

- *Rethinking of the difference between **internal** and **external** service views: the black box model is too limited*
- *Improvement of the classic **definition** of services coming from economics*
- *Focus on **core actions** instead of pre- and post conditions*
- ***Layered model** based on interdependent events*
- *Comprehensive **business-oriented** approach*
- *Common framework to describe service according to **different views***
- *Detailed account of **non-functional properties***



# Conclusions

---

- The Internet of Future needs *reality-aware* service models
- based on a *holistic view* of service system
- which includes actual events (both business events and external events) *involving people and organizations*, besides computers.



# fois2008

5th international conference on formal ontology in information systems

[HOME](#)[ORGANIZERS](#)[DATES](#)[SUBMISSIONS](#)[PAPERS](#)[REGISTRATION](#)[VENUE](#)[PROGRAM](#)[NEWS](#)

## Welcome to FOIS 2008, the 5th International Conference on Formal Ontology in Information Systems

Saarbrücken, Germany

Oct 31st - Nov 3rd 2008

co-located with *ISWC 2008, Karlsruhe, Germany* (Oct 26 - 30)

**Registration is now open!**

### Main Menu

[Home](#)[Organizers](#)[Dates](#)

*[fois08.dfki.de](http://fois08.dfki.de)*

