Towards an ontology of organizations

Social Entities

- Two senses of ‘social entity’
  1. Immaterial product of a community of agents that, by means of some sort of *convention*, creates, makes use of, talks about and accepts it; e.g. *quark*, *triangle)*
  2. In addition to 1., its nature intrinsically involves a network of *relations among agents* (collective intentionality, actions and deontic constraints, etc.); e.g. *money*

- Social Concepts and Social Individuals
  - Concepts: *bank*, *money*, *company*, *president*, as well as *quark, catalyst*…
  - Individuals: *The bank of Italy*, *the FIAT company*…

Reifying roles

General Strategy

- Reify social **concepts** to be able to predicate on them

  Social concepts and roles as *first-class-citizens*

  CN(x): “x is a social concept”

- Reify contexts or concept definitions, called here **descriptions**

  Deal with the *social*, *relational*, and *contextual* nature of social concepts

  DS(x): “x is a description”

  DF(x,y): “the concept x is defined by the description y”

  US(x,y): “the concept x is (re)used in the description y

- Introduce a **temporalized classification** relation to link concepts to the entities they classify

  Account for the *dynamic behavior* of social concepts

  CF(x,y,t): “at the time t, x is classified by the concept y”

Underlying assumptions

- Descriptions:
  - are created by intentional agents at the time of their first encoding in an expression of a ‘public’ language
  - cease to exist when their last physical support ceases to exist
  - have a unique semantic content (different, but semantically equivalent, expressions can be associated to the same description)
  - have an internal structure intimately related to the logical structure of their semantic contents; partially accounted by means of the predicate US
- Concepts:
  - are statically linked to descriptions: they cannot change their definitions
  - inherit the temporal extension of their definitions

Roles vs. *role descriptions*

- roles have *their own* dynamics (independently of role players)
- It is the *role description* that changes, in these cases

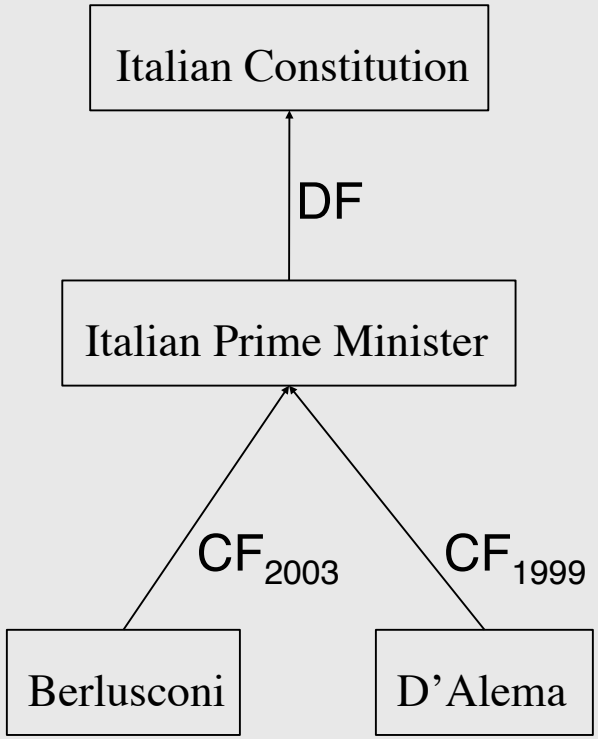
- Example: the role of *Prime Minister* has changed/will change…

Limitations

- Not all concepts are (acknowledged as) social. Social concepts are described in terms of a more comprehensive foundational ontology (DOLCE), whose (possible) social nature is not accounted for.
  - DOLCE categories are considered as *ground*, in the sense that it is not possible, in the formalism, to explicitly represent their dependence on a social construction/context.
- Although the notions of action, agentivity, behavior, intentionality, obligations, abstract semantic content, etc. are necessary for a full characterization of social concepts, we will not consider them here.

Example

- The Italian Constitution is a description defining the current concepts of Italian President, Italian government, Italian Prime Minister…
- B. is classified under the concept of IPM during 2003
- D. is classified under the concept of IPM during 1999
- During 2000, B. did not have all the necessary characteristics to be IPM, therefore he is not classified under this concept



Characterizing the key features of roles

(1) Roles, as concepts, are properties

⇨ Embedded in the CF predicate

(2) Roles are dynamic and anti-rigid

⇨ Dynamicity embedded in the temporalization of the CF predicate

⇨ $\mathrm{AR}(x) \equiv_{\mathrm{df}} \forall y,t(\mathrm{CF}(y, x, t) \rightarrow \exists t'(\mathrm{PRE}(y, t') \wedge \neg \mathrm{CF}(y, x, t')))$ *(simplified def.)*

(3) Roles have a relational nature

⇨ Property of being **founded** reflects a definitional dependence:

$$\mathrm{FD}(x) \equiv_{\mathrm{df}} \exists y,d(\mathrm{DF}(x, d) \wedge \mathrm{US}(y, d) \wedge \forall z,t(\mathrm{CF}(z, x, t) \rightarrow \exists z'(\mathrm{CF}(z', y, t) \wedge \neg \mathrm{P}(z, z', t) \wedge \neg \mathrm{P}(z', z, t))))$$

(4) Roles, as concepts, are linked to contexts and therefore social

⇨ Embedded in the DF predicate

$$\mathrm{RL}(x) \equiv_{\mathrm{df}} \mathrm{AR}(x) \wedge \mathrm{FD}(x)$$

Relations between roles

- **Sub-concept**. General relation, similar to subsumption between unary predicates (extensionally defined on CF)
  - (a) *All Italian Prime Ministers are Prime Ministers.*
  - (b) *All Italian Prime Ministers are Italian Citizens.*
- **Specialization (a).** B. is a Prime Minister 'because' it is the Italian PM. Being PM means that there is some specific nation to be PM of, i.e., "Prime Minister" is *not saturated*.
  - New primitive relation between concepts SP
  - $(\exists s(\mathrm{SP}(s, u)) \wedge \mathrm{CF}(x, u, t)) \rightarrow \exists s'(\mathrm{SP}(s', u) \wedge \mathrm{CF}(x, s', t))$
  - $\mathrm{SAT}(x) \equiv_{\mathrm{df}} \neg \exists y\, \mathrm{SP}(y, x)$
- **Requirement (b).** B. must be an Italian Citizen in order to be the IPM, i.e., the definition of IPM is based on the definition of Italian Citizen.
  - New primitive relation between concepts RQ
  - $(\mathrm{RQ}(x, y) \wedge \mathrm{DF}(x, d)) \rightarrow \mathrm{US}(y, d)$
- **Role Kind**. Not a special case of sub-concept, but a case of classification
  - (c) *Italian Prime Minister is an Italian public office.*

Organizations belong to *social reality*

- They are brought into existence by the performance of (social) ***speech acts*** (acts involving promises, obligations, duties...) [Searle]

What is the physical basis for this extended existence?

- In small societies: the memories of those involved
- In large societies: ***documents*** [De Soto]

- Indeed, documents are often the main (the only) communication channel among complex organizations (take the ***e-government*** example)

Beyond documents: what is missing?

- the various entities documents and services are about: *events, people, locations, organizations, goods…*
- the social and institutional (deontic, quasi-legal) entities created by documents
- the *social interactions* in which documents play an essential role (how documents bind people together)
- the sorts of things which we can *do* with documents
- the different types of *institutional systems* to which documents belong

No e-government interoperability without this rich ontology!

Roles in organizations

- Basic components of an organization, characterized by
  - the ***functions/objectives*** they have
  - the ***interactions*** with other roles – normally regulated by *norms*
  - the ***requirements*** agents need to satisfy in order to play the role
- collectively, all the aspects above contribute to the ***competences*** assigned to a role

Agents play roles

- The ***glue*** between concrete and abstract aspects of an organization is ***social commitment****:*
  - Agents are committed in various ways to other agents to do what is specified by the roles they play
  - An emblematic case of social commitment is the ***promise*** [Castelfranchi, Tuomela, Searle...]
  - Promises strongly depend on ***trust*** and ***delegation*** considerations
  - Promises are made public and precise by means of ***contracts***
  - Contracts have ***deontic*** implications (***obligations***, ***rights***, ***permissions...***)

Important aspects of organizations

- Organizations are
  - ***Structured*** and ***multilayered****:* not necessarily reducible to basic roles and their interrelations;
  - ***Designed****:* created with specific functions;
  - ***Realized*** by autonomous agents playing specific roles;
  - ***Agentive*** mental attitudes (e.g., goals and intentions) can be ascribed to (actual realizations of) organizations
  - ***Situated****:* immersed in an environment;
  - ***Dynamic****:* structure and realization can vary in time.

Structured organizations

- An organization is a set of ***interacting roles*** [van den Broek]
- An organization is a structured entity where agents playing roles interact to achieve organization-wide goals [De Loach and Matson]
  - [relations between individual and organizational goals have a special relevance]
- An organization has a ***social structure*** (basically a role structure) and an ***interaction structure*** (interaction relations between roles) [Dignum]

Levels of description of an organization

- ***Abstract level***: no reference to real agents – only organization roles, their links and groups, global plans, and permissions/ obligations [Sichman]

- ***Concrete level***: an organization is ***realized*** (i.e., its goals are achieved) by real agents that play the organizational roles.

Institutional Roles

- Some social roles have *institutional persons* associated with them
- In general, we have to distinguish:
  - The role
  - The individual playing the role
  - The institutional person associated to the role
  - The individual *qua* playing the role

The Artifact Metaphor

- Organizations can be seen as ***artifacts*** whose function is to constrain some collective behavior to obtain a specific objective [Tummolini and Castelfranchi 2006]
  - For a chair, each part contributes to the main function
  - Similarly, competences are assigned to every part of an organization, and they contribute to its general objective
- The specification of an organization can be *refined during the process of design*
- In short, organizations seem to represent a clear case of ***social intelligence design***

Services

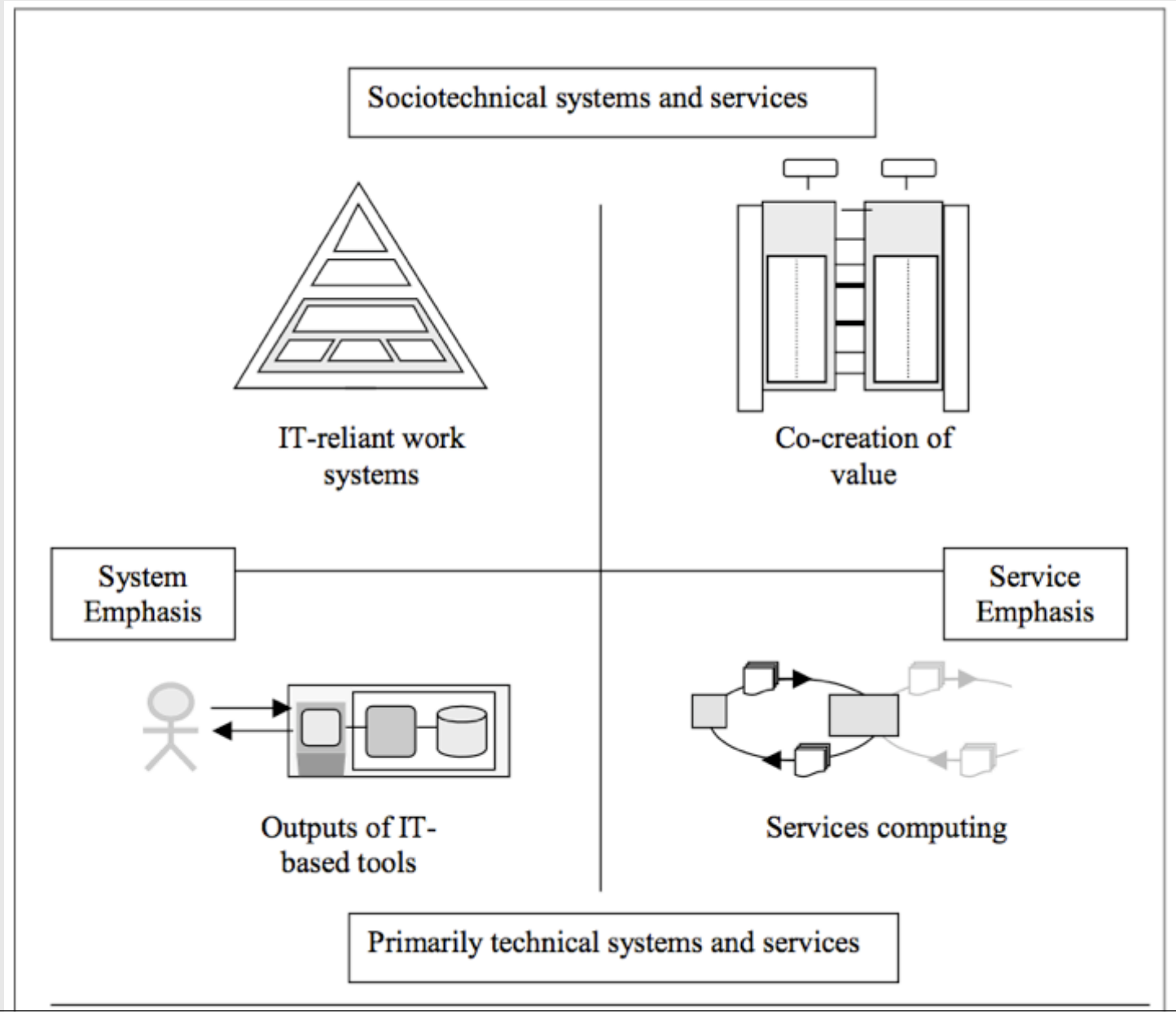
Clarifying the intended meaning of “service”

- 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
  - The result of an action
  - The (subjective) result of an action
- What is a ***service provider***?
  - The authority which guarantees the service execution
  - The actual agent who executes the service actions (possibly on behalf of somebody else)
- What is a ***service consumer***?
  - The one who requests the service
  - The one who benefits of the service

The need for a global view of services

- Current semantic web services 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... (context-aware services) [example: a directory service]
- Service Level Agreeements need to refer both to ***internal*** and ***contextual*** details
- Well-known gap between business services and IT
- Need to look *inside the black box* and *out of the box*...

Steven Alter's Systemic Approach



Three common ways of understanding services

- ***Intangible goods:*** something “we can buy, with no risk to drop it on our feet”
  - What about copyrights, IPRs?
- Things we pay for, but we ***don’t own***
  - What about rented cars?
- Sets of ***abstract capabilities***
  - Only one service for a given set of capabilites?

Services vs. goods

- Services are not kinds of goods (*immaterial goods)*, since there is a radical difference between goods and services [Hill 77]:
  - Goods are ***transactable*** and ***transferable***
  - Services are transactable, buy they are ***not transferable***
- Why are they not transferable?

*because services have a temporal nature, they are **EVENTS**!*

DOLCE's basic taxonomy

- Object (endurant)
  - Physical
    - Amount of matter
    - Physical object
    - Feature
  - Non-Physical
    - Mental object
    - Social object
  - …
- Event (perdurant)
  - Static
    - State
    - Process
  - Dynamic
    - Achievement
    - Accomplishment

- Quality
  - Physical
    - Spatial location
    - …
  - Temporal
    - Temporal location
    - …
  - Abstract

- Abstract
  - Quality region
    - Time region
    - Space region
    - Color region
    - …
  - …

Transferability and Ownership

- Owning an entity implies being in control of its *temporal behavior* (for instance, deciding to destroy it)
- Services are events in our approach
- The temporal behavior of an event is already determined: changing it would result in a different event
- Thus, *events are not ownable*
- In conclusion, it is not possible to transfer the ownership of a service, because services, being events, are not ownable

Two different notions of services as events

- Action-based: *passing the salt* is a service
- Commitment-based: a previous commitment is needed.

- *Paying* for a service vs. *finding* a service
- Service *delivery* vs. service *offer*

- Terminological solution:
  - What is delivered is the service *content*
  - A service implies always a commitment
  - Occasional favors are not services.

Services are based on *commitments*

- 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 commitment* is an agent's explicit commitment to guarantee the execution of some *type of actions*, on the occurrence of a certain *triggering event*, in the interest of another agent and upon prior agreement, according to a certain specification (*service description*) which contraints the *way* service actions will be performed (*service process*)

A service is essentially (based on) a ***promise*** [O'Sullivan 2006]

...which involves real people in real contexts

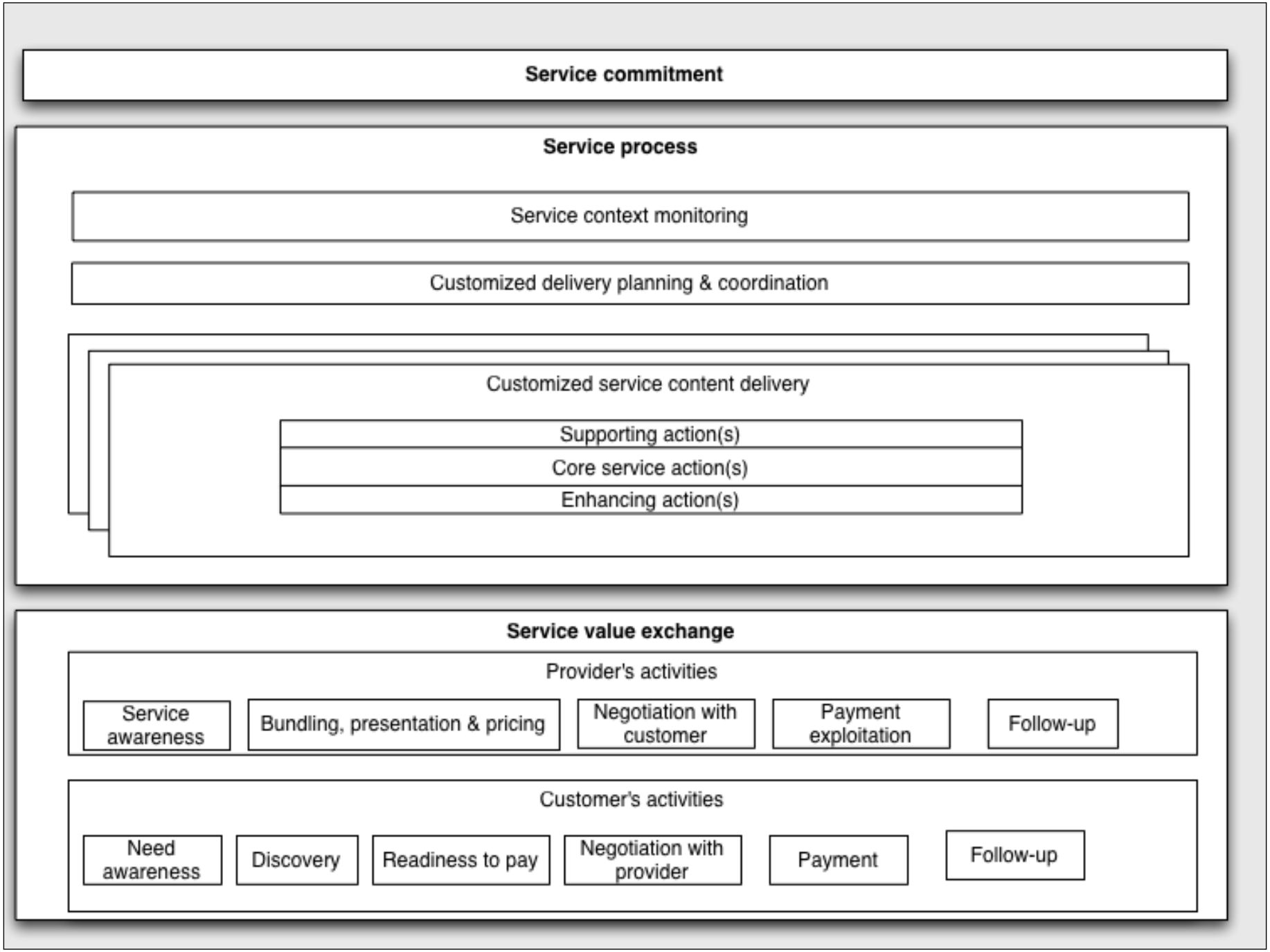
(of which IT systems are only a part!)

Service provider vs. service producer

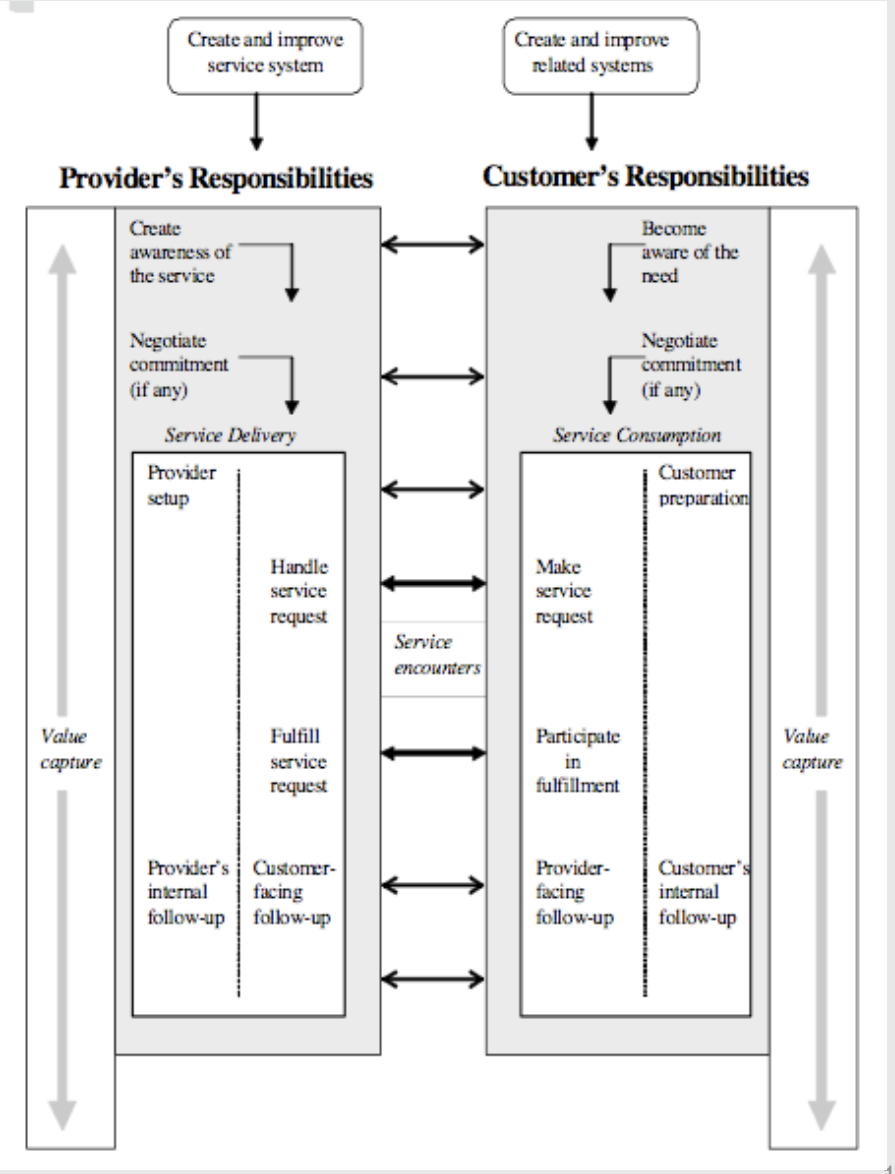
- Problem: what's the action promised by rental services? Who executes it?
- *Guaranteeing* an action vs. *producing* an action
- Three cases:
  - Service action producer = service provider
  - Service action producer delegated by provider
  - Service action producer = service consumer

Service, Service Commitment, and Service Process

- ***Service commitment***: agent's explicit commitment to guarantee the execution of some type of actions, on the occurrence of a certain triggering event, in the interest of another agent and upon prior agreement, according to a certain specification (the service description) which contraints the way the service actions will be performed (i.e., the service process that will be adopted).
- ***Service process****:* actual implementation of a service commitment, consisting of number of interdependent actions including those necessary to monitor the trigger events, the *core actions* mentioned in the commitment, and any further actions aimed at supporting or complementing the successful execution of such core actions.
- ***Service***: the visible, exposed part of a service process implementing that commitment, which includes all the activities explicitely mentioned in the service description.


Service commitment
Service process
Service context monitoring
Customized delivery planning & coordination
Customized service content delivery
Supporting action(s)
Core service action(s)
Enhancing action(s)
Service value exchange
Provider's activities
Service awareness
Bundling, presentation & pricing
Negotiation with customer
Payment exploitation
Follow-up
Customer's activities
Need awareness
Discovery
Readiness to pay
Negotiation with provider
Payment
Follow-up

A further key aspect of services: *co-creation of value*



Alter 2008:
When do Services fit in Systems Analysis and Design?

Thematic Relations

- Agent (the active role, the one who acts in the event)
- Theme/Patient (the one who undergoes the event; the patient changes its state, the theme does not)
- Goal (what the event is directed towards – typically a desired state of affairs)
- Recipient/Beneficiary (the one who receives the effects of the event)
- Instrument (something that is used in the performance of the event)
- Location (where the event takes place)
- Time/duration (when the event takes place, or how long it lasts)

Services and Value Transfer

- Although you can't transfer a service, certainly a service involves *value transfers*
- Internally to a service's value chain (at the interface between the service process and the service consumer), multiple kinds of value transfer may occur:
  - Transfers of goods
  - Transfers of rights
  - Transfers of duties

Example: car rent

- Transfer of right: to use the car
- Transfer of money (if cash): payment
- Further transfer of right: getting the car repaired if it breaks
- Transfer of duty: a third party is in charge of repairing the car

Conclusion

- Subtle meaning distinctions do matter
- Formal ontological analysis provides a rigorous methodology to obtain robust and coherent theories
- A humble interdisciplinary approach is essential

…Is this hard?

Of course yes!

(Why should it be easy??)

Ontologies should be SIMPLE...

WHY?!

- Are mobile phones simple?
- Are computers simple?
- Are nuclear plants simple?
- Are bank contracts simple?

- Bulding an ontology vs using an ontology...

- Ontology engineering ***by the masses****???*