



D3.6v01 WSMO Use Case "STREAM Flows! System"

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Abstract

This document presents a concrete use for specifying Semantic Web Service descriptions in WSMO for a frequent flyer programme called "Stream Flows! System" (SFS). This system serves as a meeting point for customers who want to book flights, train tickets, hotels, shuttle transfers and for the providers of such services. Customers can create, or use predefined packages which specify what services are needed by the customers. Providers can create, edit and publish their services on SFS in order to make them available for customers. The main objective of this document is to provide a modeling of the WSMO elements based on the SFS scenario.

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1. Introduction

This use case is defined in the area of e-Tourism, particularly, it addresses a frequent flyer programme called STREAM Flows! System (SFS for short). This system will be available online and it can be accessed both from customers and service providers. We will specify the required semantic descriptions in this system basing ourselves on the WSMO conceptual model, that is, by specifying the Ontologies, Web Services, Goals and Mediators.

Customers will be able to group and specify the services needed in terms of packages. A package is a collection of services which are to be purchased by the user. It may be either pre-defined by the SFS Administrator or customized by the customer. Service providers can publish their services with SFS in order to make them available for customers. It is up to the SFS to update the stored packages once a service has changed. Our use case shall take the following path:

- The Service Providers will have published some services: a flight, a hotel reservation, and a car rental service
- The customer searches for a package of desired services
- The SFS program access to the catalogue and search for the best services that fulfill the customer requirements

This document is structured as follows: In Section 2 a description of the SFS is provided which includes a listing of the Actors involved together with their roles and goals in the system. In Section 3 a listing of the Ontologies, Goals, Web Services and Mediators used by the system is provided. Finally, some conclusive comments and future work are given.

2. Use Case Overview

In this section we will provide an overview of the Use Case. Particular, a description of the scenario depicted will be given and we will also specify the actors, roles and goals involved in the use case.

2.1 Description

STREAM Airlines is the airline company of the STREAM Group, which works in Europe

and South America. The STREAM Group has a FFP called STREAM Flows! System (SFS). The customers of the SFS (by means of a membership) can obtain points from purchasing services of the STREAM group. These services might be an airline ticket, a hotel booking, a car rental and many others. There are several companies affiliated to SFS. Each service of the program has its counterpart in points and these points can be consolidated and exchanged by one or more services. The customer purchase services for many companies (engaged with the SFS program). These companies collect the information of the customer and send the information to the SFS program, adding the counterpart of the service in points of the SFS program. The SFS program collects all the information and stores them into its own databases.

The customers of SFS program will be able to exchange their SFS points for eTourism services, provided by companies affiliated to SFS. These services will support booking of flights, booking of hotel's rooms, booking of rental cars and booking of shuttles online. The services must have been published in the SFS Catalogue by the service providers as WSMO web services, and can be purchased by the customers directly or by an established package. The SFS program will advise the customer which services are the best that fulfil the customer requirements. Once the customer has selected the services, SFS will act as an intermediary between the customer and the service provider.

2.2 Scope

The STREAM Group wants to offer the ability to book complete vacation packages: airplane tickets, hotels, car rental, shuttle, etc. The service providers (airlines, car rental companies, hotel chains, etc) will provide web services to query their offerings and perform reservations. So, the SFS program will allow the customer to contract these services using his or her points.

2.3 Actors, Roles and Goals

2.3.1 Customer

The end user that request a service or a package of services.

- *Goal:* Automated resolutions of the request.
- *Role:* End-user. Interacts with the SFS portal.

2.3.2 Service Providers

The commercial companies affiliated to the SFS program that provides the specific tourism services.

- *Goal:* Publish their services in the SFS catalogue.
- *Role:* Provides tourism services as web services.

2.3.3 STREAM Flows! System (SFS)

The intermediate between the Customer and the Service providers.

- *Goal:* Manage the customer's record of services and manage the catalogue of services and packages contacting customers and service providers for performing its tasks.
- *Role:* Interacts with customer and service providers.

2.4 Story Board

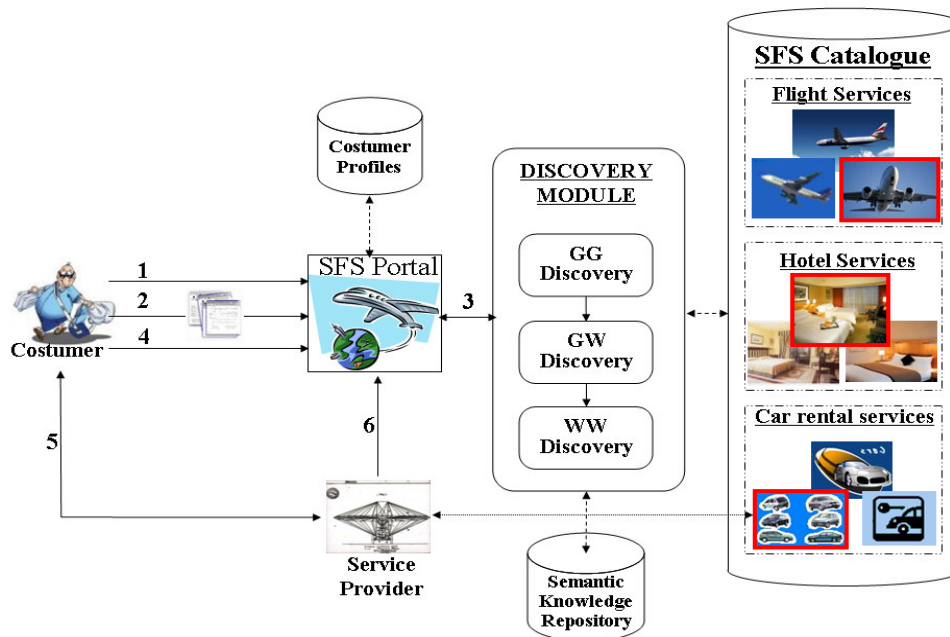


Figure 1: Story Board Overview

Step 1

The customer login in the SFS portal and, once authenticated, he consults his accumulated points. The SFS will access to the customer's profile database and will show the customer his accumulated points.

Step 2

The customer indicates the system his needs, creating a package with the tourism services required: a flight, a hotel's room and rent a car. In this package it will be defined all the travel constraints that must be fulfilled by the services: date and time constraints, place constraints, etc...

Step 3

The system will send a query to the Discovery Module to obtain the set of services which better suits the requirements of the customer. For this process, the SFS program will define a goal (with the customer preferences), which will be used in the GG, GW and WW Discovery processes for composing available web services. In the catalogue there will be several services, some of them only slightly different from other. The process of finding suitable services for a service description is done using semantic descriptions. The distributed repositories could return several services suitable for each service description. A Distributed Decision Support system (DDS) should recommend one service using functional or non-functional properties or even quality of service criterion for this purpose. Besides the functional requirements, all the services proposed for the package have to comply with other requirements to check the integrity of the package (the booking date for the hotel have to match with the flight plan for avoid inconsistencies)

Step 4

The customer chooses the services manually (or automatically). In the figure, the services

selected are in red.

Step 5

The service provider of each chosen service will try to confirm the terms of acceptance and the conditions and details of the service. Once have been accepted by both parties the terms of the contract, a book order is placed. The services definitely chosen are invoked and the service provider has to send to the customer all the information and any coupon or ticket need for the use of the service.

Step 6

Finally, the service provider will communicate with the SFS to provide him the information needed for performing the update of the customer record.

3. WSMO Use Case Modelling

3.1 Ontologies

With regard to modularized ontologies as a basic design principle of WSMO, we define five domain ontologies as the terminology definitions for the use case:

- Booking ontology describes generic elements of making a reserve.
- Flight booking ontology describes generic elements of booking a flight.
- Hotel room booking ontology describes generic elements of booking a room.
- Car rental booking ontology describes generic elements of booking a car rental.
- Shuttle booking ontology describes generic elements of booking a shuttle

The ontologies specified in the following are intended to be "real ontologies" in the sense that they describe the specific domain as a shared conceptualization in a sufficient manner. This allows to reuse this ontologies in different settings and use cases - for example, general booking ontology are needed in a lot of other possible scenarios. However, we do not claim the defined below to be such generic ontologies, but they will be enhanced and completed within cooperations with other use cases, projects, and initiatives

At this point in time, WSMO does not provide a technique to link to large set of instances. Therefore, in this version of the ontology we only include some example instances, which holds for the other ontologies defined in this use case as well. For reader's convenience, the relevant instances for this use case will be gathered in the SFS Use Case Knowledge Base, a separate ontology, that will be created in a future version.

Listing 1. Booking Ontology.

```
namespace {_"http://www.wsmo.org/ontologies/booking#",
  dc_"http://purl.org/dc/elements/1.1#",
  dt_"http://www.wsmo.org/ontologies/dateTime#",
  loc_"http://www.wsmo.org/ontologies/location#",
  xsd_"http://www.w3.org/2001/XMLSchema#"
}

ontology _"http://www.wsmo.org/ontologies/booking"
  nonFunctionalProperties
    dc#title hasValue "Booking ontology"
    dc#creator hasValue "ATOS ORIGIN S.A."
    dc#subject hasValue {"Booking request", "Buyer", "Seller", "Booking ticket", "Payment method"}
    dc#description hasValue "General description of a booking request"
    dc#publisher hasValue "ATOS ORIGIN S.A."
    dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
```

```
dc#date hasValue "2005-02-15"
dc#type hasValue _"http://www.wsmo.org/2004/d2#ontologies"
dc#format hasValue "text/plain"
dc#identifier hasValue _"http://www.wsmo.org/ontologies/booking"
dc#language hasValue "en-US"
dc#relation hasValue { _"http://www.wsmo.org/ontologies/carRentalBooking",
_ "http://www.wsmo.org/ontologies/hotelRoomBooking",
_ "http://www.wsmo.org/ontologies/flightBooking",
_ "http://www.wsmo.org/ontologies/location",
_ "http://www.wsmo.org/ontologies/dateTime"}
dc#coverage hasValue "ID:7029392 Name:World"
dc#rights hasValue _"http://deri.at/privacy.html"
version hasValue "$Revision: 1.9 $"
endNonFunctionalProperties
```

```
importsOntology { _"http://www.wsmo.org/ontologies/dateTime.wsml",
_ "http://www.wsmo.org/ontologies/location.wsml"}
```

```
/*
* Booking , bookingTicket
*/
```

```
concept booking
nonFunctionalProperties
  dc#description hasValue "A general booking"
endNonFunctionalProperties
  bookingIdentifier ofType xsd:string
  bookingPrice ofType xsd:float
  buyer impliesType buyer
  seller impliesType seller
  paymentMethod impliesType paymentMethod
  contractDate impliesType dt:date
  bookingTicket impliesType bookingTicket
```

```
concept bookingTicket
nonFunctionalProperties
  dc#description hasValue "A ticket for a booking."
endNonFunctionalProperties
  bookingTicketIdentifier ofType xsd:string
  buyerName ofType xsd:string
  sellerName ofType xsd:string
```

```
/*
* Booking parts
*/
```

```
concept buyer
nonFunctionalProperties
  dc#description hasValue "the partner that makes a booking"
  dc#relation hasValue { _"http://wsmo.org/ontologies/rosettanet#buyer"}
endNonFunctionalProperties
  contactInformation impliesType contactInformation
  bookingPreferences impliesType bookingPreferences
```

```
concept bookingPreferences
nonFunctionalProperties
  dc#description hasValue "The preferences of the buyer in a booking"
endNonFunctionalProperties
  maxPrice ofType xsd:float
```

```
concept seller
nonFunctionalProperties
  dc#description hasValue "the partner that offers a booking"
  dc#relation hasValue { _"http://wsmo.org/ontologies/rosettanet#seller"}
endNonFunctionalProperties
```

contactInformation **ofType** contactInformation

concept company **subConceptOf** seller

nonFunctionalProperties

dc:description **hasValue** "the company that offers "

endNonFunctionalProperties

companyID **ofType** xsd:string

website **ofType** xsd:string

concept contactInformation

nonFunctionalProperties

dc:description **hasValue** "The collection of business properties that provide communication and address information for contacting a person, organization or business."

dc:relation **hasValue** { "_http://wsmo.org/ontologies/rosettanet#contactInformation" }

endNonFunctionalProperties

name **ofType** xsd:string

emailaddress **ofType** xsd:string

faxnumber **ofType** xsd:string

telephonenumber **ofType** xsd:string

physicalAddress **impliesType** loc#address

concept onlineDelivery

nonFunctionalProperties

dc:description **hasValue** "a reservationTicket is delivery online as a piece of information"

endNonFunctionalProperties

onlineDeliveryMethod **ofType** xsd:string

deliveryItem **impliesType** reservationTicket

sender **impliesType** seller

receiver **impliesType** buyer

```

namespace {_ "http://www.wsmo.org/ontologies/flightBooking#",
  dc _ "http://purl.org/dc/elements/1.1#",
  dt _ "http://www.wsmo.org/ontologies/dateTime#",
  bo _ "http://www.wsmo.org/ontologies/booking#",
  loc _ "http://www.wsmo.org/ontologies/location#",
  xsd _ "http://www.w3.org/2001/XMLSchema#"
}

ontology _ "http://www.wsmo.org/ontologies/flightBooking"
nonFunctionalProperties
  dc#title hasValue "Flight Booking Ontology"
  dc#creator hasValue "ATOS ORIGIN S.A."
  dc#subject hasValue {"Flight", "Flight Booking", "Airport", "AirTrip"}
  dc#description hasValue "Flight Booking Ontology"
  dc#publisher hasValue "ATOS ORIGIN S.A."
  dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
  dc#date hasValue "2005-02-11"
  dc#type hasValue _ "http://www.wsmo.org/2004/d2#ontologies"
  dc#format hasValue "text/html"
  dc#identifier hasValue _ "http://www.wsmo.org/ontologies/flightBooking"
  dc#source hasValue _ "http://keg.cs.tsinghua.edu.cn/ontology/travel"
  dc#language hasValue "en-US"
  dc#relation hasValue {_ "http://keg.cs.tsinghua.edu.cn/ontology/travel",
    _ "http://www.wsmo.org/ontologies/booking",
    _ "http://www.wsmo.org/ontologies/dateTime#",
    _ "http://www.wsmo.org/ontologies/location",
    _ "http://www.daml.org/2001/02/geofile/geofile-ont"}
  dc#coverage hasValue "ID:7029392 Name:World"
  dc#rights hasValue _ "http://www.deri.org/privacy.html"
  version hasValue "$Revision: 1.9 $"
endNonFunctionalProperties

importsOntology {_ "http://www.wsmo.org/ontologies/dateTime",
  _ "http://www.wsmo.org/ontologies/location",
  _ "http://www.wsmo.org/ontologies/booking"
}

usesMediator {
  _ "http://www.wsmo.org/2004/d3/d3.3/v0.1/20041008/resources/owlGeoMediator.wsmI"
}

concept airport subConceptOf geo#geographicLocation
nonFunctionalProperties
  dc#description hasValue "Airport"
endNonFunctionalProperties
  code ofType xsd:string
nonFunctionalProperties
  dc#description hasValue "Code of the airport"
endNonFunctionalProperties

concept flightBooking subConceptOf bo#booking
  airTripInfo impliesType airTripInfo

concept flightBookingTicket subConceptOf bo#bookingTicket
  airTripInfo impliesType airTripInfo

concept trip
  start impliesType loc#location
  end impliesType loc#location
  departure impliesType dt#dateAndTime
  arrival impliesType dt#dateAndTime
  duration impliesType dt#interval
  distance impliesType loc#distance

```

concept airTripInfo **subConceptOf** trip
nonFunctionalProperties
 dc#description **hasValue** "An air trip between two airports"
endNonFunctionalProperties
airTripIdentiicator **ofType** xsd:string
start **ofType** airport
end **ofType** airport
sections **ofType** section

concept section
nonFunctionalProperties
 dc#description **hasValue** "A section of an air trip"
endNonFunctionalProperties
originAirport **impliesType** airport
destinationAirport **impliesType** airport
flightTicket **impliesType** flightTicket

concept flightTicket
nonFunctionalProperties
 dc#description **hasValue** "A ticket for a flighth"
endNonFunctionalProperties
ticketNumber **ofType** xsd:integer
personName **ofType** xsd:string
dateOfIssue **impliesType** dt:date
rate **impliesType** po#price
seatNumber **ofType** xsd:integer
seatClass **ofType** xsd:string
smokingSeat **ofType** xsd:boolean
flight **impliesType** flight

concept flight
nonFunctionalProperties
 dc#description **hasValue** "A flight"
endNonFunctionalProperties
flightNumber **ofType** xsd:integer
aircraft **impliesType** aircraft
carrier **impliesType** airline
scheduledDepartureDateAndTime **impliesType** dt:dateAndTime
scheduledArrivalDateAndTime **impliesType** dt:dateAndTime
currentDepartureDateAndTime **impliesType** dt:dateAndTime
currentArrivalDateAndTime **impliesType** dt:dateAndTime

concept aircraft
nonFunctionalProperties
 dc#description **hasValue** "An aircraft"
endNonFunctionalProperties
idAircraft **ofType** xsd:string
numberSeatEconomy **ofType** xsd:integer
numberSeatBusiness **ofType** xsd:integer
numberSeatFirstClass **ofType** xsd:integer

concept flightBookingPreferences **subConceptOf** bookingPreferences
nonFunctionalProperties
 dc#description **hasValue** "The airTrip preferences that must be fulfilled by the booking"
endNonFunctionalProperties
start **impliesType** airport
end **impliesType** airport
departure **impliesType** dt:dateAndTime
arrival **impliesType** dt:dateAndTime
class **ofType** xsd:string
numMaxConnections **ofType** xsd:integer

axiom airportCountry
nonFunctionalProperties

dc#description **hasValue** "Integrity constraint# if a airport is located in a place which is located in a given country, the country of the airport is the same"

endNonFunctionalProperties

definedBy

?A **memberOf** airport[
locatedIn **hasValue** ?L,
country **hasValue** ?C

]

and neg

(?L **memberOf** loc#location[
country **hasValue** ?C
]).

axiom departureBeforeArrival

nonFunctionalProperties

dc#description **hasValue** "Integrity Constraint departure has to be before arrival"

endNonFunctionalProperties

definedBy

?T **memberOf** trip[
departure **hasValue** ?D,
arrival **hasValue** ?A

]

and

?A =< ?D.

axiom startNotEqualEnd

nonFunctionalProperties

dc#description **hasValue** "Integrity Constraint# the start and end of a trip have to be different"

endNonFunctionalProperties

definedBy

?T **memberOf** trip[
start **hasValue** ?Start,
end **hasValue** ?End

]

and

?Start = ?End.

```

namespace {_ "http://www.wsmo.org/ontologies/hotelRoomBooking#",
  dc _ "http://purl.org/dc/elements/1.1#",
  dt _ "http://www.wsmo.org/ontologies/dateTime#",
  bo _ "http://www.wsmo.org/ontologies/booking#",
  loc _ "http://www.wsmo.org/ontologies/location#",
  geo _ "http://www.wsmo.org/2004/d3/d3.3/v0.1/20041008/resources/owlGeoMediator.wsm1#",
  xsd _ "http://www.w3.org/2001/XMLSchema#"
}

```

```

ontology _ "http://www.wsmo.org/ontologies/hotelRoomBooking"

```

nonFunctionalProperties

```

  dc#title hasValue "Hotel Room Booking Ontology"
  dc#creator hasValue "ATOS ORIGIN S.A."
  dc#subject hasValue {"Hotel", "Hotel room booking", "Room", "hotelStay"}
  dc#description hasValue "Hotel reservation"
  dc#publisher hasValue "ATOS ORIGIN S.A."
  dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
  dc#date hasValue "2005-02-11"
  dc#type hasValue _ "http://www.wsmo.org/2004/d2#ontologies"
  dc#format hasValue "text/html"
  dc#identifier hasValue _ "http://www.wsmo.org/ontologies/hotelRoomBooking"
  dc#source hasValue _ "http://keg.cs.tsinghua.edu.cn/ontology/travel"
  dc#language hasValue "en-US"
  dc#relation hasValue {_ "http://keg.cs.tsinghua.edu.cn/ontology/travel",
    _ "http://www.wsmo.org/ontologies/booking",
    _ "http://www.wsmo.org/ontologies/dateTime",
    _ "http://www.wsmo.org/ontologies/location",
    _ "http://www.daml.org/2001/02/geofile/geofile-ont"}
  dc#coverage hasValue "ID:7029392 Name:World"
  dc#rights hasValue _ "http://www.deri.org/privacy.html"
  version hasValue "$Revision: 1.9 $"

```

endNonFunctionalProperties

```

importsOntology {_ "http://www.wsmo.org/ontologies/dateTime",
  _ "http://www.wsmo.org/ontologies/location",
  _ "http://www.wsmo.org/ontologies/booking"}

```

```

concept hotelRoomBooking subConceptOf bo#booking

```

nonFunctionalProperties

```

  dc#description hasValue "A hotel room booking"

```

endNonFunctionalProperties

```

  hotelStay impliesType hotelStay

```

```

concept hotelRoomBookingTicket subConceptOf bo#hotelRoomBookingTicket

```

nonFunctionalProperties

```

  dc#description hasValue "A ticket of a hotel romm booking"

```

endNonFunctionalProperties

```

  hotelStay impliesType hotelStay

```

```

concept hotelStay

```

nonFunctionalProperties

```

  dc#description hasValue "A stay in a hotel"

```

endNonFunctionalProperties

```

  stayId ofType xsd#string

```

```

  checkIn impliesType dt#date

```

```

  checkOut impliesType dt#date

```

```

  hotel impliesType hotel

```

```

  room impliesType room

```

```

concept room

```

nonFunctionalProperties

```

  dc#description hasValue "A room of a hotel"

```

endNonFunctionalProperties

roomNumber **ofType** xsd#integer
area **ofType** xsd#integer
phone **ofType** xsd#integer
hasAirConditioning **ofType** xsd#boolean
fare **ofType** xsd#float
addBedFare **ofType** xsd#float

concept hotel

nonFunctionalProperties

dc#description **hasValue** "A room of a hotel"

endNonFunctionalProperties

name **ofType** xsd#string

stars **ofType** xsd#integer

city **impliesType** loc#city

address **impliesType** loc#address

builtDate **impliesType** dt#Date

lastUpdateDate **impliesType** dt#Date

hasRestaurant **ofType** xsd#boolean

rooms **impliesType** room

email **ofType** xsd#string

phone **ofType** xsd#integer

concept hotelRoomBookingPreferences **subConceptOf** bookingPreferences

nonFunctionalProperties

dc#description **hasValue** "The hotel room preferences that must be fulfilled by the booking"

endNonFunctionalProperties

checkIn **impliesType** dt#date

checkOut **impliesType** dt#date

numberOfPersons **ofType** xsd#integer

hotelStars **ofType** xsd#integer

axiom checkInBeforeCheckOut

nonFunctionalProperties

dc#description **hasValue** "Integrity Constraint: checkIn has to be before checkOut"

endNonFunctionalProperties

definedBy

?S **memberOf** hotelStay[

checkIn **hasValue** ?CI,

checkOut **hasValue** ?CO

]

and

?CI =< ?CO.

```

namespace{ _"http://www.wsmo.org/ontologies/carRentalBooking#",
  dc _"http://purl.org/dc/elements/1.1#",
  dt _"http://www.wsmo.org/ontologies/dateTime#",
  bo _"http://www.wsmo.org/ontologies/booking#",
  loc _"http://www.wsmo.org/ontologies/location#",
  prs _"http://www.wsmo.org/2004/d3/d3.3/v0.1/20041008/resources/owlPersonMediator.wsml#",
  xsd _"http://www.w3.org/2001/XMLSchema#"
}

```

```

ontology _"http://www.wsmo.org/ontologies/carRentalBooking"

```

nonFunctionalProperties

```

  dc#title hasValue "Car rental booking ontology"
  dc#creator hasValue "ATOS ORIGIN S.A."
  dc#subject hasValue {"Rent a car", "Car rental booking", "Car"}
  dc#description hasValue "Rent a car booking"
  dc#publisher hasValue "ATOS ORIGIN S.A."
  dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
  dc#date hasValue "2005-02-11"
  dc#type hasValue _"http://www.wsmo.org/2004/d2#ontologies"
  dc#format hasValue "text/html"
  dc#identifier hasValue _"http://www.wsmo.org/ontologies/carRentalBooking"
  dc#source hasValue _"http://keg.cs.tsinghua.edu.cn/ontology/travel"
  dc#language hasValue "en-US"
  dc#relation hasValue {_"http://keg.cs.tsinghua.edu.cn/ontology/travel",
    _"http://www.wsmo.org/ontologies/booking",
    _"http://www.wsmo.org/ontologies/dateTime",
    _"http://www.wsmo.org/ontologies/location"}
  dc#coverage hasValue "ID:7029392 Name:World"
  dc#rights hasValue _"http://www.deri.org/privacy.html"
  version hasValue "$Revision: 1.9 $"

```

endNonFunctionalProperties

```

importsOntology {_"http://www.wsmo.org/ontologies/dateTime",
  _"http://www.wsmo.org/ontologies/booking",
  _"http://www.wsmo.org/ontologies/location"
}

```

```

concept carRentalBooking subConceptOf bo#booking

```

nonFunctionalProperties

```

  dc#description hasValue "A booking of a car rental"

```

endNonFunctionalProperties

```

  carRentalBookingInfo impliesType carRentalBookingInfo

```

```

concept carRentalBookingTicket subConceptOf bo#bookingTicket

```

nonFunctionalProperties

```

  dc#description hasValue "A bookingTicket of a car rental booking"

```

endNonFunctionalProperties

```

  carRentalBookingInfo impliesType carRentalBookingInfo

```

```

concept carRentalBookingInfo

```

nonFunctionalProperties

```

  dc#description hasValue "The car rental information"

```

endNonFunctionalProperties

```

  driversName ofType xsd:string

```

```

  pickupLocation impliesType loc#address

```

```

  returnLocation impliesType loc#address

```

```

  pickupDateAndTime impliesType dt#dateAndTime

```

```

  returnDateAndTime impliesType dt#dateAndTime

```

```

  car impliesType car

```

```

concept car

```

nonFunctionalProperties

```

  dc#description hasValue "A car"

```

endNonFunctionalProperties

carIdentiicator **ofType** xsd:string
rentalRate **ofType** xsd:float
doorCount **ofType** xsd:integer
carSize **ofType** xsd:integer
miliageLimited **ofType** xsd:boolean
hasChildSeat **ofType** xsd:boolean
hasAirConditioning **ofType** xsd:boolean

concept carRentalBookingPreferences **subConceptOf** bookingPreferences

nonFunctionalProperties

dc:description **hasValue** "The car rental preferences that must be fulfilled by the booking"

endNonFunctionalProperties

pickupLocation **impliesType** loc#address
returnLocation **impliesType** loc#address
pickupDateAndTime **impliesType** dt#dateAndTime
returnDateAndTime **impliesType** dt#dateAndTime
doorCount **ofType** xsd:integer
carSize **ofType** xsd:integer
miliageLimited **ofType** xsd:boolean
hasChildSeat **ofType** xsd:boolean
hasAirConditioning **ofType** xsd:boolean

axiom pickupBeforeReturn

nonFunctionalProperties

dc:description **hasValue** "Integrity Constraint# pickupDate has to be before returnDate"

endNonFunctionalProperties**definedBy**

?B **memberOf** carRentalBooking[
 carRentalBookingInfo **hasValue** ?C
]
and
?C **memberOf** carRentalBookingInfo[
 pickupDateAndTime **hasValue** ?P,
 returnDateAndTime **hasValue** ?R
]
and
?P =< ?R.

```

namespace{ _"http://www.wsmo.org/ontologies/shuttleBooking#",
  dc _"http://purl.org/dc/elements/1.1#",
  dt _"http://www.wsmo.org/ontologies/dateTime#",
  bo _"http://www.wsmo.org/ontologies/booking#",
  loc _"http://www.wsmo.org/ontologies/location#",
  fb _"http://www.wsmo.org/ontologies/flightBooking#",
  xsd _"http://www.w3.org/2001/XMLSchema#"
}

ontology _"http://www.wsmo.org/ontologies/shuttleBooking"
nonFunctionalProperties
  dc#title hasValue "Shuttle booking ontology"
  dc#creator hasValue "ATOS ORIGIN S.A."
  dc#subject hasValue {"Taxi shuttle", "Shuttle booking", "Taxi"}
  dc#description hasValue "The ontology for booking a shuttle"
  dc#publisher hasValue "ATOS ORIGIN S.A."
  dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
  dc#date hasValue "2005-02-11"
  dc#type hasValue _"http://www.wsmo.org/2004/d2#ontologies"
  dc#format hasValue "text/html"
  dc#identifier hasValue _"http://www.wsmo.org/ontologies/shuttleBooking"
  dc#source hasValue _"http://keg.cs.tsinghua.edu.cn/ontology/travel"
  dc#language hasValue "en-US"
  dc#relation hasValue {_"http://keg.cs.tsinghua.edu.cn/ontology/travel",
    _"http://www.wsmo.org/ontologies/booking",
    _"http://www.wsmo.org/ontologies/flightBooking",
    _"http://www.wsmo.org/ontologies/dateTime",
    _"http://www.wsmo.org/ontologies/location"}
  dc#coverage hasValue "ID:7029392 Name:World"
  dc#rights hasValue _"http://www.deri.org/privacy.html"
  version hasValue "$Revision: 1.9 $"
endNonFunctionalProperties

importsOntology {_"http://www.wsmo.org/ontologies/dateTime",
  _"http://www.wsmo.org/ontologies/booking",
  _"http://www.wsmo.org/ontologies/flightBooking",
  _"http://www.wsmo.org/ontologies/location"
}

concept shuttleBooking subConceptOf bo#booking
nonFunctionalProperties
  dc#description hasValue "A booking of a shuttle"
endNonFunctionalProperties
shuttleBookingInfo impliesType shuttleBookingInfo

concept shuttleBookingTicket subConceptOf bo#bookingTicket
nonFunctionalProperties
  dc#description hasValue "A bookingTicket of a shuttle booking"
endNonFunctionalProperties
shuttleBookingInfo impliesType shuttleBookingInfo

concept shuttleBookingInfo
nonFunctionalProperties
  dc#description hasValue "The shuttle booking information"
endNonFunctionalProperties
pickupLocation impliesType fb#airport
pickupDateAndTime impliesType dt#dateAndTime
destination impliesType loc#location
shuttle impliesType shuttle

concept shuttle
nonFunctionalProperties
  dc#description hasValue "A shuttle"
endNonFunctionalProperties

```

shuttleIdentifier **ofType** xsd#integer
year **impliesType** dt#year

concept shuttleBookingPreferences **subConceptOf** bo#bookingPreferences

nonFunctionalProperties

dc#description **hasValue** "The shuttle booking preferences"

endNonFunctionalProperties

pickupLocation **impliesType** fb#airport

pickupDateAndTime **impliesType** dt#dateAndTime

destination **impliesType** loc#location

SFS uses a catalogue as an exhaustive repository of information for web service attributes. This catalogue enables users to browse through the Packages, Package templates and also through Web Services available. Additionally, the user may also query the Catalogue on the basis of some desired properties of the service, such as, service providers, category, points needed to contract the service etc. Thus, the purpose of the catalogue is not for automatic service discovery, but rather, the latter process takes place inside the Semantic Web Service Repository.

```

namespace {_ "http://www.wsmo.org/ontologies/sfs/sfsRecord#",
dc _ "http://purl.org/dc/elements/1.1#",
tsd _ "http://www.wsmo.org/ontologies/sfs/travelServiceDescription#",
cu _ "http://www.wsmo.org/ontologies/sfs/customer#",
dt _ "http://www.wsmo.org/ontologies/dateTime#",
xsd _ "http://www.w3.org/2001/XMLSchema#"}

ontology _ "http://www.wsmo.org/ontologies/sfs/sfsRecord"
nonFunctionalProperties
dc#creator hasValue "ATOS ORIGIN S.A."
dc#subject hasValue {"Car tourismServiceProvider", "Car"}
dc#description hasValue "Rent a car booking"
dc#publisher hasValue "ATOS ORIGIN S.A."
dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
dc#date hasValue "2005-02-11"
dc#type hasValue _ "http://www.wsmo.org/2004/d2#ontologies"
dc#format hasValue "text/html"
dc#identifier hasValue _ "http://www.wsmo.org/ontologies/sfs/sfsRecord"
dc#language hasValue "en-US"
dc#relation hasValue {_ "http://www.wsmo.org/ontologies/dateTime",
_ "http://www.wsmo.org/ontologies/sfs/travelServiceDescription",
_ "http://www.wsmo.org/ontologies/sfs/customer"}
dc#coverage hasValue "ID:7029392 Name:World"
endNonFunctionalProperties

importsOntology {_ "http://www.wsmo.org/ontologies/sfs/travelServiceDescription",
_ "http://www.wsmo.org/ontologies/sfs/customer",
_ "http://www.wsmo.org/ontologies/dateTime"}

concept sfsServiceRecord
nonFunctionalProperties
dc#description hasValue "A service record description "
dc#sfscustomer hasValue "The sfs customer "
dc#service hasValue "The service that has been used by the customer"
dc#lastUsedDate hasValue "The last date that the package has been used by the customer"
dc#points hasValue "Points obtained by using the package"
dc#effects hasValue "Possible incidences"
endNonFunctionalProperties
sfscustomer ofType cu#customer
sfsServiceProvider ofType tsp#tourismServiceProvider
service ofType tsd#travelServiceDescription
recordDate ofType dt#dateAndTime
points ofType xsd#float
effects ofType xsd#string

concept sfsPackageRecord
nonFunctionalProperties
dc#description hasValue "A package record description "
dc#sfscustomer hasValue "The sfs customer "
dc#package hasValue "The package that has been used by the customer"
dc#lastUsedDate hasValue "The last date that the package has been used by the customer"
dc#points hasValue "Points obtained by using the package"
dc#effects hasValue "Possible incidences"
endNonFunctionalProperties
sfscustomer ofType cu#customer
sfsServiceProvider ofType tsp#tourismServiceProvider
package ofType tsd#package
recordDate ofType dt#dateAndTime
points ofType xsd#float
effects ofType xsd#string

```



```

namespace {_ "http://www.wsmo.org/ontologies/sfs/serviceDescription#",
dc _"http://purl.org/dc/elements/1.1#",
tsp _"http://www.wsmo.org/ontologies/sfs/tourismServiceProvider#",
ho _"http://www.wsmo.org/ontologies/sfs/hotel#",
fl _"http://www.wsmo.org/ontologies/sfs/flight#",
cr _"http://www.wsmo.org/ontologies/sfs/carRental#",
sh _"http://www.wsmo.org/ontologies/sfs/shuttle#",
cu _"http://www.wsmo.org/ontologies/sfs/customer#",
dt _"http://www.wsmo.org/ontologies/dateTime#",
loc _"http://www.wsmo.org/ontologies/location#",
xsd _"http://www.w3.org/2001/XMLSchema#"}

ontology _"http://www.wsmo.org/ontologies/sfs/travelServiceDescription"
nonFunctionalProperties
dc#title hasValue "Description of the Travel Services in the SFS Catalogue"
dc#creator hasValue "ATOS ORIGIN S.A."
dc#subject hasValue {"travel Service description", "Package description"}
dc#description hasValue "Ontology to describes travel services and packages"
dc#publisher hasValue "ATOS ORIGIN S.A."
dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
dc#date hasValue "2005-04-08"
dc#type hasValue _"http://www.wsmo.org/2004/d2#ontologies"
dc#format hasValue "text/html"
dc#identifier hasValue _"http://www.wsmo.org/ontologies/sfs/travelServiceDescription"
dc#language hasValue "en-US"
dc#relation hasValue {_ "http://keg.cs.tsinghua.edu.cn/ontology/travel",
_ "http://www.wsmo.org/ontologies/sfs/flight",
_ "http://www.wsmo.org/ontologies/sfs/hotel",
_ "http://www.wsmo.org/ontologies/sfs/carRental",
_ "http://www.wsmo.org/ontologies/sfs/shuttle",
_ "http://www.wsmo.org/ontologies/sfs/customer",
_ "http://www.wsmo.org/ontologies/sfs/tourismServiceProvider",
_ "http://www.wsmo.org/ontologies/dateTime",
_ "http://www.wsmo.org/ontologies/location"}
dc#coverage hasValue "ID:7029392 Name:World"
endNonFunctionalProperties

importsOntology {_ "http://www.wsmo.org/ontologies/sfs/tourismServiceProvider",
_ "http://www.wsmo.org/ontologies/sfs/flight",
_ "http://www.wsmo.org/ontologies/sfs/hotel",
_ "http://www.wsmo.org/ontologies/sfs/carRental",
_ "http://www.wsmo.org/ontologies/sfs/shuttle",
_ "http://www.wsmo.org/ontologies/sfs/customer",
_ "http://www.wsmo.org/ontologies/dateTime",
_ "http://www.wsmo.org/ontologies/location"}

concept travelServiceDescription
nonFunctionalProperties
dc#description hasValue "A travel service description "
dc#publisher hasValue "Service Provider"
dc#title hasValue "Name of Service"
dc#category hasValue "Category of Service"
dc#deliveryDate hasValue "Date of publication"
dc#points hasValue "Points obtained by using the service"
dc#reliability hasValue "reliability percentage"
dc#timeOfResponse hasValue "Indicates the time of response of the travel service(in seconds)"
dc#securityIssues hasValue "Indicates the security issues that must accomplish"
dc#termsOfAcceptance hasValue "Indicates the terms of the acceptance of the contract"
endNonFunctionalProperties
serviceProvider impliesType tsp#tourismServiceProvider
serviceName ofType xsd:string
textualServiceDescription ofType xsd:string
category impliesType serviceCategory

```

deliveryDate **ofType** xsd#date
points **ofType** xsd#integer
reliability **ofType** xsd#float
timeOfResponse **ofType** xsd#float
securityIssues **ofType** xsd#string
termsOfAcceptance **ofType** xsd#string

concept serviceCategory
nonFunctionalProperties
dc#description **hasValue** "defines a category of a service"
dc#name **hasValue** "the name of the service category"
dc#keywords **hasValue** "the keywords that identifies the category"
endNonFunctionalProperties
name **ofType** xsd#string
keywords **ofType** xsd#string

instance flightBookingCategory **memberOf** serviceCategory
nonFunctionalProperties
dc#description **hasValue** "defines the category for a flight Booking service"
endNonFunctionalProperties
name **hasValue** "Flight Booking"
keywords **hasValue** {"flight","reservation","booking","schedule","travel"}

instance hotelBookingCategory **memberOf** serviceCategory
nonFunctionalProperties
dc#description **hasValue** "defines the category for a Hotel Booking service"
endNonFunctionalProperties
name **hasValue** "Hotel Booking"
keywords **hasValue** {"hotel","room","booking","travel"}

instance carRentalBookingCategory **memberOf** serviceCategory
nonFunctionalProperties
dc#description **hasValue** "defines the category for a Car rental Booking service"
endNonFunctionalProperties
name **hasValue** "Car rental Booking"
keywords **hasValue** {"car rental","rent a car","car","booking","travel"}

instance shuttleBookingCategory **memberOf** serviceCategory
nonFunctionalProperties
dc#description **hasValue** "defines the category for a Shuttle Booking service"
endNonFunctionalProperties
name **hasValue** "Shuttle Booking"
keywords **hasValue** {"shuttle","taxi","booking","travel"}

concept flightTravelServiceDescription **subConceptOf** travelServiceDescription
nonFunctionalProperties
dc#description **hasValue** "The flight service description to diferenciate services between them"
dc#allowKidsAloneService **hasValue** "Indicates if the service has the kids service for travelling alone"
dc#hasChildSeats **hasValue** "Indicates if the flights has child seats"
dc#minimunRate **hasValue** "Indicates the minimun rate in this service"
dc#maximunRate **hasValue** "Indicates the maximun rate in this service"
dc#originCities **hasValue** "The available origin cities"
dc#destinationCities **hasValue** "The available destination cities"
endNonFunctionalProperties
serviceProvider **impliesType** fl#flightServiceProgram
allowKidsAloneService **ofType** xsd#boolean
hasChildSeats **ofType** xsd#boolean
minimunRate **ofType** xsd#float
maximunRate **ofType** xsd#float
originCities **impliesType** loc#city
destinationCities **impliesType** loc#city

concept hotelRoomTravelServiceDescription **subConceptOf** travelServiceDescription
nonFunctionalProperties

dc#description **hasValue** "The hotel room service description to diferenciate services between them"
dc#allowPets **hasValue** "Indicates if thi service offers having pets in its hotels"
dc#allowGroupsReservation **hasValue** "Indicates if this service allow reservations for group"
dc#hasSuites **hasValue** "Indicates if this service offers suites"
dc#minimunRoomRate **hasValue** "Indicates the minimun room rate in this service"
dc#maximunRoomRate **hasValue** "Indicates the maximun room rate in this service"
dc#minimunStars **hasValue** "The available destination cities"
dc#maximunStars **hasValue** "The available cities that this service offers"
dc#availableCities **hasValue** "The available cities that this service offers"
dc#availableHotels **hasValue** "The available hotels that this service offers"

endNonFunctionalProperties

serviceProvider **impliesType** ho#hotelServiceProvider
allowPets **ofType** xsd#boolean
allowGroupsReservation **ofType** xsd#boolean
hasSuites **ofType** xsd#boolean
minimunRoomRate **ofType** xsd#float
maximunRoomRate **ofType** xsd#float
minimunStars **ofType** xsd#integer
maximunStars **ofType** xsd#integer
availableCities **ofType** loc#city
availableHotels **ofType** hb#hotel

concept carRentalTravelServiceDescription **subConceptOf** travelServiceDescription

nonFunctionalProperties

dc#description **hasValue** "The car rental service description to diferenciate services between them"
dc#allowSendToHome **hasValue** "Indicates if this service offers sending the car to the customers hor"
dc#allowOutlineReturn **hasValue** "Indicates if this service allow returning the car outline"
dc#minimunRate **hasValue** "Indicates the minimun car rental rate in this service"
dc#maximunRate **hasValue** "Indicates the maximun room car rental in this service"
dc#hasChildSeats **hasValue** "Indicates if this service offers child seats"
dc#availableCities **hasValue** "The available cities that this service offers"
dc#parkingLocations **hasValue** "The available parking locations that this service offers"

endNonFunctionalProperties

serviceProvider **impliesType** cr#carRentalServiceProvider
allowSendToHome **ofType** xsd#boolean
allowOutlineReturn **ofType** xsd#boolean
minimunRate **ofType** xsd#float
maximunRate **ofType** xsd#float
hasChildSeats **ofType** xsd#boolean
availableCities **ofType** loc#city
parkingLocations **ofType** loc#address

concept shuttleTravelServiceDescription **subConceptOf** travelServiceDescription

nonFunctionalProperties

dc#description **hasValue** "The shuttle service description to diferenciate services between them"
dc#allowKidsAloneService **hasValue** "Indicates if the service has the kids service for travelling alone"
dc#allowKidsAloneService **hasValue** "Indicates if the service offers vans or not"
dc#hasChildSeats **hasValue** "Indicates if this service offers child seats"
dc#availableCities **hasValue** "The available origin airports where this service is offered"

endNonFunctionalProperties

serviceProvider **impliesType** sh#shuttleServiceProvider
allowKidsAloneService **ofType** xsd#boolean
hasChildSeats **ofType** xsd#boolean
hasVans **ofType** xsd#boolean
availableOriginAirports **impliesType** fl#airport

concept package

nonFunctionalProperties

dc#description **hasValue** "defines a package"
dc#name **hasValue** "Indicates the name of the package"
dc#creationDate **hasValue** "Indicates ithe package creation date"
dc#service **hasValue** "The services that compose this package"
dc#constraints **hasValue** "The constraints of the package"

endNonFunctionalProperties

name **ofType** xsd:string
creationDate **ofType** dt:date
slots **impliesType** travelServiceDescription
constraints **impliesType** constraintDescription

concept usersPackage **subConceptOf** package**nonFunctionalProperties**

dc:description **hasValue** "defines a package created by a user"
dc:user **hasValue** "The user that has created this package"

endNonFunctionalProperties

user **ofType** cu#customer

concept constraintDescription**nonFunctionalProperties**

dc:description **hasValue** "defines a constraint in the package definition"
dc#properties **hasValue** "The constraint has to be in a constraint language"

endNonFunctionalProperties

properties **ofType** xsd:string

instance ESPAIR **memberOf** flightTravelServiceDescription

serviceProvider **hasValue** {Espair}
serviceName **hasValue** "Espair flights"
category **hasValue** flightBookingCategory
deliveryDate **hasValue** _date(2004,5,15)
points **hasValue** 200
reliability **hasValue** 90
timeOfResponse **hasValue** 30
securityIssues **hasValue** ""
allowKidsAloneService **hasValue** "true"
hasChildSeats **hasValue** "true"
minimunRate **hasValue** 60
maximunRate **hasValue** 500
originCities **hasValue** {Madrid, Barcelona, Valencia, Bilbao, PalmaDeMallorca}
destinationCities **hasValue** {Madrid, Barcelona, Valencia, Bilbao, PalmaDeMallorca}

instance BALEAIR **memberOf** flightTravelServiceDescription

serviceProvider **hasValue** {Balear}
serviceName **hasValue** " Balear flights"
category **hasValue** flightBookingCategory
deliveryDate **hasValue** _date(2004,12,1)
points **hasValue** 120
reliability **hasValue** 92
timeOfResponse **hasValue** 25
securityIssues **hasValue** ""
allowKidsAloneService **hasValue** "false"
hasChildSeats **hasValue** "false"
minimunRate **hasValue** 70
maximunRate **hasValue** 600
originCities **hasValue** {Madrid, Barcelona}
destinationCities **hasValue** {PalmaDeMallorca, libiza}

instance HOTESP **memberOf** hotelRoomTravelServiceDescription

serviceProvider **hasValue** {Hotesp}
serviceName **hasValue** "Hotesp hotels"
category **hasValue** hotelBookingCategory
deliveryDate **hasValue** _date(2004,2,2)
points **hasValue** 50
reliability **hasValue** 98
timeOfResponse **hasValue** 15
securityIssues **hasValue** ""
allowPets **hasValue** "true"

allowGroupsReservation **hasValue** "true"
hasSuites **hasValue** "true"
minimunRoomRate **hasValue** 150
maximunRoomRate **hasValue** 40
minimunStars **hasValue** 3
maximunStars **hasValue** 5
availableCities **hasValue** {Madrid,Barcelona,Valencia,Bilbao,Sevilla}
availableHotels **hasValue** {HOTESPMadrid, HOTESPBarcelona, HOTESPValencia, HOTESPBilbao, H

instance HOTELBAL **memberOf** hotelRoomTravelServiceDescription
serviceProvider **hasValue** { HotelBal }
serviceName **hasValue** "HotelBal hotels"
category **hasValue** hotelBookingCategory
deliveryDate **hasValue** _date(2004,5,6)
points **hasValue** 55
reliability **hasValue** 94
timeOfResponse **hasValue** 12
securityIssues **hasValue** ""
allowPets **hasValue** "false"
allowGroupsReservation **hasValue** "true"
hasSuites **hasValue** "true"
minimunRoomRate **hasValue** 175
maximunRoomRate **hasValue** 50
minimunStars **hasValue** 4
maximunStars **hasValue** 5
availableCities **hasValue** {PalmaDeMallorca, Ibiza, Menorca}
availableHotels **hasValue** {HOTELBALMallorca, HOTELBALIbiza}

```

namespace {_ "http://www.wsmo.org/ontologies/sfs/customer#",
dc _ "http://purl.org/dc/elements/1.1#",
loc _ "http://www.wsmo.org/ontologies/location#",
xsd _ "http://www.w3.org/2001/XMLSchema#"}

ontology _ "http://www.wsmo.org/ontologies/sfs/customer"
nonFunctionalProperties
dc#title hasValue "customer SFS"
dc#creator hasValue "ATOS ORIGIN S.A."
dc#subject hasValue {"Service record "}
dc#description hasValue "The SFS customer ontology "
dc#publisher hasValue "ATOS ORIGIN S.A."
dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
dc#date hasValue "2005-02-11"
dc#type hasValue _ "http://www.wsmo.org/2004/d2#ontologies"
dc#format hasValue "text/html"
dc#identifier hasValue _ "http://www.wsmo.org/ontologies/sfs/customer"
dc#language hasValue "en-US"
dc#coverage hasValue "ID:7029392 Name:World"
endNonFunctionalProperties

importsOntology {_ "http://www.wsmo.org/ontologies/sfs/serviceDescription",
_ "http://www.wsmo.org/ontologies/location"}

concept customer
nonFunctionalProperties
dc#description hasValue "A SFS customer"
dc#username hasValue "The username of the customer"
dc#password hasValue "The password of the customer"
dc#accumulatedPoints hasValue "The points accumulated by the user"
endNonFunctionalProperties
username ofType xsd:string
password ofType xsd:string
contactInformation impliesType contactInformation
accumulatedPoints ofType xsd:integer

concept contactInformation
nonFunctionalProperties
dc#description hasValue "The collection of business properties that
provide communication and address information for
contacting a person, organization or business."
dc#name hasValue "The customers name"
dc#emailaddress hasValue "The email of the customer"
dc#faxnumber hasValue "The fax number of the customer"
dc#telephonenumber hasValue "The phone number of the customer"
dc#physicalAddress hasValue "A address of the customer"
endNonFunctionalProperties
name ofType xsd:string
emailaddress ofType xsd:string
faxnumber ofType xsd:string
telephonenumber ofType xsd:string
physicalAddress ofType loc#address

instance Paquito memberOf customer
username hasValue "paquito"
password hasValue "paquito"

instance paquitoContactInfo memberOf contactInformation
name hasValue "Francisco De Benito Bercimuelle"
emailaddress hasValue "paquito@anymail.com"
faxnumber hasValue "34913452121"

```

```
telephonenumber hasValue "34696023424"  
physicalAddress hasValue paquitoAddress  
accumulatedPoints hasValue 3000
```

3.2 Goals

Goals denote what a user wants as the result of the Web Service. For modeling the goal, WSMO describes the information elements that the user wants to get from the service (the postcondition) together with the state of the world desired after the service execution (the effect).

In WSMO, Goals can be defined a different levels of granularity. By so-called GG Mediators, new, more specific Goals can be created out of generic existing Goals. You can also think of generic Goals as being pre-defined in a specific application context, wherefrom concrete Goals can be generated from. In order to showcase this, we define a generic goal for each service.

All of the goals will have the following description elements

- postcondition: a booking for a buyer
- effect: the booking ticket is delivered to the buyer via email

```

namespace{ _"http://www.wsmo.org/2005/d10/resources/flightBookingBuyerGoal#",
  dc _"http://purl.org/dc/elements/1.1#",
  fb _"http://www.wsmo.org/ontologies/flightBooking#",
  bo _"http://www.wsmo.org/ontologies/booking#",
  loc _"http://www.wsmo.org/ontologies/location#",
  dt _"http://www.wsmo.org/ontologies/dateTime#"
}

goal _"http://www.wsmo.org/2005/d10/resources/flightBookingBuyerGoal"

nonFunctionalProperties
  dc#title hasValue "Flight Booking Buyer Goal"
  dc#creator hasValue "ATOS ORIGIN S.A."
  dc#subject hasValue {"Flight", "Flight Booking", "Airport", "AirTrip"}
  dc#description hasValue "Express the goal booking an airTrip"
  dc#publisher hasValue "ATOS ORIGIN S.A."
  dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
  dc#date hasValue "2005-02-15"
  dc#type hasValue _"http://www.wsmo.org/2004/d2#goals"
  dc#format hasValue "text/plain"
  dc#identifier hasValue _"http://www.wsmo.org/2005/d10/resources/flightBookingBuyerGoal"
  dc#language hasValue "en-US"
  dc#relation hasValue {_"http://www.wsmo.org/ontologies/flightBooking",
    _"http://www.wsmo.org/ontologies/booking",
    _"http://www.wsmo.org/ontologies/location",
    _"http://www.wsmo.org/ontologies/dateTime"}
  dc#coverage hasValue "ID:7029392 Name:World"
  dc#rights hasValue _"http://deri.at/privacy.html"
  version hasValue "$Revision: 1.9 $"
endNonFunctionalProperties

importsOntology {_"http://www.wsmo.org/ontologies/flightBooking",
  _"http://www.wsmo.org/ontologies/booking",
  _"http://www.wsmo.org/ontologies/location",
  _"http://www.wsmo.org/ontologies/dateTime"
}

capability
  postcondition
    nonFunctionalProperties
      dc#description hasValue "This goal expresses the general desire of booking a flight ."
    endNonFunctionalProperties
    definedBy
      exists {?BookingIdentifier, ?FlightBookingTicket, ?BookingTicketIdentifier, ?AirTripInfo,
        ?Start, ?End, ?Departure, ?Arrival, ?Buyer, ?BuyerContactInformation,
        ?FlightBookingPreferences, ?BuyerEmail, ?Class, ?NumMaxConnections}
      (
        ?BookingIdentifier memberOf bo#bookingIdentifier and
        ?FlightBookingTicket memberOf fb#flightBookingTicket
        [
          bookingTicketIdentifier hasValue ?BookingTicketIdentifier,
          airTripInfo hasValue ?AirTripInfo
        ] and
        ?BookingTicketIdentifier memberOf bo#bookingTicketIdentifier and
        ?AirTripInfo memberOf fb#airTripInfo
        [
          start hasValue ?Start,
          end hasValue ?End,
          departure hasValue ?Departure,
          arrival hasValue ?Arrival
        ] and
        ?Buyer memberOf bo#buyer[
          contactInformation hasValue ?BuyerContactInformation,
          flightBookingPreferences hasValue ?FlightBookingPreferences

```

```

] and
?BuyerContactInformation memberOf bo#contactInformation [
  emailAddress hasValue ?BuyerEmail
]and
?BuyerEmail memberOf xsd#string and
?FlightBookingPreferences memberOf fb#flightBookingPreferences
[
  start hasValue ?Start,
  end hasValue ?End,
  departure hasValue ?Departure,
  arrival hasValue ?Arrival,
  class hasValue ?Class,
  numMaxConnections hasValue ?NumMaxConnections
] and
?Start memberOf fb#airport and
?End memberOf fb#airport and
?Departure memberOf dt#dateAndTime and
?Arrival memberOf dt#dateAndTime and
?Class memberOf xsd#string and
?NumMaxConnections memberOf xsd#integer
) and
?X memberOf fb#flightBooking[
  bookingIdentifier hasValue ?BookingIdentifier,
  airTripInfo hasValue ?AirTripInfo,
  buyer hasValue ?Buyer,
  bookingTicket hasValue ?FlightBookingTicket
].

```

effect

nonFunctionalProperties

dc#description **hasValue** "The goal effect that a flight booking ticket is delivered via email."

endNonFunctionalProperties

definedBy

exists {?FlightBooking, ?BookingIdentifier, ?FlightBookingTicket, ?BookingTicketIdentifier, ?AirTripInfo, ?Start, ?End, ?Departure, ?Arrival, ?Buyer, ?BuyerContactInformation, ?FlightBookingPreferences, ?BuyerEmail, ?Class, ?NumMaxConnections}

```

(
?FlightBooking memberOf fb#flightBooking
[
  bookingIdentifier hasValue ?BookingIdentifier,
  airTripInfo hasValue ?AirTripInfo,
  buyer hasValue ?Buyer,
  bookingTicket hasValue ?FlightBookingTicket
] and
?BookingIdentifier memberOf xsd#String and
?AirTripInfo memberOf fb#airTripInfo
[
  start hasValue ?Start,
  end hasValue ?End,
  departure hasValue ?Departure,
  arrival hasValue ?Arrival
] and
?FlightBookingTicket memberOf fb#flightBookingTicket
[
  bookingTicketIdentifier hasValue ?BookingTicketIdentifier,
  airTripInfo hasValue ?AirTripInfo
] and
?Buyer memberOf bo#buyer[
  contactInformation hasValue ?BuyerContactInformation,
  flightBookingPreferences hasValue ?FlightBookingPreferences
] and
?BuyerContactInformation memberOf bo#contactInformation [
  emailAddress hasValue ?BuyerEmail
]and

```

```
?BuyerEmail memberOf xsd:string and
?FlightBookingPreferences memberOf fb#flightBookingPreferences
[
  start hasValue ?Start,
  end hasValue ?End,
  departure hasValue ?Departure,
  arrival hasValue ?Arrival,
  class hasValue ?Class,
  numMaxConnections hasValue ?NumMaxConnections
] and
?Start memberOf fb#airport and
?End memberOf fb#airport and
?Departure memberOf dt#dateAndTime and
?Arrival memberOf dt#dateAndTime and
?Class memberOf xsd:string and
?NumMaxConnections memberOf xsd#integer
) and
?X memberOf bo#onlineDelivery[
  deliveryItem hasValue {?FlightBookingTicket},
  receiver hasValue ?Buyer,
  onlineDeliveryMethod hasValue "email"
].
```

```

namespace{ _"http://www.wsmo.org/2005/d10/resources/hotelRoomBookingBuyerGoal#",
  dc _"http://purl.org/dc/elements/1.1#",
  hb _"http://www.wsmo.org/ontologies/hotelRoomBooking#",
  bo _"http://www.wsmo.org/ontologies/booking#",
  loc _"http://www.wsmo.org/ontologies/location#",
  dt _"http://www.wsmo.org/ontologies/dateTime#"
}

goal _"http://www.wsmo.org/2005/d10/resources/hotelRoomBookingBuyerGoal"

nonFunctionalProperties
  dc#title hasValue "Fight Booking Buyer Goal"
  dc#creator hasValue "ATOS ORIGIN S.A."
  dc#subject hasValue {"Hotel", "Hotel room booking", "Room", "hotelStay"}
  dc#description hasValue "Express the goal of booking a hotel room"
  dc#publisher hasValue "ATOS ORIGIN S.A."
  dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
  dc#date hasValue "2005-02-15"
  dc#type hasValue _"http://www.wsmo.org/2004/d2#goals"
  dc#format hasValue "text/plain"
  dc#identifier hasValue _"http://www.wsmo.org/2005/d10/resources/hotelRoomBookingBuyerGoal"
  dc#language hasValue "en-US"
  dc#relation hasValue {_"http://www.wsmo.org/ontologies/hotelRoomBooking",
    _"http://www.wsmo.org/ontologies/booking",
    _"http://www.wsmo.org/ontologies/location",
    _"http://www.wsmo.org/ontologies/dateTime"}
  dc#coverage hasValue "ID:7029392 Name:World"
  dc#rights hasValue _"http://deri.at/privacy.html"
  version hasValue "$Revision: 1.9 $"
endNonFunctionalProperties

importsOntology {_"http://www.wsmo.org/ontologies/hotelRoomBooking",
  _"http://www.wsmo.org/ontologies/booking",
  _"http://www.wsmo.org/ontologies/location",
  _"http://www.wsmo.org/ontologies/dateTime"
}

capability
  postcondition
    nonFunctionalProperties
      dc#description hasValue "This goal expresses the general desire of booking a hotel room ."
    endNonFunctionalProperties
    definedBy
      exists {?BookingIdentifier, ?HotelRoomBookingTicket, ?BookingTicketIdentifier,
        ?HotelStay, ?DateAndTime, ?CheckIn, ?CheckOut, ?Room, ?Hotel, ?Buyer,
        ?BuyerContactInformation, ?HotelRoomBookingPreferences, ?numberOfPersons, ?hotelStars}
      (
        ?BookingIdentifier memberOf bo#bookingIdentifier and
        ?HotelRoomBookingTicket memberOf hb#hotelRoomBookingTicket
        [
          bookingTicketIdentifier hasValue ?BookingTicketIdentifier,
          hotelStay hasValue ?HotelStay
        ] and
        ?BookingTicketIdentifier memberOf bo#bookingTicketIdentifier and
        ?HotelStay memberOf hb#hotelStay [
          checkIn hasValue ?CheckIn,
          checkOut hasValue ?CheckOut,
          room hasValue ?Room,
          hotel hasValue ?Hotel
        ] and
        ?CheckIn memberOf dt#date and
        ?CheckOut memberOf dt#date and
        ?Room memberOf hb#room and
        ?Hotel memberOf hb#hotel and
      )
    
```

```

?Buyer memberOf bo#buyer[
  contactInformation hasValue ?ContactInformation,
  bookingPreferences hasValue ?HotelRoomBookingPreferences
] and
?BuyerContactInformation memberOf bo#contactInformation [
  emailAddress hasValue ?InputBuyerEmail
] and
?HotelRoomBookingPreferences memberOf hb#hotelRoomBookingPreferences
[
  checkIn hasValue ?CheckIn,
  checkOut hasValue ?CheckOut,
  numberOfPersons hasValue ?NumberOfPersons,
  hotelStars hasValue ?HotelStars
] and
?NumberOfPersons memberOf xsd#integer and
?HotelStars memberOf xsd#integer
)
and
?X memberOf hb#hotelRoomBooking[
  bookingIdentifier hasValue ?BookingIdentifier,
  hotelStay hasValue ?HotelStay,
  buyer hasValue ?Buyer,
  bookingTicket hasValue ?HotelRoomBookingTicket
].

```

effect

nonFunctionalProperties

dc#description **hasValue** "The goal effect that a hotel room booking ticket is delivered via email."

endNonFunctionalProperties

definedBy

exists {?HotelRoomBooking, ?BookingIdentifier, ?HotelRoomBookingTicket, ?BookingTicketIdentifier, ?HotelStay, ?DateAndTime, ?CheckIn, ?CheckOut, ?Room, ?Hotel, ?Buyer, ?BuyerContactInformation, ?HotelRoomBookingPreferences, ?numberOfPersons, ?hotelStars}

```

(
  ?BookingIdentifier memberOf bo#bookingIdentifier and
  ?HotelRoomBookingTicket memberOf hb#hotelRoomBookingTicket
  [
    bookingTicketIdentifier hasValue ?BookingTicketIdentifier,
    hotelStay hasValue ?HotelStay
  ] and
  ?BookingTicketIdentifier memberOf bo#bookingTicketIdentifier and
  ?HotelStay memberOf hb#hotelStay [
    checkIn hasValue ?CheckIn,
    checkOut hasValue ?CheckOut,
    room hasValue ?Room,
    hotel hasValue ?Hotel
  ] and
  ?CheckIn memberOf dt#date and
  ?CheckOut memberOf dt#date and
  ?Room memberOf hb#room and
  ?Hotel memberOf hb#hotel and
  ?Buyer memberOf bo#buyer[
    contactInformation hasValue ?ContactInformation,
    bookingPreferences hasValue ?HotelRoomBookingPreferences
  ] and
  ?BuyerContactInformation memberOf bo#contactInformation [
    emailAddress hasValue ?InputBuyerEmail
  ] and
  ?HotelRoomBookingPreferences memberOf hb#hotelRoomBookingPreferences
  [
    checkIn hasValue ?CheckIn,
    checkOut hasValue ?CheckOut,
    numberOfPersons hasValue ?NumberOfPersons,
    hotelStars hasValue ?HotelStars
  ]
)

```

```
] and
?NumberOfPersons memberOf xsd#integer and
?HotelStars memberOf xsd#integer and
?HotelRoomBooking memberOf hb#hotelRoomBooking [
  bookingIdentifier hasValue ?BookingIdentifier,
  hotelStay hasValue ?HotelStay,
  buyer hasValue ?Buyer,
  bookingTicket hasValue ?HotelRoomBookingTicket
]
)
and
?X memberOf bo#onlineDelivery[
  deliveryItem hasValue {?HotelRoomBookingTicket},
  receiver hasValue ?Buyer,
  onlineDeliveryMethod hasValue "email"
].
```

```

namespace {_ "http://www.wsmo.org/2005/d10/resources/carRentalBookingBuyerGoal#",
  dc _ "http://purl.org/dc/elements/1.1#",
  cb _ "http://www.wsmo.org/ontologies/carRentalBooking#",
  bo _ "http://www.wsmo.org/ontologies/booking#",
  loc _ "http://www.wsmo.org/ontologies/location#",
  dt _ "http://www.wsmo.org/ontologies/dateTime#"
}

goal _ "http://www.wsmo.org/2005/d10/resources/carRentalBookingBuyerGoal.wsmi"
nonFunctionalProperties
  dc#title hasValue "Car Rental Booking Buyer Goal"
  dc#creator hasValue "ATOS ORIGIN S.A."
  dc#subject hasValue {"Car rental", "Rent a car online", "Car booking"}
  dc#description hasValue "Express the goal of renting a car"
  dc#publisher hasValue "ATOS ORIGIN S.A."
  dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
  dc#date hasValue "2005-02-15"
  dc#type hasValue _ "http://www.wsmo.org/2004/d2#goals"
  dc#format hasValue "text/plain"
  dc#identifier hasValue _ "http://www.wsmo.org/2005/d10/resources/carRentalBookingBuyerGoal.wsmi"
  dc#language hasValue "en-US"
  dc#relation hasValue {_ "http://www.wsmo.org/ontologies/carRentalBooking",
    _ "http://www.wsmo.org/ontologies/booking",
    _ "http://www.wsmo.org/ontologies/location",
    _ "http://www.wsmo.org/ontologies/dateTime"}
  dc#coverage hasValue "ID:7029392 Name:World"
  dc#rights hasValue _ "http://deri.at/privacy.html"
  version hasValue "$Revision: 1.9 $"
endNonFunctionalProperties

importsOntology {_ "http://www.wsmo.org/ontologies/carRentalBooking",
  _ "http://www.wsmo.org/ontologies/booking",
  _ "http://www.wsmo.org/ontologies/location",
  _ "http://www.wsmo.org/ontologies/dateTime"
}

capability
postcondition
nonFunctionalProperties
  dc#description hasValue "This goal expresses the general desire of booking a car rental ."
endNonFunctionalProperties
definedBy
exists {?BookingIdentifier, ?CarRentalBookingTicket, ?BookingTicketIdentifier,
  ?CarRentalBookingInfo, ?PickupLocation, ?ReturnLocation, ?PickupDateAndTime,
  ?ReturnDateAndTime, ?Car, ?Buyer, ?BuyerContactInformation, ?DoorCount,
  ?CarSize, ?MiliageLimited, ?HasChildSeat, ?HasAirConditioning}
(
  ?BookingIdentifier memberOf xsd:string and
  ?CarRentalBookingInfo memberOf cb#carRentalBookingInfo[
    pickupLocation hasValue ?PickupLocation,
    returnLocation hasValue ?ReturnLocation,
    pickupDateAndTime hasValue ?PickupDateAndTime,
    returnDateAndTime hasValue ?ReturnDateAndTime,
    car hasValue ?Car
  ] and
  ?PickupLocation memberOf loc#location and
  ?ReturnLocation memberOf loc#location and
  ?PickupDateAndTime memberOf dt#dateAndTime and
  ?ReturnDateAndTime memberOf dt#dateAndTime and
  ?Car memberOf cb#car
[
  doorCount hasValue ?DoorCount,
  carSize hasValue ?CarSize,
  miliageLimited hasValue ?MiliageLimited.

```

hasChildSeat **hasValue** ?HasChildSeat,
 hasAirConditioning **hasValue** ?HasAirConditioning
] and
 ?CarRentalBookingTicket **memberOf** cb#carRentalBookingTicket
[
 bookingTicketIdentificator **hasValue** ?BookingTicketIdentificator,
 carRentalBookingInfo **hasValue** ?CarRentalBookingInfo
] and
 ?BookingTicketIdentificator **memberOf** xsd#string **and**
 ?Buyer **memberOf** bo#buyer[
 contactInformation **hasValue** ?BuyerContactInformation,
 bookingPreferences **hasValue** ?CarRentalBookingPreferences
] and
 ?BuyerContactInformation **memberOf** bo#contactInformation [
 emailAddress **hasValue** ?Emailaddress
]and
 ?Emailaddress **memberOf** xsd#string **and**
 ?CarRentalBookingPreferences **memberOf** cb#carRentalBookingPreferences
[
 pickupLocation **hasValue** ?PickupLocation,
 returnLocation **hasValue** ?ReturnLocation,
 pickupDateAndTime **hasValue** ?PickupDateAndTime,
 returnDateAndTime **hasValue** ?ReturnDateAndTime,
 doorCount **hasValue** ?DoorCount,
 carSize **hasValue** ?CarSize,
 miliageLimited **hasValue** ?MiliageLimited,
 hasChildSeat **hasValue** ?HasChildSeat,
 hasAirConditioning **hasValue** ?HasAirConditioning
] and
 ?DoorCount **memberOf** xsd#integer **and**
 ?CarSize **memberOf** xsd#integer **and**
 ?MiliageLimited **memberOf** xsd#boolean **and**
 ?HasChildSeat **memberOf** xsd#boolean **and**
 ?HasAirConditioning **memberOf** xsd#boolean
) and
 ?X **memberOf** cb#carRentalBooking[
 bookingIdentifier **hasValue** ?BookingIdentifier,
 carRentalBookingInfo **hasValue** ?CarRentalBookingInfo,
 buyer **hasValue** ?Buyer,
 bookingTicket **hasValue** ?CarRentalBookingTicket
].

effect

nonFunctionalProperties

dc#description **hasValue** "The goal effect that a carRrebnta is delivered via emial."

endNonFunctionalProperties

definedBy

exists {?CarRentalBooking, ?BookingIdentifier, ?CarRentalBookingTicket, ?BookingTicketIdentical
 ?CarRentalBookingInfo, ?PickupLocation, ?ReturnLocation, ?PickupDateAndTime, ?ReturnDate
 ?Car, ?Buyer, ?BuyerContactInformation, ?DoorCount, ?CarSize, ?MiliageLimited,
 ?HasChildSeat, ?HasAirConditioning}

(
 ?CarRentalBooking **memberOf** bo#carRentalBooking
[
 bookingIdentifier **hasValue** ?BookingIdentifier,
 carRentalBookingInfo **hasValue** ?CarRentalBookingInfo,
 buyer **hasValue** ?Buyer,
 bookingTicket **hasValue** ?CarRentalBookingTicket
] and
 ?BookingIdentifier **memberOf** xsd#string **and**
 ?CarRentalBookingInfo **memberOf** cb#carRentalBookingInfo [
 pickupLocation **hasValue** ?PickupLocation,
 returnLocation **hasValue** ?ReturnLocation,
 pickupDateAndTime **hasValue** ?PickupDateAndTime,

```

returnDateAndTime hasValue ?ReturnDateAndTime,
car hasValue ?Car
] and
?PickupLocation memberOf loc#location and
?ReturnLocation memberOf loc#location and
?PickupDateAndTime memberOf dt#dateAndTime and
?ReturnDateAndTime memberOf dt#dateAndTime and
?Car memberOf cb#car [
doorCount ?DoorCount,
carSize hasVhasValue ?CarSize,
miliageLimited hasValue ?MiliageLimited,
hasChildSeat hasValue ?HasChildSeat,
hasAirConditioning hasValue ?HasAirConditioning
] and
?CarRentalBookingTicket memberOf cb#carRentalBookingTicket
[
bookingTicketIdentificator hasValue ?BookingTicketIdentificator,
carRentalBookingInfo hasValue ?CarRentalBookingInfo
] and
?BookingTicketIdentificator memberOf xsd#string and
?Buyer memberOf bo#buyer[
contactInformation hasValue ?BuyerContactInformation,
bookingPreferences hasValue ?CarRentalBookingPreferences
] and
?BuyerContactInformation memberOf bo#contactInformation [
emailaddress hasValue ?Emailaddress
] and
?Emailaddress memberOf xsd#string and
?CarRentalBookingPreferences memberOf cb#carRentalBookingPreferences
[
pickupLocation hasValue ?PickupLocation,
returnLocation hasValue ?ReturnLocation,
pickupDateAndTime hasValue ?PickupDateAndTime,
returnDateAndTime hasValue ?ReturnDateAndTime,
doorCount hasValue ?DoorCount,
carSize hasValue ?CarSize,
miliageLimited hasValue ?MiliageLimited,
hasChildSeat hasValue ?HasChildSeat,
hasAirConditioning hasValue ?HasAirConditioning
] and
?DoorCount memberOf xsd#integer and
?CarSize memberOf xsd#integer and
?MiliageLimited memberOf xsd#boolean and
?HasChildSeat memberOf xsd#boolean and
?HasAirConditioning memberOf xsd#boolean
) and
?X memberOf bo#onlineDelivery[
deliveryItem hasValue {?CarRentalBookingTicket},
receiver hasValue ?Buyer,
onlineDeliveryMethod hasValue "email"
].

```

```

namespace {_ "http://www.wsmo.org/2005/d10/resources/shuttleBookingBuyerGoal#",
  dc _ "http://purl.org/dc/elements/1.1#",
  sb _ "http://www.wsmo.org/ontologies/shuttleBooking#",
  fb _ "http://www.wsmo.org/ontologies/flightBooking#",
  bo _ "http://www.wsmo.org/ontologies/booking#",
  loc _ "http://www.wsmo.org/ontologies/location#",
  dt _ "http://www.wsmo.org/ontologies/dateTime#"
}

goal _ "http://www.wsmo.org/2005/d10/resources/shuttleBookingBuyerGoal.wsmi"

nonFunctionalProperties
  dc#title hasValue "Shuttle booking ontology"
  dc#creator hasValue "ATOS ORIGIN S.A."
  dc#subject hasValue {"Taxi shuttle", "Shuttle booking", "Taxi"}
  dc#description hasValue "Express the goal for booking a shuttle"
  dc#publisher hasValue "ATOS ORIGIN S.A."
  dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
  dc#date hasValue "2005-02-15"
  dc#type hasValue _ "http://www.wsmo.org/2004/d2#goals"
  dc#format hasValue "text/plain"
  dc#identifier hasValue _ "http://www.wsmo.org/2005/d10/resources/shuttleBookingBuyerGoal.wsmi"
  dc#language hasValue "en-US"
  dc#relation hasValue {_ "http://www.wsmo.org/ontologies/shuttleBooking",
    _ "http://www.wsmo.org/ontologies/flightBooking",
    _ "http://www.wsmo.org/ontologies/booking",
    _ "http://www.wsmo.org/ontologies/location",
    _ "http://www.wsmo.org/ontologies/dateTime"}
  dc#coverage hasValue "ID:7029392 Name:World"
  dc#rights hasValue _ "http://deri.at/privacy.html"
  version hasValue "$Revision: 1.9 $"
endNonFunctionalProperties

importsOntology {_ "http://www.wsmo.org/ontologies/shuttleBooking",
  _ "http://www.wsmo.org/ontologies/flightBooking",
  _ "http://www.wsmo.org/ontologies/booking",
  _ "http://www.wsmo.org/ontologies/location",
  _ "http://www.wsmo.org/ontologies/dateTime"
}

capability
  postcondition
    nonFunctionalProperties
      dc#description hasValue "This goal expresses the general desire of booking a shuttle ."
    endNonFunctionalProperties
    definedBy
      exists {?BookingIdentifier, ?ShuttleBookingTicket, ?BookingTicketIdentifier,
        ?ShuttleBookingInfo, ?PickupAirport, ?PickupDateAndTime, ?Destination,
        ?Buyer, ?BuyerContactInformation, ?ShuttleBookingTicket}
      (
        ?BookingIdentifier memberOf xsd:string and
        ?ShuttleBookingInfo memberOf sb#shuttleBookingInfo [
          pickupAirport hasValue ?PickupAirport,
          pickupDateAndTime hasValue ?PickupDateAndTime,
          destination hasValue ?Destination,
          shuttle hasValue ?Shuttle
        ] and
        ?PickupAirport memberOf fb#airport and
        ?PickupDateAndTime memberOf dt#dateAndTime and
        ?Destination memberOf loc#location and
        ?Shuttle memberOf sb#shuttle and
        ?ShuttleBookingTicket memberOf sb#shuttleBookingTicket [
          bookingTicketIdentifier hasValue ?BookingTicketIdentifier,

```

```

    shuttleBookingInfo hasValue ?ShuttleBookingInfo
  ] and
  ?BookingTicketIdentifier memberOf xsd:string and
  ?Buyer memberOf bo#buyer[
    contactInformation hasValue ?BuyerContactInformation,
    bookingPreferences hasValue ?ShuttleBookingPreferences
  ] and
  ?BuyerContactInformation memberOf bo#contactInformation [
    emailAddress hasValue ?Emailaddress
  ] and
  ?Emailaddress memberOf xsd:string and
  ?ShuttleBookingPreferences memberOf sb#shuttleBookingPreferences[
    pickupAirport hasValue ?PickupLocation,
    pickupDateAndTime hasValue ?PickupDateAndTime,
    destination hasValue ?Destination
  ]
) and
?X memberOf sb#shuttleBooking[
  bookingIdentifier hasValue ?BookingIdentifier,
  shuttleBookingInfo hasValue ?ShuttleBookingInfo,
  buyer hasValue ?Buyer,
  bookingTicket hasValue ?ShuttleBookingTicket
].

```

effect

nonFunctionalProperties

dc:description **hasValue** "The goal effect that a carRrebnta is delivered via emial."

endNonFunctionalProperties

definedBy

exists {?ShuttleBooking ,?BookingIdentifier, ?ShuttleBookingTicket, ?BookingTicketIdentifier, ?ShuttleBookingInfo, ?PickupAirport , ?PickupDateAndTime, ?Destination, ?Buyer, ?BuyerContactInformation, ?ShuttleBookingTicket}

(

```

  ?ShuttleBooking memberOf sb#shuttleBooking[
    bookingIdentifier hasValue ?BookingIdentifier,
    shuttleBookingInfo hasValue ?ShuttleBookingInfo,
    buyer hasValue ?Buyer,
    bookingTicket hasValue ?ShuttleBookingTicket
  ] and
  ?BookingIdentifier memberOf xsd:string and
  ?ShuttleBookingInfo memberOf sb#shuttleBookingInfo [
    pickupAirport hasValue ?PickupAirport,
    pickupDateAndTime hasValue ?PickupDateAndTime,
    destination hasValue ?Destination,
    shuttle hasValue ?Shuttle
  ] and
  ?PickupAirport memberOf fb#airport and
  ?PickupDateAndTime memberOf dt#dateAndTime and
  ?Destination memberOf loc#location and
  ?Shuttle memberOf sb#shuttle and
  ?ShuttleBookingTicket memberOf sb#shuttleBookingTicket [
    bookingTicketIdentifier hasValue ?BookingTicketIdentifier,
    shuttleBookingInfo hasValue ?ShuttleBookingInfo
  ] and
  ?BookingTicketIdentifier memberOf xsd:string and
  ?Buyer memberOf bo#buyer[
    contactInformation hasValue ?BuyerContactInformation,
    bookingPreferences hasValue ?ShuttleBookingPreferences
  ] and
  ?BuyerContactInformation memberOf bo#contactInformation [
    emailAddress hasValue ?Emailaddress
  ] and
  ?Emailaddress memberOf xsd:string and

```

```

?ShuttleBookingPreferences memberOf sb#shuttleBookingPreferences[
  pickupAirport hasValue ?PickupLocation,
  pickupDateAndTime hasValue ?PickupDateAndTime,
  destination hasValue ?Destination
]
) and
?X memberOf bo#onlineDelivery[
  deliveryItem hasValue {?ShuttleBookingTicket},
  receiver hasValue ?Buyer,
  onlineDeliveryMethod hasValue "email"
].

```

3.3 Web Services

We define the Web Services in this use case: end-user services (means that the user interacts with this services) for booking a flight, a hotel room and a car rental. This Web Services can be composed of other Web Services. This setting allows modeling all notions of a WSMO Web Service description: a Capability of the end-user service and its Choreography for user-service interaction, as well as the orchestration which incorporates the aggregated Web Services. The current version of WSMO Standard does only provide a stable specification for describing Capabilities, the model below is restricted to the overall Web Service description and the Capability definition. The modeling for the WSMO Web Service Interface will be added in a later version. A Web Service Capability in WSMO is described by pre- and post-conditions, assumptions and effects, as defined in [[Roman et al., 2004](#)].

Listing 13. Flight Booking Web Service.

```

namespace {_ "http://www.wsmo.org/2004/d3/d3.3/v0.1/20041119/resources/flightBuyerWS#",
  dc _ "http://purl.org/dc/elements/1.1#",
  fb _ "http://www.wsmo.org/ontologies/flightBooking#",
  bo _ "http://www.wsmo.org/ontologies/booking#",
  loc _ "http://www.wsmo.org/ontologies/location#",
  dt _ "http://www.wsmo.org/ontologies/dateTime#"
}

webService _ "http://www.wsmo.org/2004/d3/d3.3/v0.1/20041119/resources/flightBuyerWS.wsml"

nonFunctionalProperties
  dc#title hasValue "Online Booking Web Service"
  dc#creator hasValue "ATOS ORIGIN S.A."
  dc#subject hasValue {"Flight", "Flight Booking", "Airport", "AirTrip"}
  dc#description hasValue "Web service for booking an airTrip"
  dc#publisher hasValue "ATOS ORIGIN S.A."
  dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
  dc#date hasValue "2005-02-11"
  dc#type hasValue _ "http://www.wsmo.org/2004/d2#webservice"
  dc#format hasValue "text/html"
  dc#identifier hasValue _ "http://www.wsmo.org/ontologies/flightBuyerWS"
  dc#source hasValue _ "http://keg.cs.tsinghua.edu.cn/ontology/travel"
  dc#language hasValue "en-US"
  dc#relation hasValue {_ "http://keg.cs.tsinghua.edu.cn/ontology/travel",
  _ "http://daml.umbc.edu/ontologies/ittalks/person",
  _ "http://www.wsmo.org/ontologies/booking",
  _ "http://www.wsmo.org/ontologies/flightBooking",
  _ "http://www.wsmo.org/ontologies/dateTime",
  _ "http://www.wsmo.org/ontologies/location"}
  dc#coverage hasValue "ID:7029392 Name:World"
  dc#rights hasValue _ "http://www.deri.org/privacy.html"

```

version **hasValue** "\$Revision: 1.9 \$"
endNonFunctionalProperties

importsOntology {_"http://www.wsmo.org/ontologies/flightBooking",
_"http://www.wsmo.org/ontologies/booking",
_"http://www.wsmo.org/ontologies/location",
_"http://www.wsmo.org/ontologies/dateTime"
}

capability flightBuyerWSCapability

precondition

nonFunctionalProperties

dc:description **hasValue** "Required input is#
[1] buyer email information
[2] airTrip requirements"

endNonFunctionalProperties

definedBy

?Buyer **memberOf** bo#buyer[
contactInformation **hasValue** ?BuyerContactInformation,
flightBookingPreferences **hasValue** ?FlightBookingPreferences
] **and**
?BuyerContactInformation **memberOf** bo#contactInformation [
emailaddress **hasValue** ?InputBuyerEmail
] **and**
?FlightBookingPreferences **memberOf** fb#flightBookingPreferences
[
start **hasValue** ?Start,
end **hasValue** ?End,
departure **hasValue** ?Departure,
arrival **hasValue** ?Arrival,
class **hasValue** ?Class,
numMaxConnections **hasValue** ?NumMaxConnections
] **and**
?Start **memberOf** fb#airport **and**
?End **memberOf** fb#airport **and**
?Departure **memberOf** dt#dateAndTime **and**
?Arrival **memberOf** dt#dateAndTime **and**
?Class **memberOf** xsd#string **and**
?NumMaxConnections **memberOf** xsd#integer.

postcondition

nonFunctionalProperties

dc:description **hasValue** "the output of the service is a flight booking."

endNonFunctionalProperties

definedBy

exists {?BookingIdentifier, ?FlightBookingTicket, ?BookingTicketIdentifier, ?AirTripInfo,
?Start, ?End, ?Departure, ?Arrival, ?Buyer, ?BuyerContactInformation,
?FlightBookingPreferences, ?BuyerEmail, ?Class, ?NumMaxConnections}
(
?BookingIdentifier **memberOf** bo#bookingIdentifier **and**
?FlightBookingTicket **memberOf** fb#flightBookingTicket
[
bookingTicketIdentifier **hasValue** ?BookingTicketIdentifier,
airTripInfo **hasValue** ?AirTripInfo
] **and**
?BookingTicketIdentifier **memberOf** bo#bookingTicketIdentifier **and**
?AirTripInfo **memberOf** fb#airTripInfo
[
start **hasValue** ?Start,
end **hasValue** ?End,
departure **hasValue** ?Departure,
arrival **hasValue** ?Arrival
] **and**
?Buyer **memberOf** bo#buyer[

contactInformation **hasValue** ?BuyerContactInformation,
 flightBookingPreferences **hasValue** ?FlightBookingPreferences
] and
 ?BuyerContactInformation **memberOf** bo#contactInformation [
 emailAddress **hasValue** ?BuyerEmail
]and
 ?BuyerEmail **memberOf** xsd#string **and**
 ?FlightBookingPreferences **memberOf** fb#flightBookingPreferences
 [
 start **hasValue** ?Start,
 end **hasValue** ?End,
 departure **hasValue** ?Departure,
 arrival **hasValue** ?Arrival,
 class **hasValue** ?Class,
 numMaxConnections **hasValue** ?NumMaxConnections
] and
 ?Start **memberOf** fb#airport **and**
 ?End **memberOf** fb#airport **and**
 ?Departure **memberOf** dt#dateAndTime **and**
 ?Arrival **memberOf** dt#dateAndTime **and**
 ?Class **memberOf** xsd#string **and**
 ?NumMaxConnections **memberOf** xsd#integer
) and
 ?X **memberOf** fb#flightBooking[
 bookingIdentifier **hasValue** ?BookingIdentifier,
 airTripInfo **hasValue** ?AirTripInfo,
 buyer **hasValue** ?Buyer,
 bookingTicket **hasValue** ?FlightBookingTicket
].

effect

nonFunctionalProperties

dc#description **hasValue** "the flight booking ticket is delivered to the buyer via email."

endNonFunctionalProperties

definedBy

exists {?FlightBooking, ?BookingIdentifier, ?FlightBookingTicket, ?BookingTicketIdentifier,
 ?AirTripInfo, ?Start, ?End, ?Departure, ?Arrival, ?Buyer, ?BuyerContactInformation,
 ?FlightBookingPreferences, ?BuyerEmail, ?Class, ?NumMaxConnections}

(
 ?FlightBooking **memberOf** fb#flightBooking
 [
 bookingIdentifier **hasValue** ?BookingIdentifier,
 airTripInfo **hasValue** ?AirTripInfo,
 buyer **hasValue** ?Buyer,
 bookingTicket **hasValue** ?FlightBookingTicket
] and
 ?BookingIdentifier **memberOf** xsd#String **and**
 ?AirTripInfo **memberOf** fb#airTripInfo
 [
 start **hasValue** ?Start,
 end **hasValue** ?End,
 departure **hasValue** ?Departure,
 arrival **hasValue** ?Arrival
] and
 ?FlightBookingTicket **memberOf** fb#flightBookingTicket
 [
 bookingTicketIdentifier **hasValue** ?BookingTicketIdentifier,
 airTripInfo **hasValue** ?AirTripInfo
] and
 ?Buyer **memberOf** bo#buyer[
 contactInformation **hasValue** ?BuyerContactInformation,
 flightBookingPreferences **hasValue** ?FlightBookingPreferences
] and
 ?BuyerContactInformation **memberOf** bo#contactInformation [

```
    emailAddress hasValue ?BuyerEmail
]and
?BuyerEmail memberOf xsd:string and
?FlightBookingPreferences memberOf fb#flightBookingPreferences
[
    start hasValue ?Start,
    end hasValue ?End,
    departure hasValue ?Departure,
    arrival hasValue ?Arrival,
    class hasValue ?Class,
    numMaxConnections hasValue ?NumMaxConnections
] and
?Start memberOf fb#airport and
?End memberOf fb#airport and
?Departure memberOf dt#dateAndTime and
?Arrival memberOf dt#dateAndTime and
?Class memberOf xsd:string and
?NumMaxConnections memberOf xsd:integer
) and
?X memberOf bo#onlineDelivery[
    deliveryItem hasValue {?FlightBookingTicket},
    receiver hasValue ?Buyer,
    onlineDeliveryMethod hasValue "email"
].
```

interface flightBuyerWSInterface

nonFunctionalProperties

dc:description **hasValue** "describes the Interface of the Web Service (not specified yet)"

endNonFunctionalProperties

```

namespace {_ "http://www.wsmo.org/2004/d3/d3.3/v0.1/20041119/resources/hotelRoomBuyerWS#",
  dc _ "http://purl.org/dc/elements/1.1#",
  dt _ "http://www.wsmo.org/ontologies/dateTime#",
  hb _ "http://www.wsmo.org/ontologies/hotelRoomBooking#",
  bo _ "http://www.wsmo.org/ontologies/booking#",
  loc _ "http://www.wsmo.org/ontologies/location#"
}

webService _ "http://www.wsmo.org/2004/d3/d3.3/v0.1/20041119/resources/hotelRoomBuyerWS.wsml"

nonFunctionalProperties
  dc#creator hasValue "ATOS ORIGIN S.A."
  dc#subject hasValue {"Hotel", "Hotel room booking", "Room", "hotelStay"}
  dc#description hasValue "Hotel reservation"
  dc#publisher hasValue "ATOS ORIGIN S.A."
  dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
  dc#date hasValue "2005-02-11"
  dc#type hasValue _ "http://www.wsmo.org/2004/d2#webservice"
  dc#format hasValue "text/html"
  dc#identifier hasValue _ "http://www.wsmo.org/ontologies/hotelRoomBuyerWS"
  dc#source hasValue _ "http://keg.cs.tsinghua.edu.cn/ontology/travel"
  dc#language hasValue "en-US"
  dc#relation hasValue {_ "http://keg.cs.tsinghua.edu.cn/ontology/travel",
    _ "http://www.wsmo.org/ontologies/booking",
    _ "http://www.wsmo.org/ontologies/hotelRoomBooking",
    _ "http://www.wsmo.org/ontologies/dateTime",
    _ "http://www.wsmo.org/ontologies/location"}
  dc#coverage hasValue "ID:7029392 Name:World"
  dc#rights hasValue _ "http://www.deri.org/privacy.html"
  version hasValue "$Revision: 1.9 $"
endNonFunctionalProperties

importsOntology {_ "http://www.wsmo.org/ontologies/hotelRoomBooking",
  _ "http://www.wsmo.org/ontologies/booking",
  _ "http://www.wsmo.org/ontologies/location",
  _ "http://www.wsmo.org/ontologies/dateTime"
}

capability hotelRoomBuyerWSCapability
precondition
  nonFunctionalProperties
    dc#description hasValue "Required input is#
      [1] buyer information
      [2] hotel room booking preferences"
  endNonFunctionalProperties
definedBy
  ?Buyer memberOf bo#buyer[
    contactInformation hasValue ?ContactInformation,
    bookingPreferences hasValue ?HotelRoomBookingPreferences
  ] and
  ?BuyerContactInformation memberOf bo#contactInformation [
    emailAddress hasValue ?InputBuyerEmail
  ] and
  ?HotelRoomBookingPreferences memberOf hb#hotelRoomBookingPreferences
  [
    checkIn hasValue ?CheckIn,
    checkOut hasValue ?CheckOut,
    numberOfPersons hasValue ?NumberOfPersons,
    hotelStars hasValue ?HotelStars
  ] and
  ?CheckIn memberOf dt#date and
  ?CheckOut memberOf dt#date and
  ?NumberOfPersons memberOf xsd#integer and
  ?HotelStars memberOf xsd#integer.

```

postcondition

nonFunctionalProperties

dc#description **hasValue** "the output of the service is a hotel room booking."

endNonFunctionalProperties

definedBy

exists {?BookingIdentifier, ?HotelRoomBookingTicket, ?BookingTicketIdentifier,
?HotelStay, ?DateAndTime, ?CheckIn, ?CheckOut, ?Room, ?Hotel, ?Buyer, ?BuyerEmail,
?BuyerContactInformation, ?HotelRoomBookingPreferences, ?numberOfPersons, ?hotelStars}

(
?BookingIdentifier **memberOf** bo#bookingIdentifier **and**
?HotelRoomBookingTicket **memberOf** hb#hotelRoomBookingTicket
[
 bookingTicketIdentifier **hasValue** ?BookingTicketIdentifier,
 hotelStay **hasValue** ?HotelStay
] **and**
?BookingTicketIdentifier **memberOf** bo#bookingTicketIdentifier **and**
?HotelStay **memberOf** hb#hotelStay [
 checkIn **hasValue** ?CheckIn,
 checkOut **hasValue** ?CheckOut,
 room **hasValue** ?Room,
 hotel **hasValue** ?Hotel
] **and**
?CheckIn **memberOf** dt#date **and**
?CheckOut **memberOf** dt#date **and**
?Room **memberOf** hb#room **and**
?Hotel **memberOf** hb#hotel **and**
?Buyer **memberOf** bo#buyer[
 contactInformation **hasValue** ?ContactInformation,
 bookingPreferences **hasValue** ?HotelRoomBookingPreferences
] **and**
?BuyerContactInformation **memberOf** bo#contactInformation [
 emailaddress **hasValue** ?BuyerEmail
] **and**
?BuyerEmail **memberOf** xsd:string **and**
?HotelRoomBookingPreferences **memberOf** hb#hotelRoomBookingPreferences
[
 checkIn **hasValue** ?CheckIn,
 checkOut **hasValue** ?CheckOut,
 numberOfPersons **hasValue** ?NumberOfPersons,
 hotelStars **hasValue** ?HotelStars
] **and**
?CheckIn **memberOf** dt#date **and**
?CheckOut **memberOf** dt#date **and**
?NumberOfPersons **memberOf** xsd:integer **and**
?HotelStars **memberOf** xsd:integer
)
and
?X **memberOf** hb#hotelRoomBooking[
 bookingIdentifier **hasValue** ?BookingIdentifier,
 hotelStay **hasValue** ?HotelStay,
 buyer **hasValue** ?Buyer,
 bookingTicket **hasValue** ?HotelRoomBookingTicket
].

effect

nonFunctionalProperties

dc#description **hasValue** "the booking ticket is delivered to the buyer via email."

endNonFunctionalProperties

definedBy

exists {?HotelRoomBooking, ?BookingIdentifier, ?HotelRoomBookingTicket, ?BookingTicketIdentifier,
?HotelStay, ?DateAndTime, ?CheckIn, ?CheckOut, ?Room, ?Hotel, ?Buyer,
?BuyerContactInformation, ?HotelRoomBookingPreferences, ?numberOfPersons, ?hotelStars}

(

```

?BookingIdentifier memberOf bo#bookingIdentifier and
?HotelRoomBookingTicket memberOf hb#hotelRoomBookingTicket
[
  bookingTicketIdentifier hasValue ?BookingTicketIdentifier,
  hotelStay hasValue ?HotelStay
] and
?BookingTicketIdentifier memberOf bo#bookingTicketIdentifier and
?HotelStay memberOf hb#hotelStay [
  checkIn hasValue ?CheckIn,
  checkOut hasValue ?CheckOut,
  room hasValue ?Room,
  hotel hasValue ?Hotel
] and
?CheckIn memberOf dt#date and
?CheckOut memberOf dt#date and
?Room memberOf hb#room and
?Hotel memberOf hb#hotel and
?Buyer memberOf bo#buyer[
  contactInformation hasValue ?ContactInformation,
  bookingPreferences hasValue ?HotelRoomBookingPreferences
] and
?BuyerContactInformation memberOf bo#contactInformation [
  emailAddress hasValue ?BuyerEmail
] and
?BuyerEmail memberOf xsd:string and
?HotelRoomBookingPreferences memberOf hb#hotelRoomBookingPreferences
[
  checkIn hasValue ?CheckIn,
  checkOut hasValue ?CheckOut,
  numberOfPersons hasValue ?NumberOfPersons,
  hotelStars hasValue ?HotelStars
] and
?CheckIn memberOf dt#date and
?CheckOut memberOf dt#date and
?NumberOfPersons memberOf xsd#integer and
?HotelStars memberOf xsd#integer and
?HotelRoomBooking memberOf hb#hotelRoomBooking [
  bookingIdentifier hasValue ?BookingIdentifier,
  hotelStay hasValue ?HotelStay,
  buyer hasValue ?Buyer,
  bookingTicket hasValue ?HotelRoomBookingTicket
]
)
and
?X memberOf bo#onlineDelivery[
  deliveryItem hasValue {?HotelRoomBookingTicket},
  receiver hasValue ?Buyer,
  onlineDeliveryMethod hasValue "email"
].

```

interface hotelRoomBuyerWSInterface

nonFunctionalProperties

dc:description **hasValue** "describes the Interface of Web Service (not specified yet)"

endNonFunctionalProperties

```

namespace {_ "http://www.wsmo.org/2004/d3/d3.3/v0.1/20041119/resources/carBuyerWS#",
  dc _ "http://purl.org/dc/elements/1.1#",
  dt _ "http://www.wsmo.org/ontologies/dateTime#",
  cb _ "http://www.wsmo.org/ontologies/carRentalBooking#",
  bo _ "http://www.wsmo.org/ontologies/booking#",
  loc _ "http://www.wsmo.org/ontologies/location#"
}

```

```

webService _ "http://www.wsmo.org/2004/d3/d3.3/v0.1/20041119/resources/carBuyerWS.wsml"

```

nonFunctionalProperties

```

  dc#title hasValue "Online Car rental Booking Web Service"
  dc#creator hasValue "ATOS ORIGIN S.A."
  dc#subject hasValue {"Car rental", "Car booking web service", "Car"}
  dc#description hasValue "Web service for booking online carRental"
  dc#publisher hasValue "ATOS ORIGIN S.A."
  dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
  dc#date hasValue "2005-02-11"
  dc#type hasValue _ "http://www.wsmo.org/2004/d2#webservice"
  dc#format hasValue "text/html"
  dc#identifier hasValue _ "http://www.wsmo.org/ontologies/carBuyerWS"
  dc#source hasValue _ "http://keg.cs.tsinghua.edu.cn/ontology/travel"
  dc#language hasValue "en-US"
  dc#relation hasValue {_ "http://keg.cs.tsinghua.edu.cn/ontology/travel",
    _ "http://www.wsmo.org/ontologies/booking",
    _ "http://www.wsmo.org/ontologies/carBooking",
    _ "http://www.wsmo.org/ontologies/dateTime",
    _ "http://www.wsmo.org/ontologies/location"}
  dc#coverage hasValue "ID:7029392 Name:World"
  dc#rights hasValue _ "http://www.deri.org/privacy.html"
  version hasValue "$Revision: 1.9 $"

```

endNonFunctionalProperties

```

importsOntology {_ "http://www.wsmo.org/ontologies/carRentalBooking",
  _ "http://www.wsmo.org/ontologies/booking",
  _ "http://www.wsmo.org/ontologies/location",
  _ "http://www.wsmo.org/ontologies/dateTime"
}

```

```

capability carBuyerWSCapability

```

precondition

nonFunctionalProperties

```

  dc#description hasValue "Required input is#
    [1] buyer information with the
    [2] car rental preferences"

```

endNonFunctionalProperties

definedBy

```

  ?Buyer memberOf bo#buyer[
    contactInformation hasValue ?BuyerContactInformation,
    bookingPreferences hasValue ?CarRentalBookingPreferences
  ] and
  ?BuyerContactInformation memberOf bo#contactInformation [
    emailAddress hasValue ?Emailaddress
  ] and
  ?Emailaddress memberOf xsd#string and
  ?CarRentalBookingPreferences memberOf cb#carRentalBookingPreferences
  [
    pickupLocation hasValue ?PickupLocation,
    returnLocation hasValue ?ReturnLocation,
    pickupDateAndTime hasValue ?PickupDateAndTime,
    returnDateAndTime hasValue ?ReturnDateAndTime,
    doorCount hasValue ?DoorCount,
    carSize hasValue CarSize,
    miliaageLimited hasValue ?MiliaageLimited.
  ]

```

hasChildSeat **hasValue** ?HasChildSeat,
hasAirConditioning **hasValue** ?HasAirConditioning
] and
?PickupLocation **memberOf** loc#location **and**
?ReturnLocation **memberOf** loc#location **and**
?PickupDateAndTime **memberOf** dt#dateAndTime **and**
?ReturnDateAndTime **memberOf** dt#dateAndTime **and**
?DoorCount **memberOf** xsd#integer **and**
?CarSize **memberOf** xsd#integer **and**
?MiliageLimited **memberOf** xsd#boolean **and**
?HasChildSeat **memberOf** xsd#boolean **and**
?HasAirConditioning **memberOf** xsd#boolean.

postcondition

nonFunctionalProperties

dc#description **hasValue** "the output of the service is a booking."

endNonFunctionalProperties

definedBy

exists {?BookingIdentifier, ?CarRentalBookingTicket, ?BookingTicketIdentifier,
?CarRentalBookingInfo, ?PickupLocation, ?ReturnLocation, ?PickupDateAndTime,
?ReturnDateAndTime, ?Car, ?Buyer, ?BuyerContactInformation, ?DoorCount,
?CarSize, ?MiliageLimited, ?HasChildSeat, ?HasAirConditioning}

(
?BookingIdentifier **memberOf** xsd#string **and**
?CarRentalBookingInfo **memberOf** cb#carRentalBookingInfo
[
pickupLocation **hasValue** ?PickupLocation,
returnLocation **hasValue** ?ReturnLocation,
pickupDateAndTime **hasValue** ?PickupDateAndTime,
returnDateAndTime **hasValue** ?ReturnDateAndTime,
car **hasValue** ?Car
] and
?PickupLocation **memberOf** loc#location **and**
?ReturnLocation **memberOf** loc#location **and**
?PickupDateAndTime **memberOf** dt#dateAndTime **and**
?ReturnDateAndTime **memberOf** dt#dateAndTime **and**
?Car **memberOf** cb#car
[
doorCount **hasValue** ?DoorCount,
carSize **hasValue** ?CarSize,
miliageLimited **hasValue** ?MiliageLimited,
hasChildSeat **hasValue** ?HasChildSeat,
hasAirConditioning **hasValue** ?HasAirConditioning
] and
?CarRentalBookingTicket **memberOf** cb#carRentalBookingTicket
[
bookingTicketIdentifier **hasValue** ?BookingTicketIdentifier,
carRentalBookingInfo **hasValue** ?CarRentalBookingInfo
] and
?BookingTicketIdentifier **memberOf** xsd#string **and**
?Buyer **memberOf** bo#buyer[
contactInformation **hasValue** ?BuyerContactInformation,
bookingPreferences **hasValue** ?CarRentalBookingPreferences
] and
?BuyerContactInformation **memberOf** bo#contactInformation [
emailaddress **hasValue** ?Emailaddress
]and
?Emailaddress **memberOf** xsd#string **and**
?CarRentalBookingPreferences **memberOf** cb#carRentalBookingPreferences
[
pickupLocation **hasValue** ?PickupLocation,
returnLocation **hasValue** ?ReturnLocation,
pickupDateAndTime **hasValue** ?PickupDateAndTime,

returnDateAndTime **hasValue** ?ReturnDateAndTime,
 doorCount **hasValue** ?DoorCount,
 carSize **hasValue** ?CarSize,
 miliageLimited **hasValue** ?MiliageLimited,
 hasChildSeat **hasValue** ?HasChildSeat,
 hasAirConditioning **hasValue** ?HasAirConditioning
] and
 ?DoorCount **memberOf** xsd#integer **and**
 ?CarSize **memberOf** xsd#integer **and**
 ?MiliageLimited **memberOf** xsd#boolean **and**
 ?HasChildSeat **memberOf** xsd#boolean **and**
 ?HasAirConditioning **memberOf** xsd#boolean
) and
 ?X **memberOf** cb#carRentalBooking[
 bookingIdentifier **hasValue** ?BookingIdentifier,
 carRentalBookingInfo **hasValue** ?CarRentalBookingInfo,
 buyer **hasValue** ?Buyer,
 bookingTicket **hasValue** ?CarRentalBookingTicket
].

effect

nonFunctionalProperties

dc#description **hasValue** "The booking ticket is delivered to the buyer via email"

endNonFunctionalProperties

definedBy

exists {?CarRentalBooking ,?BookingIdentifier, ?CarRentalBookingTicket, ?BookingTicketIdentificat
 ?CarRentalBookingInfo, ?PickupLocation ,?ReturnLocation ,?PickupDateAndTime, ?ReturnDate/
 ?Car, ?Buyer, ?BuyerContactInformation, ?DoorCount, ?CarSize, ?MiliageLimited, ?HasChildSea
 ?HasAirConditioning}

(
 ?CarRentalBooking **memberOf** bo#carRentalBooking
 [
 bookingIdentifier **hasValue** ?BookingIdentifier,
 carRentalBookingInfo **hasValue** ?CarRentalBookingInfo,
 buyer **hasValue** ?Buyer,
 bookingTicket **hasValue** ?CarRentalBookingTicket
] and
 ?BookingIdentifier **memberOf** xsd#string **and**
 ?CarRentalBookingInfo **memberOf** cb#carRentalBookingInfo [
 pickupLocation **hasValue** ?PickupLocation,
 returnLocation **hasValue** ?ReturnLocation,
 pickupDateAndTime **hasValue** ?PickupDateAndTime,
 returnDateAndTime **hasValue** ?ReturnDateAndTime,
 car **hasValue** ?Car
] and
 ?PickupLocation **memberOf** loc#location **and**
 ?ReturnLocation **memberOf** loc#location **and**
 ?PickupDateAndTime **memberOf** dt#dateAndTime **and**
 ?ReturnDateAndTime **memberOf** dt#dateAndTime **and**
 ?Car **memberOf** cb#car [
 doorCount **hasValue** ?DoorCount,
 carSize **hasValue** ?CarSize,
 miliageLimited **hasValue** ?MiliageLimited,
 hasChildSeat **hasValue** ?HasChildSeat,
 hasAirConditioning **hasValue** ?HasAirConditioning
] and
 ?CarRentalBookingTicket **memberOf** cb#carRentalBookingTicket
 [
 bookingTicketIdentificator **hasValue** ?BookingTicketIdentificator,
 carRentalBookingInfo **hasValue** ?CarRentalBookingInfo
] and
 ?BookingTicketIdentificator **memberOf** xsd#string **and**
 ?Buyer **memberOf** bo#buyer[
 contactInformation **hasValue** ?BuyerContactInformation,

```

    bookingPreferences hasValue ?CarRentalBookingPreferences
  ] and
  ?BuyerContactInformation memberOf bo#contactInformation [
    emailAddress hasValue ?EmailAddress
  ] and
  ?EmailAddress memberOf xsd#string and
  ?CarRentalBookingPreferences memberOf cb#carRentalBookingPreferences
  [
    pickupLocation hasValue ?PickupLocation,
    returnLocation hasValue ?ReturnLocation,
    pickupDateAndTime hasValue ?PickupDateAndTime,
    returnDateAndTime hasValue ?ReturnDateAndTime,
    doorCount hasValue ?DoorCount,
    carSize hasValue CarSize,
    miliageLimited hasValue ?MiliageLimited,
    hasChildSeat hasValue ?HasChildSeat,
    hasAirConditioning hasValue ?HasAirConditioning
  ] and
  ?DoorCount memberOf xsd#integer and
  ?CarSize memberOf xsd#integer and
  ?MiliageLimited memberOf xsd#boolean and
  ?HasChildSeat memberOf xsd#boolean and
  ?HasAirConditioning memberOf xsd#boolean
) and
?X memberOf bo#onlineDelivery[
  deliveryItem hasValue {?CarRentalBookingTicket},
  receiver hasValue ?Buyer,
  onlineDeliveryMethod hasValue "email"
].

```

interface carBuyerWSInterface

nonFunctionalProperties

dc#description **hasValue** "describes the Interface of Web Service (not specified yet)"

endNonFunctionalProperties

```

namespace {_ "http://www.wsmo.org/2004/d3/d3.3/v0.1/20041119/resources/shuttleBuyerWS#",
  dc _ "http://purl.org/dc/elements/1.1#",
  dt _ "http://www.wsmo.org/ontologies/dateTime#",
  cb _ "http://www.wsmo.org/ontologies/shuttleBooking#",
  bo _ "http://www.wsmo.org/ontologies/booking#",
  loc _ "http://www.wsmo.org/ontologies/location#"
}

webService _ "http://www.wsmo.org/2004/d3/d3.3/v0.1/20041119/resources/shuttleBuyerWS.wsmi"

nonFunctionalProperties
  dc#title hasValue "Online Shuttle Booking Web Service"
  dc#creator hasValue "ATOS ORIGIN S.A."
  dc#subject hasValue {"Taxi shuttle", "Shuttle booking", "Taxi"}
  dc#description hasValue "Web service for booking online a shuttle"
  dc#publisher hasValue "ATOS ORIGIN S.A."
  dc#contributor hasValue {"Alejandro López", "Ozelin López", "Clara Pezuela"}
  dc#date hasValue "2005-02-11"
  dc#type hasValue _ "http://www.wsmo.org/2004/d2#webservice"
  dc#format hasValue "text/html"
  dc#identifier hasValue _ "http://www.wsmo.org/ontologies/shuttleBuyerWS"
  dc#source hasValue _ "http://keg.cs.tsinghua.edu.cn/ontology/travel"
  dc#language hasValue "en-US"
  dc#relation hasValue {_ "http://keg.cs.tsinghua.edu.cn/ontology/travel",
    _ "http://www.wsmo.org/ontologies/booking",
    _ "http://www.wsmo.org/ontologies/shuttleBooking",
    _ "http://www.wsmo.org/ontologies/dateTime",
    _ "http://www.wsmo.org/ontologies/location"}
  dc#coverage hasValue "ID:7029392 Name:World"
  dc#rights hasValue _ "http://www.deri.org/privacy.html"
  version hasValue "$Revision: 1.9 $"
endNonFunctionalProperties

importsOntology {_ "http://www.wsmo.org/ontologies/shuttleBooking",
  _ "http://www.wsmo.org/ontologies/flightBooking",
  _ "http://www.wsmo.org/ontologies/booking",
  _ "http://www.wsmo.org/ontologies/location",
  _ "http://www.wsmo.org/ontologies/dateTime"
}

capability shuttleBuyerWSCapability

precondition
  nonFunctionalProperties
    dc#description hasValue "Required input is#
      [1] buyer information with the
      [2] shuttle preferences"
  endNonFunctionalProperties
  definedBy
    ?Buyer memberOf bo#buyer[
      contactInformation hasValue ?BuyerContactInformation,
      bookingPreferences hasValue ?ShuttleBookingPreferences
    ] and
    ?BuyerContactInformation memberOf bo#contactInformation [
      emailAddress hasValue ?Emailaddress
    ] and
    ?Emailaddress memberOf xsd#string and
    ?ShuttleBookingPreferences memberOf sb#shuttleBookingPreferences[
      pickupAirport hasValue ?PickupLocation,
      pickupDateAndTime hasValue ?PickupDateAndTime,
      destination hasValue ?Destination
    ].
  ]

postcondition

```

nonFunctionalProperties

dc:description **hasValue** "the output of the service is a booking."

endNonFunctionalProperties**definedBy**

exists {?BookingIdentifier, ?ShuttleBookingTicket, ?BookingTicketIdentifier, ?ShuttleBookingInfo, ?PickupAirport, ?PickupDateAndTime, ?Destination, ?Buyer, ?BuyerContactInformation, ?ShuttleBookingTicket}

```
(
  ?BookingIdentifier memberOf xsd:string and
  ?ShuttleBookingInfo memberOf sb#shuttleBookingInfo [
    pickupAirport hasValue ?PickupAirport,
    pickupDateAndTime hasValue ?PickupDateAndTime,
    destination hasValue ?Destination,
    shuttle hasValue ?Shuttle
  ] and
  ?PickupAirport memberOf fb#airport and
  ?PickupDateAndTime memberOf dt#dateAndTime and
  ?Destination memberOf loc#location and
  ?Shuttle memberOf sb#shuttle and
  ?ShuttleBookingTicket memberOf sb#shuttleBookingTicket [
    bookingTicketIdentifier hasValue ?BookingTicketIdentifier,
    shuttleBookingInfo hasValue ?ShuttleBookingInfo
  ] and
  ?BookingTicketIdentifier memberOf xsd:string and
  ?Buyer memberOf bo#buyer[
    contactInformation hasValue ?BuyerContactInformation,
    bookingPreferences hasValue ?ShuttleBookingPreferences
  ] and
  ?BuyerContactInformation memberOf bo#contactInformation [
    emailAddress hasValue ?EmailAddress
  ] and
  ?EmailAddress memberOf xsd:string and
  ?ShuttleBookingPreferences memberOf sb#shuttleBookingPreferences[
    pickupAirport hasValue ?PickupLocation,
    pickupDateAndTime hasValue ?PickupDateAndTime,
    destination hasValue ?Destination
  ]
) and
?X memberOf sb#shuttleBooking[
  bookingIdentifier hasValue ?BookingIdentifier,
  shuttleBookingInfo hasValue ?ShuttleBookingInfo,
  buyer hasValue ?Buyer,
  bookingTicket hasValue ?ShuttleBookingTicket
].
```

effect**nonFunctionalProperties**

dc:description **hasValue** "The booking ticket is delivered to the buyer via email"

endNonFunctionalProperties**definedBy**

exists {?ShuttleBooking, ?BookingIdentifier, ?ShuttleBookingTicket, ?BookingTicketIdentifier, ?ShuttleBookingInfo, ?PickupAirport, ?PickupDateAndTime, ?Destination, ?Buyer, ?BuyerContactInformation, ?ShuttleBookingTicket}

```
(
  ?ShuttleBooking memberOf sb#shuttleBooking [
    bookingIdentifier hasValue ?BookingIdentifier,
    shuttleBookingInfo hasValue ?ShuttleBookingInfo,
    buyer hasValue ?Buyer,
    bookingTicket hasValue ?ShuttleBookingTicket
  ] and
  ?BookingIdentifier memberOf xsd:string and
  ?ShuttleBookingInfo memberOf sb#shuttleBookingInfo [
    pickupAirport hasValue ?PickupAirport,
```

```

pickupDateAndTime hasValue ?PickupDateAndTime,
destination hasValue ?Destination,
shuttle hasValue ?Shuttle
] and
?PickupAirport memberOf fb#airport and
?PickupDateAndTime memberOf dt#dateAndTime and
?Destination memberOf loc#location and
?Shuttle memberOf sb#shuttle and
?ShuttleBookingTicket memberOf sb#shuttleBookingTicket [
  bookingTicketIdentifier hasValue ?BookingTicketIdentifier,
  shuttleBookingInfo hasValue ?ShuttleBookingInfo
] and
?BookingTicketIdentifier memberOf xsd#string and
?Buyer memberOf bo#buyer[
  contactInformation hasValue ?BuyerContactInformation,
  bookingPreferences hasValue ?ShuttleBookingPreferences
] and
?BuyerContactInformation memberOf bo#contactInformation [
  emailAddress hasValue ?Emailaddress
]and
?Emailaddress memberOf xsd#string and
?ShuttleBookingPreferences memberOf sb#shuttleBookingPreferences[
  pickupAirport hasValue ?PickupLocation,
  pickupDateAndTime hasValue ?PickupDateAndTime,
  destination hasValue ?Destination
]
) and
?X memberOf bo#onlineDelivery[
  deliveryItem hasValue {?ShuttleBookingTicket},
  receiver hasValue ?Buyer,
  onlineDeliveryMethod hasValue "email"
].

```

```

interface shuttleBuyerWSInterface
nonFunctionalProperties
  dc#description hasValue "describes the Interface of Web Service (not specified yet)"
endNonFunctionalProperties

```

3.4 Mediators

Since WSMO mediators are still underspecified, they will be considered in future versions of this document.

4. Conclusions and Future Work

We hereby provided an overview of the Stream Flows! System use case using WSMO as the base description language. Future work on this use case will include the following:

- A simple sequence diagram outlining the chain of events that occur during the interaction with the SFS
- Interface descriptions for Web Services which would include the choreography and orchestration and also the ontologies which serve as the state-base for these aspects
- The Mediators which are required to solve heterogeneity problems between different entities.

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[webmaster](#)