DEMO-3

Way of Working

(version 3, 1 September 2009)

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Introduction

In the book Enterprise Ontology (Chapter 15) a modeling method is presented that aims to help novice DEMO Professionals to devise ontological models. Let us refer to this way of working as "DEMO-2 WoW". Initially, the importance of a clear and detailed way of working was valuated low by me. I thought that professionals would develop soon their own, personal, way of working, once they would be practicing DEMO. With hindsight, this was a wrong point of view. People apparently expect more help from a methodology. This has motivated me to develop a new way of working, in parallel with the development of the DEMO-3 way of modeling.

The way of working that is presented hereafter (referred to by "DEMO-3 WoW"), taking the EU-Rent case to exemplify it, is the result of a long lasting experience in teaching DEMO and in applying it in practice. It is quite different from the DEMO-2 WoW. In the DEMO-3 WoW, the knowledge that is gradually acquired about a case is represented in all aspect models to which it is applicable. So, instead of producing one aspect model after the other, all of them are produced in parallel and incrementally. This way of working appears to enhance the integrated understanding of an ontological model. In addition, it demonstrates that all aspect models are equally important for understanding the total model.

Let us hope that DEMO-3 WoW will also improve the adoption of DEMO.

Jan Dietz

EU-Rent: description

EU-Rent is a company that rents cars to persons, operating from geographically dispersed branches. The cars of EU-Rent are divided in car types (brands and models); for every car type there is a particular rental tariff per day.

A car may be rented by a reservation in advance or by a 'walk-in' customer on the day of renting. A rental contract specifies the start and end dates of the rental, the car type one whishes, the branch where the rental starts (called the pick-up branch), and the branch where the rental will end (called the drop-off branch). Rentals have a maximum duration.

The person who rents the car is called the renter. The one who is going to drive is called the driver. A rental will only be started if the driver has a valid driving license. In addition, a car of the requested type must be available.

As soon as the car of a rental has been dropped-off, the rental can be ended, after the incurred charge has been paid. This charge may consist of several elements. First, there is the basic charge (number of days times the tariff per day). Next, there may be a penalty charge for exceeding this duration (number of extra days times the late return penalty tariff). Lastly, a location penalty charge is added if the car has been dropped-off at another branch than agreed (this charge depends on the distance between the branches).

EU-Rent: analysis (1)

Apparently, the relevant unit of service of EU-Rent is the rental of a car for some period. In the case description this notion was already designated by "car rental". The rental of a car is a space-time notion, like e.g. the loan of a book from a library, or the rental of a hotel room. Basically, it is the right to use a space-bound service for some time. The usage of such a service has to be started and to be ended explicitly.

So, we identify two transaction kinds, which we will call rental start (B-T01) and rental end (B-T02). The transaction results are respectively "[rental] has been started" (B-R01) and "[rental] has been ended" (B-R02). In the formulation of these results "[rental]" is a placeholder for concrete individual instances of the type rental.

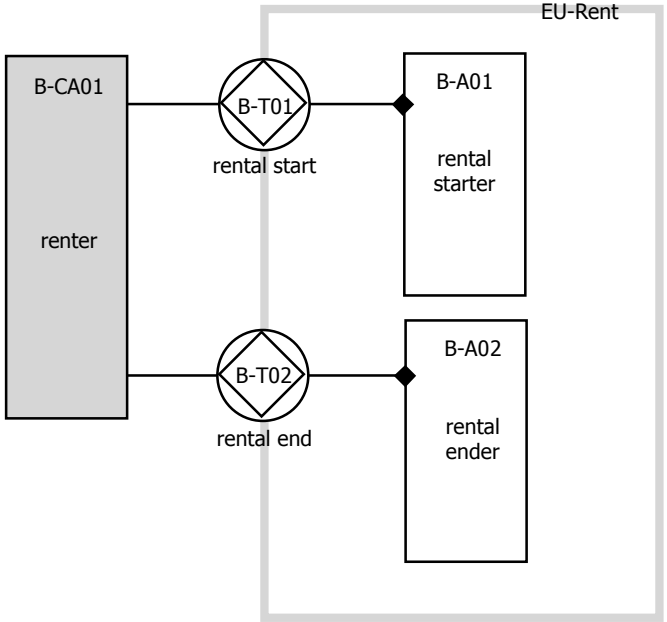
By convention, the executor of B-T01 gets the actor role number "B-A01"; let us call this actor role "rental starter". Similarly, the executor of B-T02 is designated by "B-A02"; let us call it "rental ender". Moreover, we call the initiator of both B-T01 and B-T02 "renter"; let us give this external (and by convention composite) actor role the number "B-CA01".

In the period between the creation time of B-R01 and the creation time of B-R02 of a rental, the rental is considered to be alive. It means that during the lifetime of a rental, B-CA01 (the renter) has the right to make use of the rented car.

We are now able to devise the first part of the Construction Model of EU-Rent, represented in an Actor Transaction Diagram and a Transaction Result Table.

EU-Rent: Construction Model (1)

Organization Construction Diagram



Transaction Result Table

Transaction kind	Transaction result
B-T01 rental start	B-R01 [rental] has been started
B-T02 rental end	B-R02 [rental] has been ended

EU-Rent: analysis (2)

We are able now to produce the first part of the State Model, represented in a State Space Diagram.

From the case description, and the Transaction Result Table, we identify the internal category RENTAL and the external categories CAR TYPE, BRANCH, and PERSON (all colored gray), as well as the binary fact kinds that are contained in the first part of the State Model. In addition, we define graphically the object class DRIVER.

We also include the (unary) transaction result kind B-R01, and the graphically defined object class STARTED RENTAL.

In addition, we identify the next properties:

rental tariff per day (with domain CAR TYPE and range MONEY),

contracted start date (with domain STARTED RENTAL and range TIME),

contracted end date (with domain STARTED RENTAL and range TIME).

max rental duration (with domain RENTAL COMPANY and range TIME),

location penalty tariff (with domain RENTAL COMPANY and range MONEY),

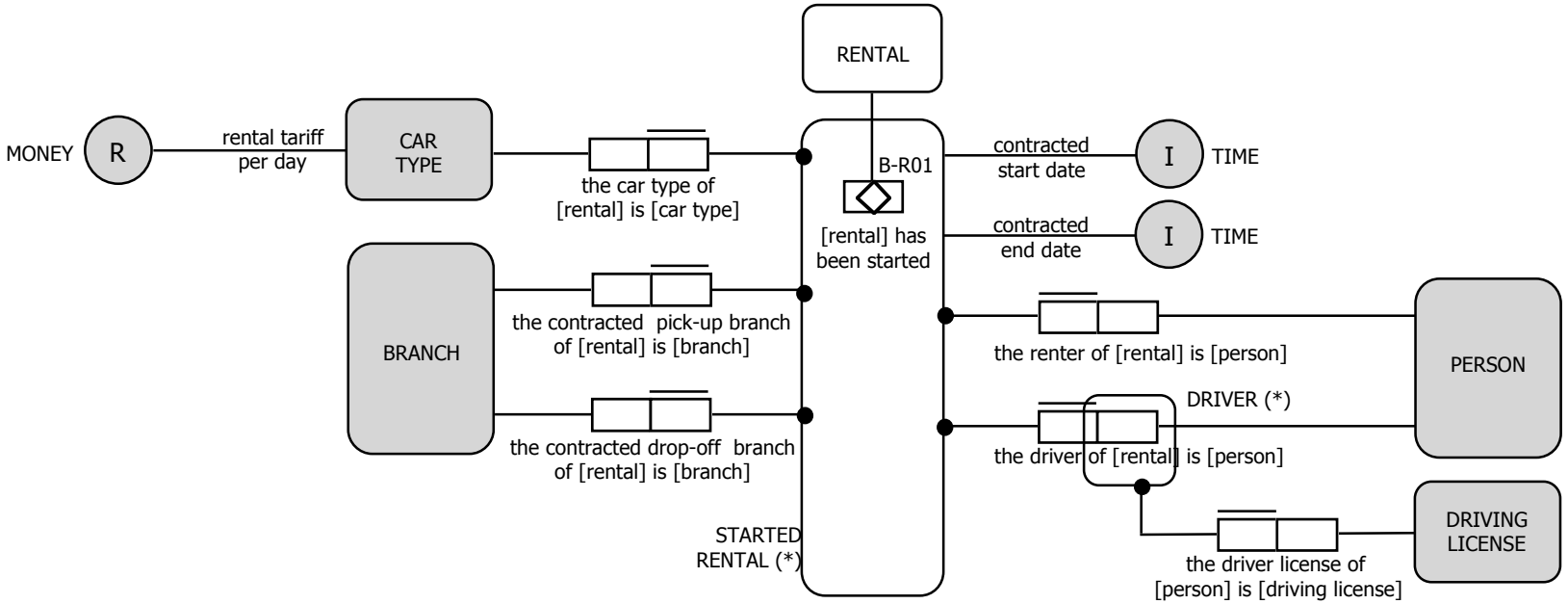
late return penalty tariff (with domain RENTAL COMPANY and range MONEY),

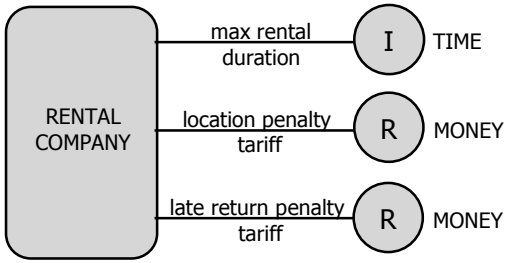
Note that the last three properties are parameters of EU-Rent itself. This is modeled by taking as the domain the external category RENTAL COMPANY, of which EU-Rent is an instance.

Next to the first part of the State Space Diagram, we present the first part of the Bank Contents Table, as well as the according extension of the Actor Transaction Diagram.

EU-Rent: State Model (1)

State Space Diagram





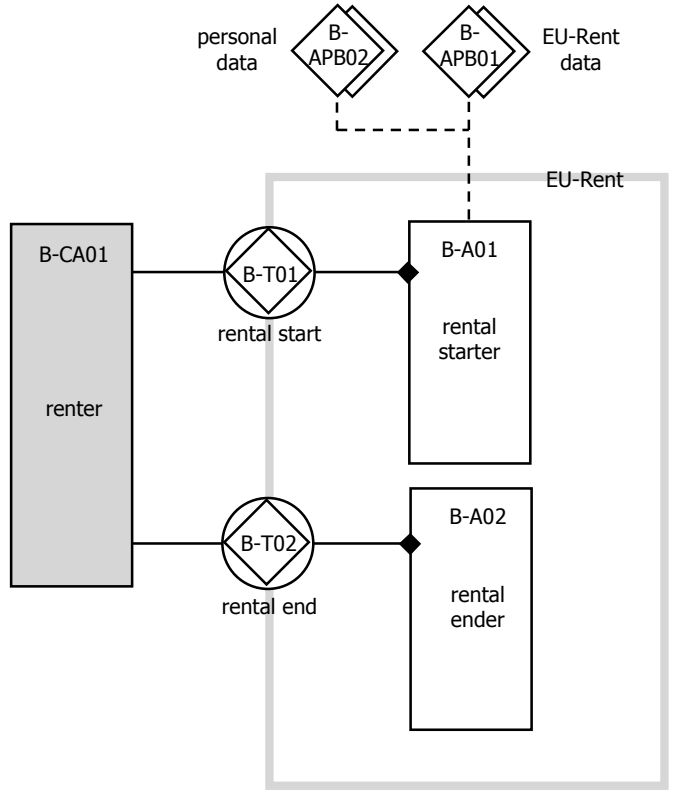
EU-Rent: Construction Model (2)

Bank Contents Table (1)

Fact bank	Fact kind
B-APB01	BRANCH
	CAR TYPE
	rental tariff per day
	max rental duration
	location penalty tariff
	late return penalty tariff
	PERSON
	the driving license of [person] is [license]
B-APB02	DRIVING LICENSE
	RENTAL
	[renta]l has been started
B-PB01	contracted start date
	contracted end date
	the renter of [rental] is [person]
	the driver of [rental] is [person]
	the car type of [rental] is [car type]
	the contracted pick-up branch of [rental] is [branch]
	the contracted drop-off branch of [rental] is [branch]

EU-Rent: Construction Model (3)

Organization Construction Diagram



Transaction Result Table

Transaction kind	Transaction result
B-T01 rental start	B-R01 [rental] has been started
B-T02 rental end	B-R02 [rental] has been ended

EU-Rent: analysis (3)

We are able now to formulate the first business rule for actor role B-A01. This business rule is the guideline for dealing with business events of the kind "rental start of [rental] is requested".

Three conditions can be identified which must hold for promising a rental start:

"there is a car available of the preferred car type",

"contracted duration must be less or equal to the maximum rental duration",

"the driver must have a valid driving license".

NOTE

Making a booking in advance seems to be a separate transaction but it is not. Booking means only that the requested creation time of B-T01, i.e. the contracted start date, is some time in the future.

EU-Rent: Action Model (1)

Action Rule Specification for B-A01 (1)

when rental start **of** [rental] **is** requested

if	*the driver has a valid driving license*	**and**
	there is a car available of the car type of rental	**and**
	(contracted end date **minus** contracted start date) ≤ max rental duration	
then	rental start **of** [rental] **must be** promised	
else	rental start **of** [rental] **must be** declined	

NOTE

Conditions written in italic are formulated informally; it should, however, not be too hard to formulate them formally.

EU-Rent: analysis (4)

When the rental start is promised, the rental starter will proceed with requesting the driver to pick up the selected car at the contracted pick-up branch (B-T03), as well as to drop off the car at the contracted drop-off branch on the contracted end date (B-T04).

So, the initiator of B-T03 and B-T04 is B-A01. The executor of B-T03 as well as the executor of B-T04 is an elementary actor role within the (external) composite actor role B-CA02, which we will call "driver".

We are now able to extend the Actor Transaction Diagram and the Transaction Result Table for the transaction kinds B-T03 and B-T04.

NOTE

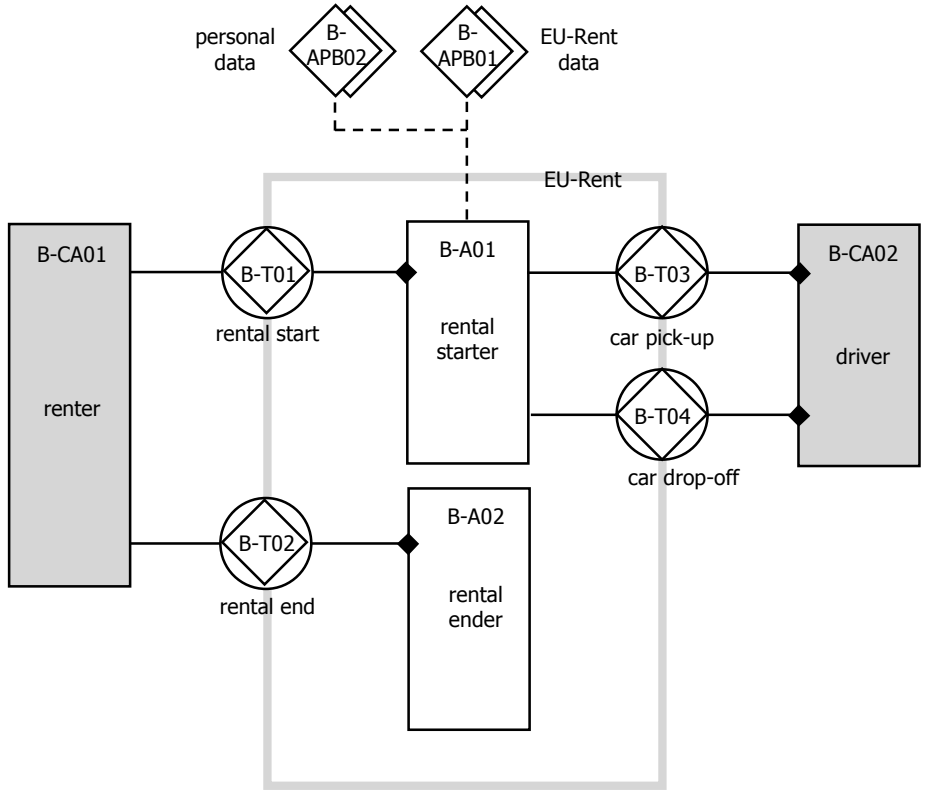
In B-R03 and B-R04 the car to be picked-up and dropped-off is referred to indirectly. One cannot refer to it by "[car]" because the car is specific for a rental; therefore the only correct way is to refer to it by "car of [rental]".

NOTE

The driver need not be, but usually will be, the same person as the renter.

EU-Rent: Construction Model (4)

Organization Construction Diagram



Transaction Result Table

Transaction kind	Transaction result
B-T01 rental start	B-R01 [rental] has been started
B-T02 rental end	B-R02 [rental] has been ended
B-T03 car pick-up	B-R03 the car of [rental] has been picked-up
B-T04 car drop-off	B-R04 the car of [rental] has been dropped-off

EU-Rent: analysis (5)

We are now able to extend the State Model of EU-Rent. The next explanation applies.

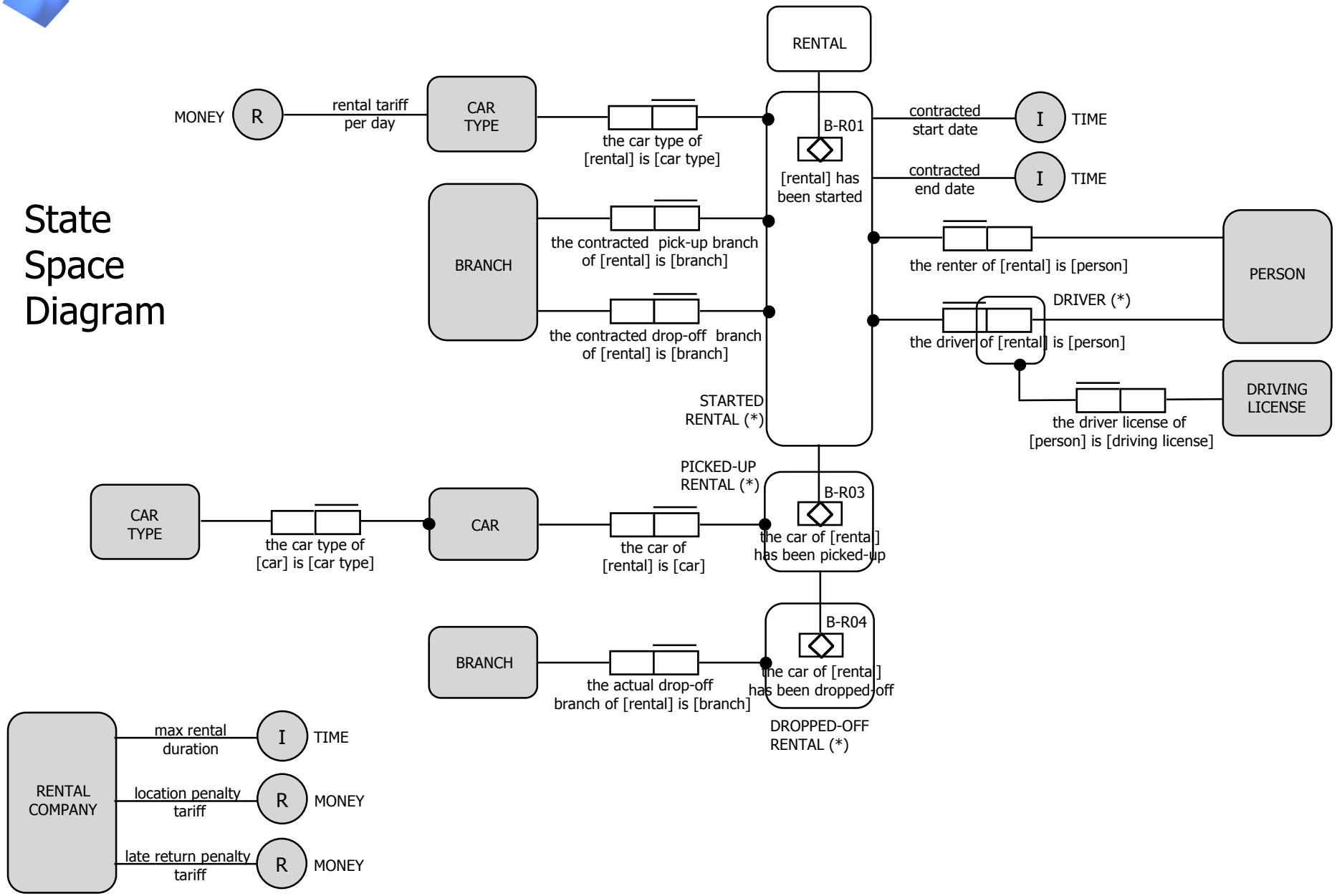
The object class STARTED RENTAL is the domain of the transaction result kind B-R03 (the car of [rental] has been picked up). We graphically define the object class PICKED-UP RENTAL. We also add the fact kinds 'the car of [rental] is [car], and 'the car type of [car] is [car type]'.

The object class PICKED-UP RENTAL is the domain of the transaction result kind B-R04 (the car of [rental] has been dropped off). We graphically define the object class DROPPED-OFF RENTAL. We also add the fact kind 'the actual drop-off branch of [rental] is [branch].

Next, we present the corresponding extension of the Bank Contents Table.

EU-Rent: State Model (2)

State Space Diagram



EU-Rent: Construction Model (5)

Bank Contents Table (2)

Fact bank	Fact kind
B-APB01	CAR
	the car type of [car] is [car type]
B-PB03	the car of [rental] has been picked-up
	the car of [rental] is [car]
B-PB04	the car of [rental] has been dropped-off
	the actual drop-off branch of [rental] is [branch]

EU-Rent: analysis (6)

*We are also able now to formulate the additional business rules for actor role B-A01. They apply to dealing with business events of the kinds "rental start of [rental] is promised" and "car pick-up of [rental] is promised **and** car drop-off of [rental] is promised".*

We also present the first parts of the Process Model, namely the Transaction Structure Diagrams of B-T01, B-T03, and B-T04, as well as the first version of the Process Structure Diagram.

Next, we complete the business rules for actor role B-A01.

EU-Rent: Action Model (2)

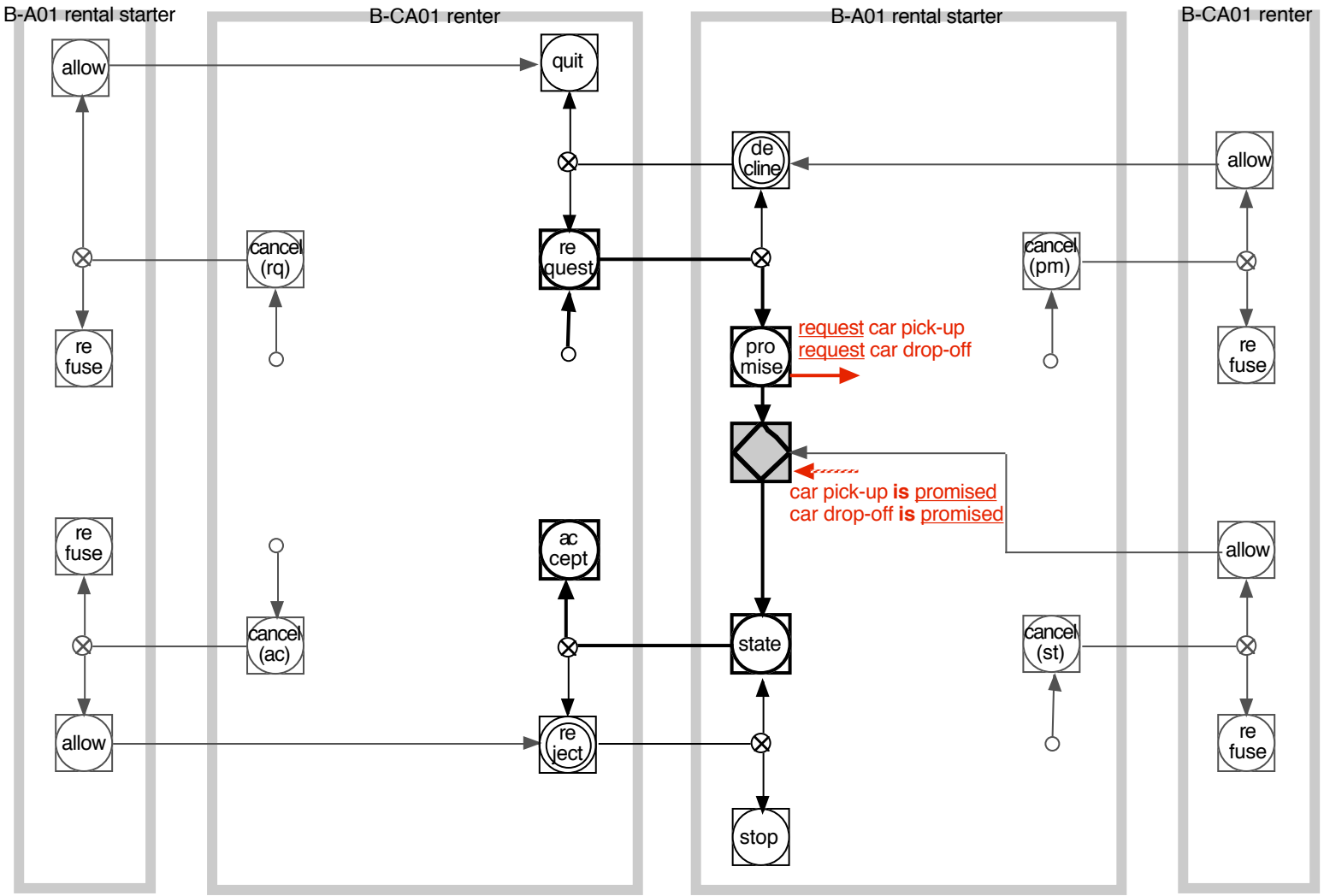
Action Rule Specification for B-A01 (2)

when rental start **of** [rental] **is** promised
then car pick-up **of** [rental] **must be** requested **with**
requested settlement time **is within** contracted start date **and**
the car of [rental] is [selected car of car type of rental];
car drop-off **of** [rental] **must be** requested **with**
requested settlement time **is within** contracted end date **and**

when car pick-up **of** [rental] **is** promised **and** car drop-off **of** [rental] **is** promised
then rental start **of** [rental] **must be** executed
rental start **of** [rental] **must be** stated

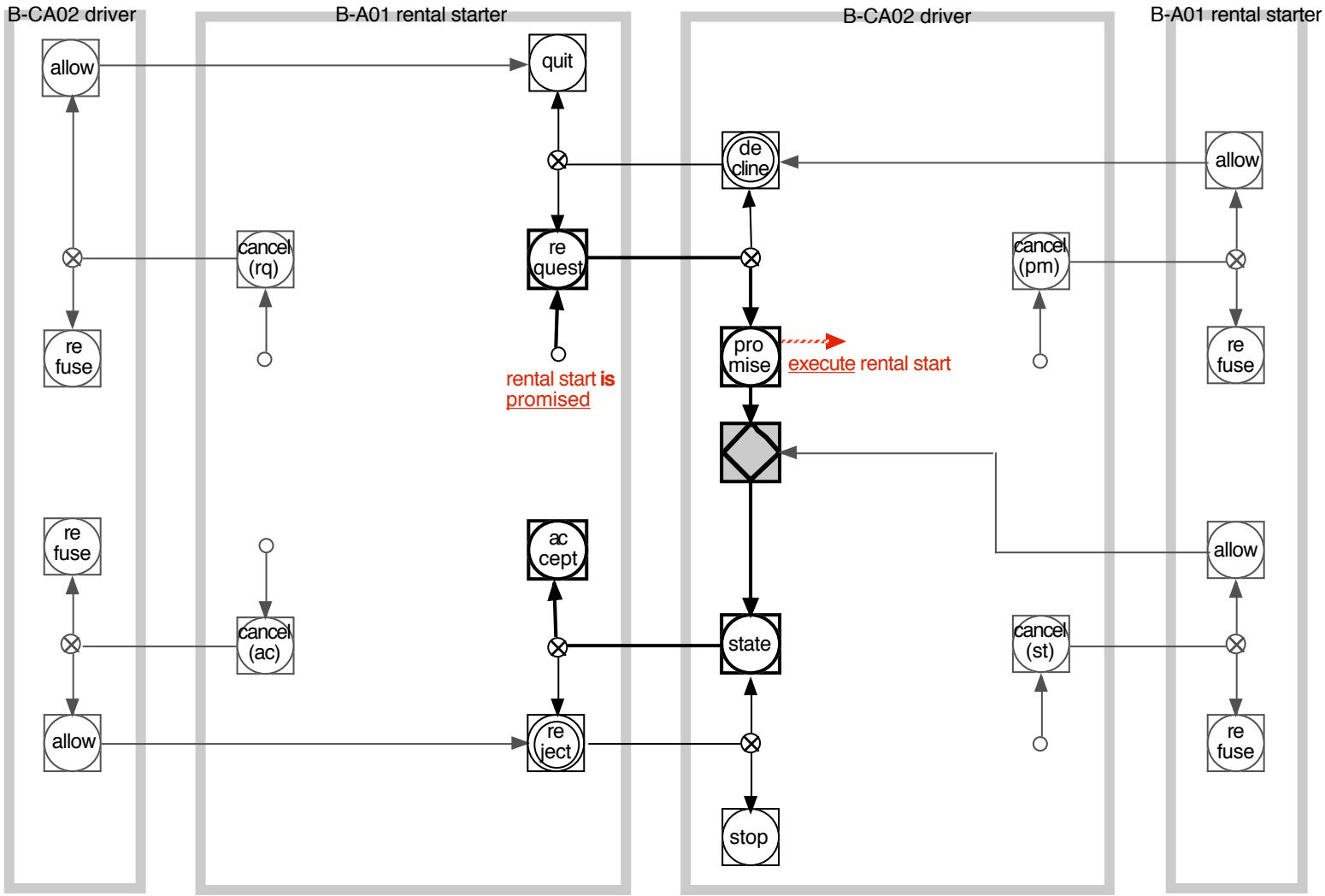
EU-Rent: Process Model (1)

Transaction Pattern Diagram of B-T01 (rental start)



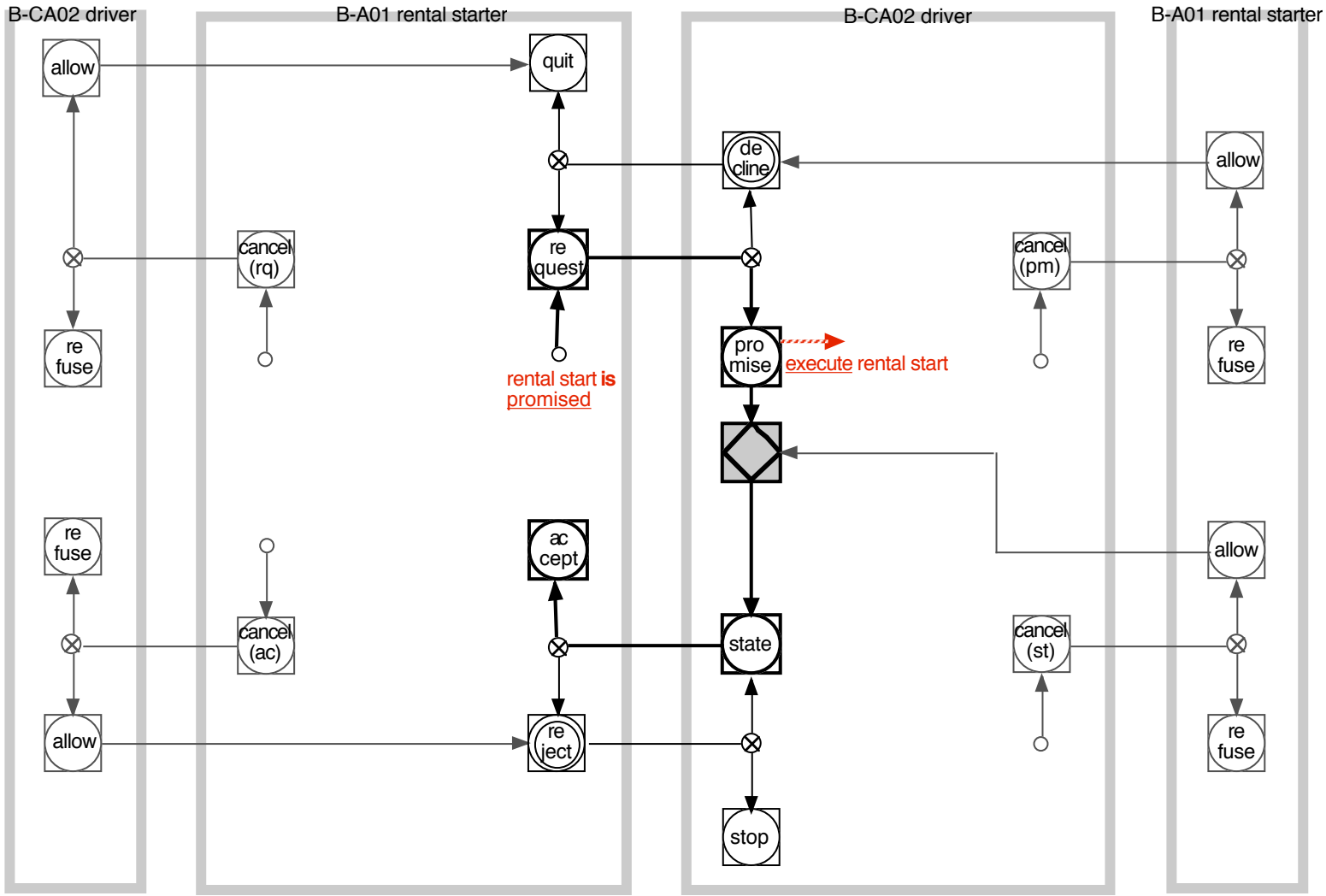
EU-Rent: Process Model (2)

Transaction Pattern Diagram of B-T03 (car pick-up)



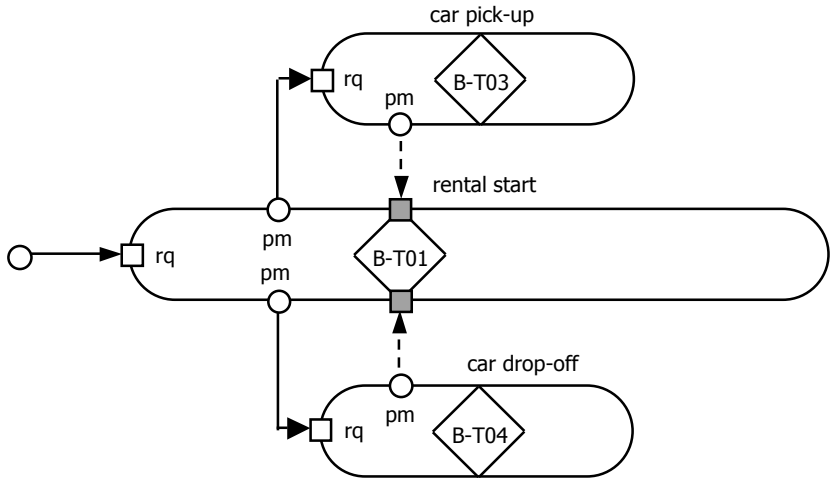
EU-Rent: Process Model (3)

Transaction Pattern Diagram of B-T04 (car drop-off)



EU-Rent: Process Model (4)

Process
Structure
Diagram



EU-Rent: Action Model (3)

Action Rule Specification for B-A01 (3)

when car pick-up **of** [rental] **is** stated
then car pick-up **of** [rental] **must be** accepted

when car drop-off **of** [rental] **is** stated **with**
the actual drop-off branch of [rental] is [branch]
then car drop-off **of** [rental] **must be** accepted

when rental start **of** [rental] **is** stated
then rental start **of** [rental] **must be** accepted

EU-Rent: analysis (7)

At some time, the driver will drop-off the car at some branch, and the renter will subsequently request to end the car rental.

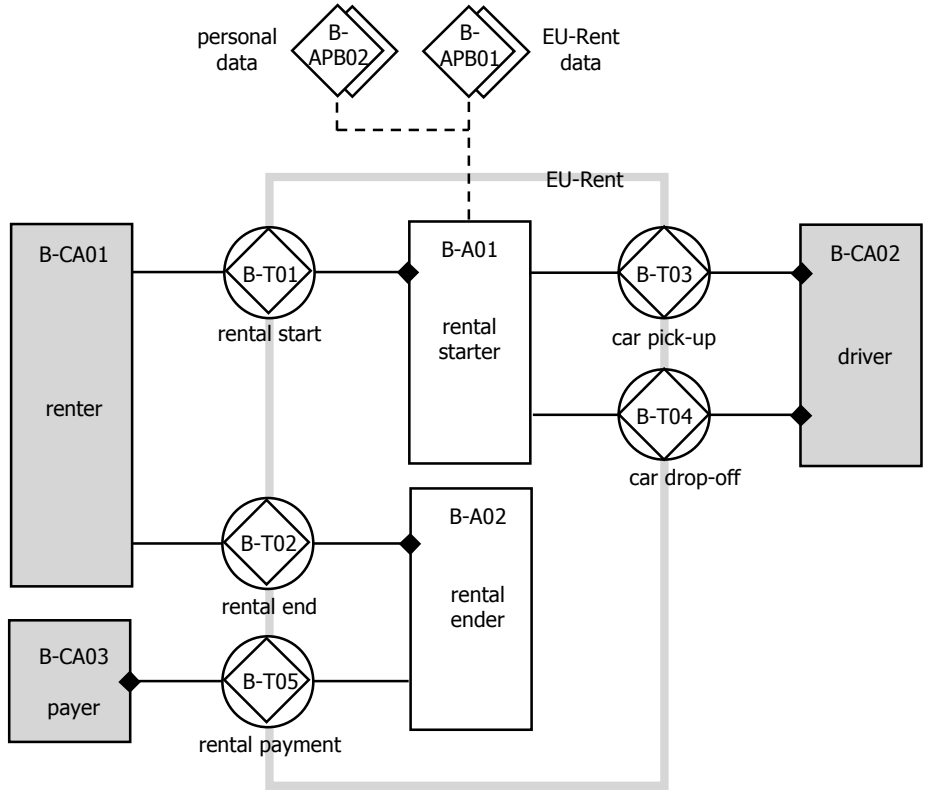
Before completing the rental end (B-T02), however, the costs of the rental have to be paid.

So, we identify the last transaction kind, B-T05 (rental payment). The initiator is obviously B-A02 (rental ender) and the executor is the elementary actor role B-A05 within the external (composite) actor role B-CA03, which we will name "payer".

Next, we present the final State Model, represented in a State Space Diagram and a Fact Definition List. We also present the corresponding part of the Bank Contents Table.

EU-Rent: Construction Model (6)

Organization Construction Diagram

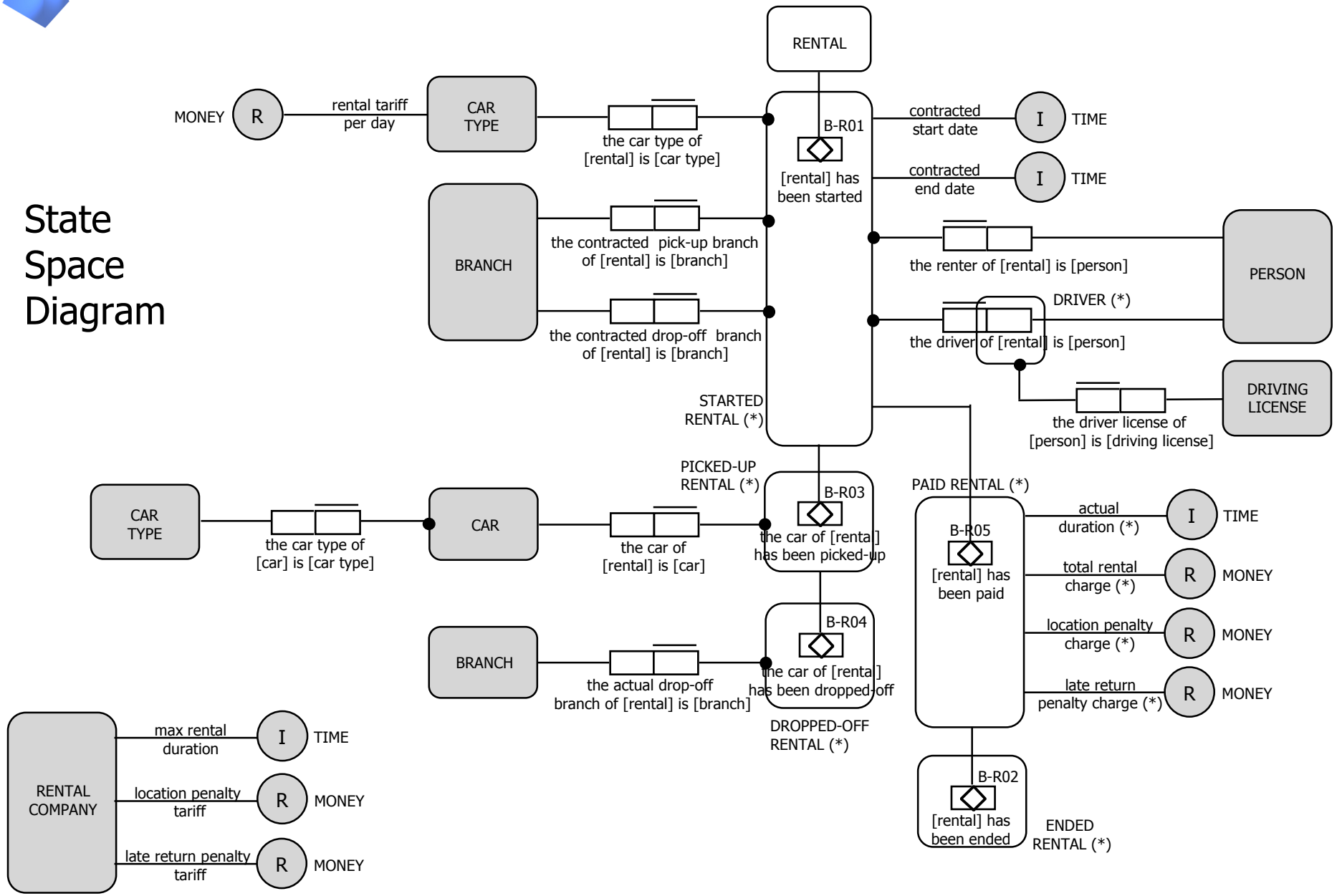


Transaction Result Table

Transaction kind	Transaction result
B-T01 rental start	B-R01 [rental] has been started
B-T02 rental end	B-R02 [rental] has been ended
B-T03 car pick-up	B-R03 the car of [rental] has been picked-up
B-T04 car drop-off	B-R04 the car of [rental] has been dropped-off
B-T05 rental payment	B-R05 [rental] has been paid

EU-Rent: State Model (3)

State Space Diagram



EU-Rent: State Model (4)

Fact Definition List

actual duration **of** [rental]) =
promised creation **of** ([rental] has been ended) **minus**
actual creation time **of** ([rental] has been started)

total rental charge **of** [rental] =
(actual duration **of** [rental] **times** rental tariff per day **of** [car type] **of** [car] **of** [rental]) **plus**
location penalty charge **of** [rental] **plus**
late return penalty charge **of** [rental]

location penalty charge **of** [rental] =
(*distance between* contracted drop-off branch of [rental] and actual drop-off branch of [rental]) **times**
location penalty tariff **of** 'EU-Rent'

late return penalty charge of [rental] =
(actual duration **of** [rental] **minus**
(contracted end date **of** [rental] **minus** contracted start date of [rental])) **times**
late return penalty tariff **of** 'EU-Rent'

NOTE
The (unary) fact kinds *driver*, *started rental*, *ended rental*, *picked-up rental*, *dropped-off rental*, and *paid rental* are defined graphically in the State Space Diagram

EU-Rent: Construction Model (7)

Bank Contents Table (3)

Fact bank	Fact kind
B-PB02	[rental] has been ended
B-PB05	[rental] has been paid

EU-Rent: analysis (8)

When the renter initiates the rental end (B-T02) the rental ender will check whether the car has been dropped off, i.e. whether the car drop-off has been accepted. Note that it may be the case that B-T05 has not been initiated at all because the rental pick-up (B-T04) has not been executed! Although strange of course, this may happen. The normal case, however, is that the car has been picked-up and been dropped-off.

As soon as B-T05 is accepted, B-T02 will be continued and completed.

We are now able to produce the business rules for actor role B-A02. Next, we present the corresponding parts of the Process Model, namely the Transaction Structure Diagrams of B-T02 and B-T05, as well as the final Process Structure Diagram.

In addition we extend the Construction Model with the apparent interstriction relationships. The presented Organization Construction Diagram is the final one.

EU-Rent: Action Model (4)

Action Rule Specification for B-A02

when rental end **of** [rental] **is** requested
if [rental] has been started **and**
(the car of [rental] has been dropped-off **or** (the car of [rental] has **not** been picked-up))
then rental end **of** [rental] **must be** promised
else rental start **of** [rental] **must be** declined

when rental end **of** [rental] **is** promised
then rental payment **of** [rental] **must be** requested **with**
the final charge **of** [rental] = [money]

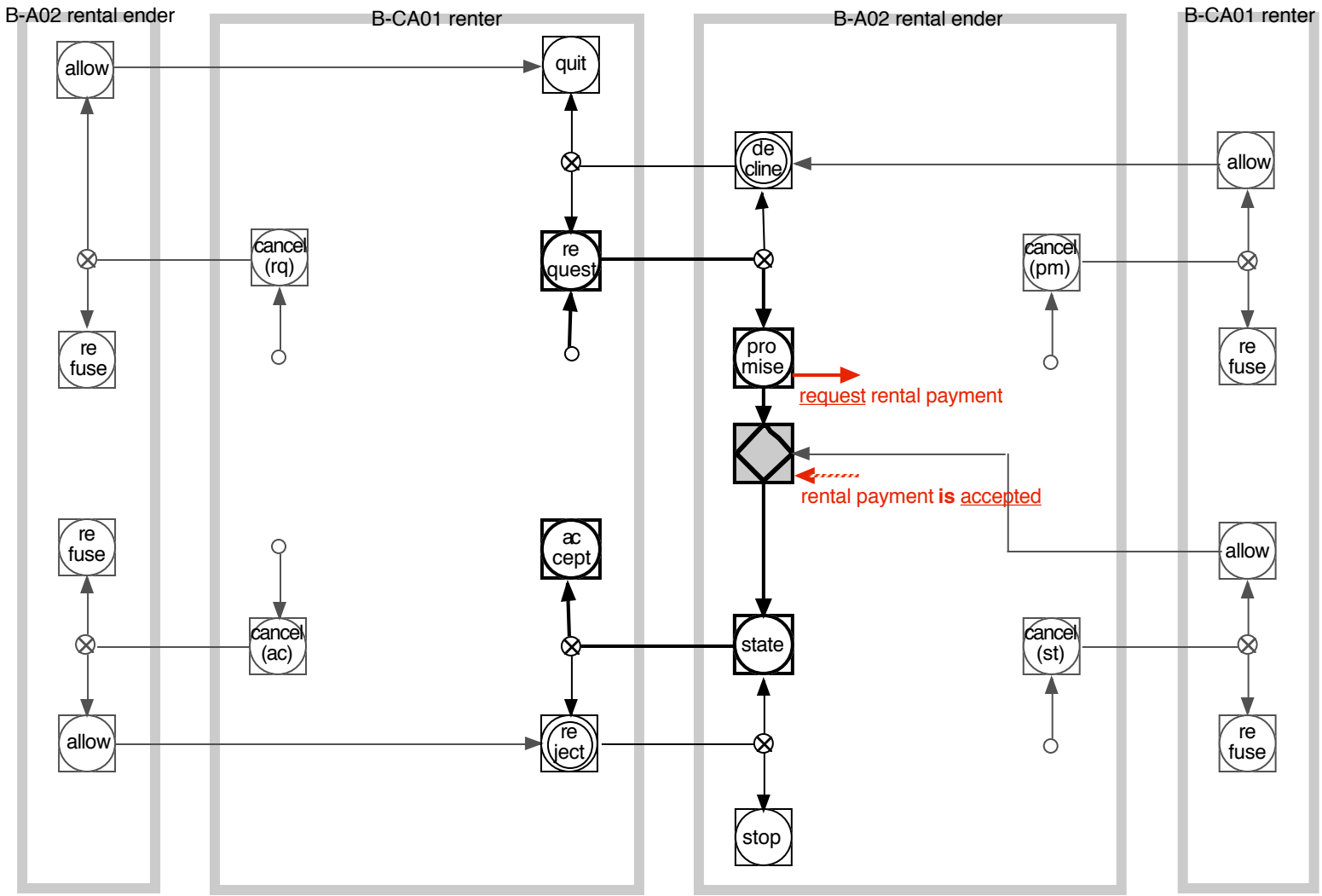
when rental payment **of** [rental] **is** stated
if *everything is ok*
then rental payment **of** [rental] **must be** accepted
else rental payment **of** [rental] **must be** rejected

when rental payment **of** [rental] **is** accepted
then rental end **of** [rental] **must be** executed
rental end **of** [rental] **must be** stated

when rental end **of** [rental] **is** stated
then rental end **of** [rental] **must be** accepted

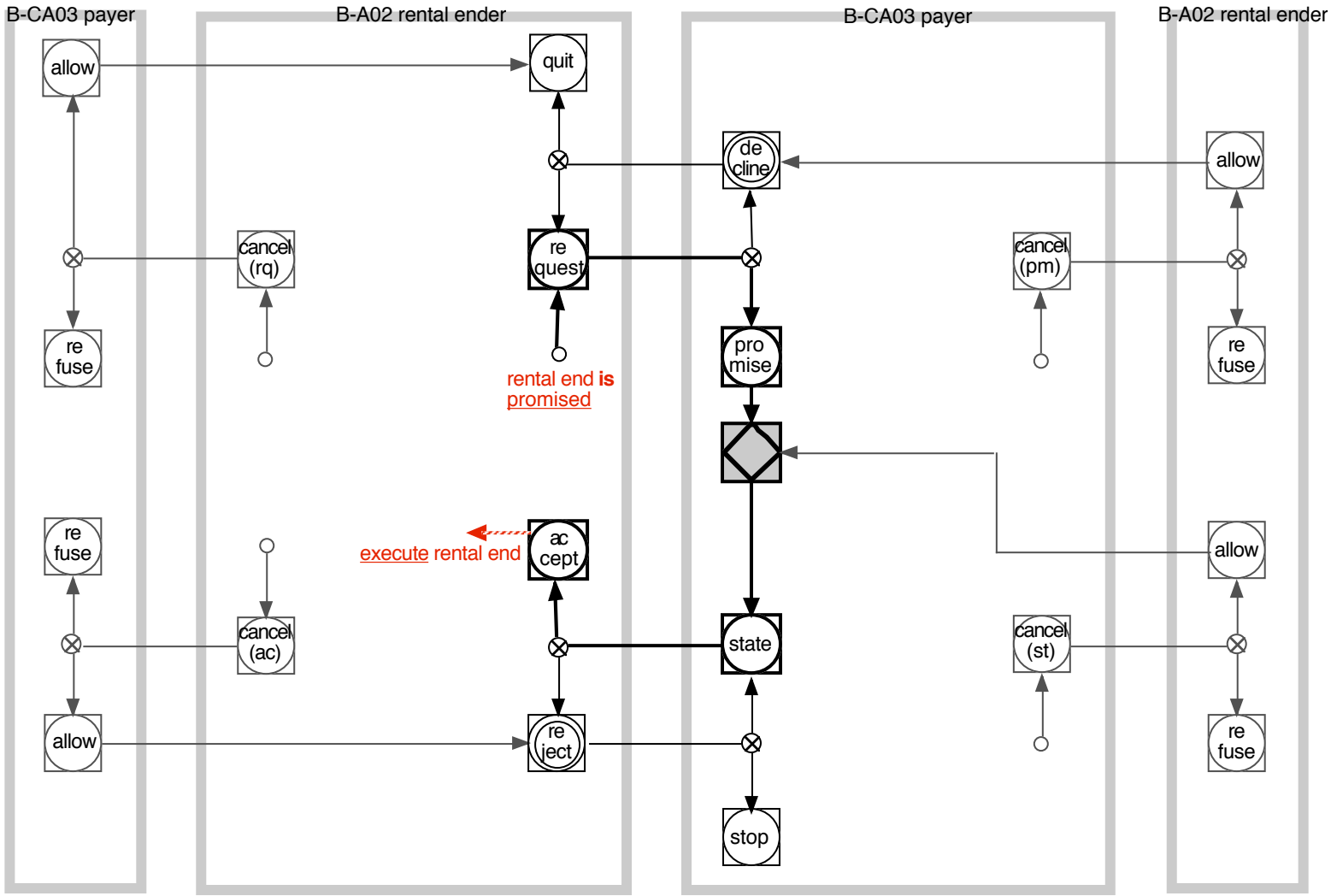
EU-Rent: Process Model (5)

Transaction Pattern Diagram of B-T02 (rental end)



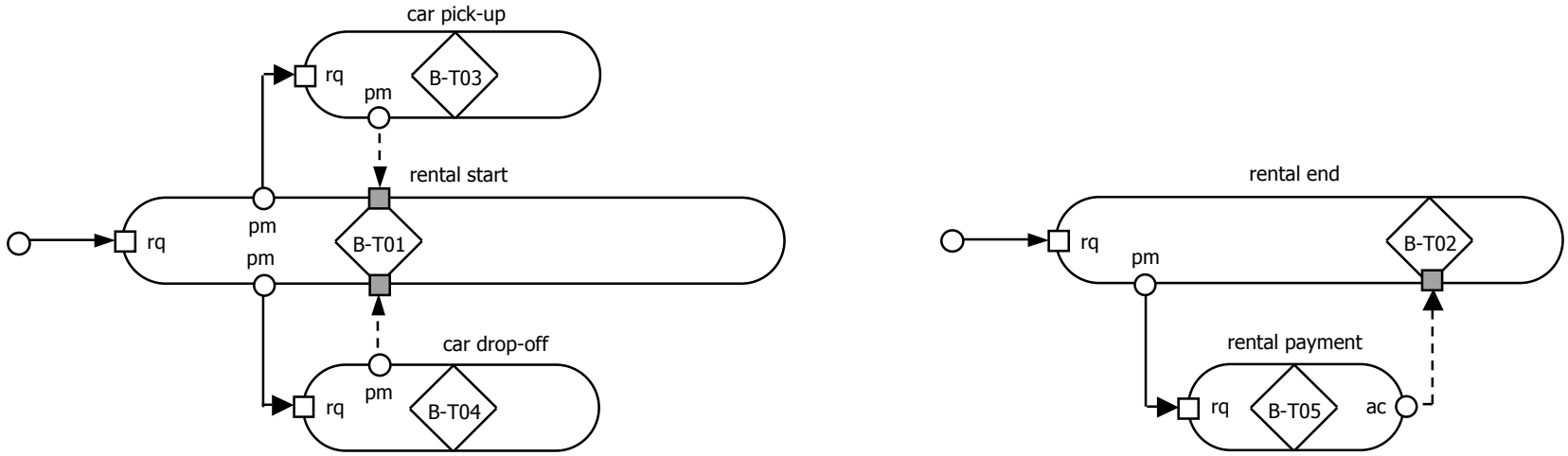
EU-Rent: Process Model (6)

Transaction Pattern Diagram of B-T05 (rental payment)



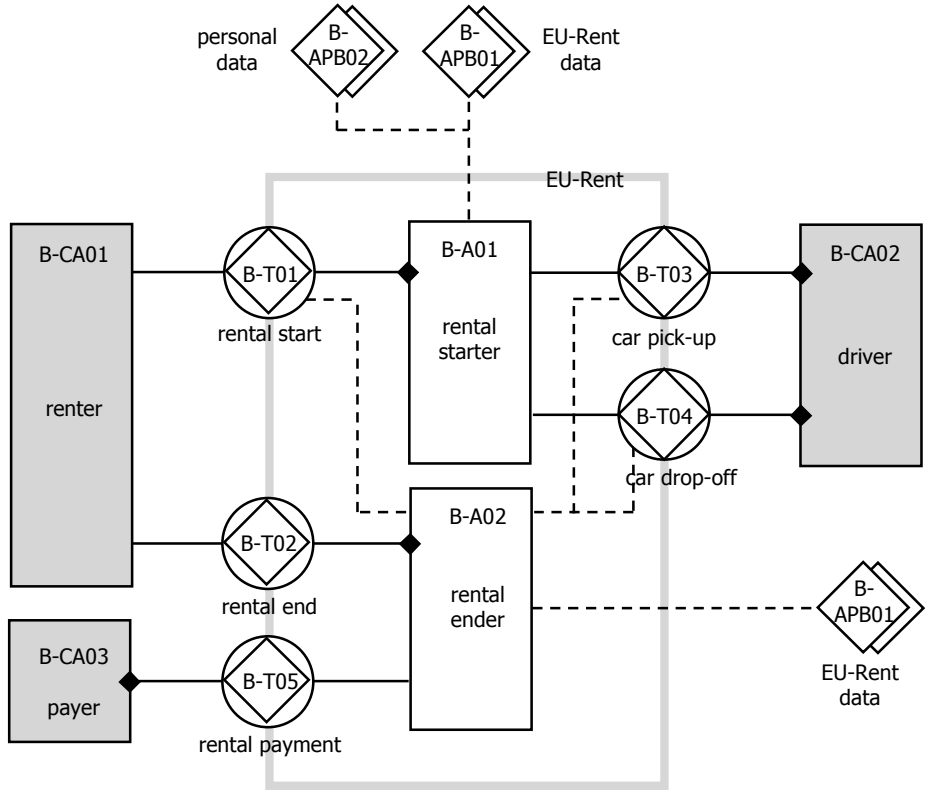
EU-Rent: Process Model (7)

Process
Structure
Diagram



EU-Rent: Construction Model (8)

Organization Contruction Diagram



Transaction Result Table

Transaction kind	Transaction result
B-T01 rental start	B-R01 [rental] has been started
B-T02 rental end	B-R02 [rental] has been ended
B-T03 car pick-up	B-R03 the car of [rental] has been picked-up
B-T04 car drop-off	B-R04 the car of [rental] has been dropped-off
B-T05 rental payment	B-R05 [rental] has been paid