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| **No:** | **Type of Change** | **Example** |
| CS1 | Inclusion of a mandatory feature | Supporting the reimbursement of costs met by a member |
| CS2 | Inclusion of an optional feature | Supporting renting a vehicle as an alternative transport |
| CS3 | Inclusion of an alternative feature | Supporting paying by credit card or bank transfer |
| CS4 | Changing a mandatory feature to an optional feature | Allowing a member to use towing or expert advice without repairing |
| CS5 | Removal of an optional feature | Discontinuing providing accommodations |
| CS6 | Removal of an alternative feature | Dropping the bank transfer payment option |
| CS7 | Splitting one feature into two features | Separating legal assistance from the accident towing to reuse it in other situations |
| CS8 | Merging two features into one feature | Merging providing technical advice and vehicle test reports |
| CS9 | No feature changes: extending a collaboration | Using a nearby service center when the garage cannot deliver fuels within 2 hours |
| CS10 | No feature changes: contracting a collaboration | Direct notification of a member by the garage instead via the support center |

1. Change Scenario 1

The feature Reimbursement is implemented by a collaboration among services of Member, AccountingFirm, and CreditCardCompany. The product line is already using these services for implementing other features such Payment. The initial role-contract topology consists of roles Member, AccountingFirm, and CreditCardCompany. The tasks representing new capabilities are added. The task NotifyReimbursementCompletion is added to the role Member. The task ValidateReimbursementBills is added to the role AccountingFirm. The task PayBillsByCreditCard is added to the CreditCardCompany. To capture the required relationships between Member and AccountingFirm, the contract Member-AccountingFirm is created. This contract has the interaction term reimburse. In addition, the interaction term payBillsByCreditCard is added to the already existing contract AccountingFirm-CreditCardCompany. After introducing the structural changes required for the new collaboration, the behavior unit Reimbursing is created to capture this collaboration. The task references of AccountingFirm.ValidateReimbursementBills, CreditCardCompany.PayBillsByCreditCard, and Member.NotifyReimbursementCompletion are added to the new behavior unit Reimbursing. The preEP and postEP of these tasks are defined to create a control flow within the collaboration. Finally, a reference to the behavior unit Reimbursing is added to the product Tenant3, which needs the feature Reimbursement.

1. Change Scenario 2

To support the feature VehicleHire, we need to create a service collaboration among the players RoadsideTaxiChain, Support Center, and Member. As the initial system have the last two players and the related roles, we only need to add the player RoadsideTaxiChain to the product line and create the role RoadsideTaxiChain to provide an abstraction over such a service type. The tasks RentVehicle and EndLease are added to this role as abstractions over the capability expected by the player. The capture the relationships required to provide these new tasks, the contract SupportCentre-RoadsideTaxiChain is created and the interactions rentVehicle and endVehicleLease are added. The tasks AckRepairing and AnalyseAssistRequest were changed to reflect new task-interaction relations. As the next step, the behavior unit RentingVehicle is created to represent the required collaboration. It comprises the task references RoadsideTaxiChain.RentVehicle and RoadsideTaxiChain.EndLease. Finally, as Tenant2 needs the feature VehicleHire, a reference to the behavior unit RentingVehicle is added to the product Tenant2.

1. Change Scenario 3

To add the feature BankTransfer, we create a collaboration consists of the roles RoadsideBank, AccountingFirm, and Member. The last two roles and the contract between them are part of the initial system. Two new contracts AccountingFirm-RoadsideBank and RoadsideBank\_Member are created. Next, the tasks and interactions required to implement the bank transfer functionality are added/modified. The RoadsideBack consists of the tasks PayRepair , PayTow, PayLegalAdvice , and PayRentVehicle. The contract AccountingFirm-RoadsideBank includes the interaction terms payRepairByBankTransfer, payTowByBankTransfer, payLegalAdviceByBankTransfer, and payRentVehicleByBankTransfer A new player for realizing the role RoadsideBank, and the player-binding is added. Finally, the behavior unit PayingByBankTransfer, to capture this collaboration is created, and the related products (Tenant1 ad Tenant2) are updated to refer to it. The new behavior unit contains the task references RoadsideBank.PayRepair, RoadsideBank.PayTow, RoadsideBank.PayLegalAdvice, and RoadsideBank.PayRentVehicle.

1. Change Scenario 4

This scenario requires the towing collaboration is decoupled from the repair collaboration so that the towing can be used independently. For this purpose, we need to allow a member to directly participate in the towing collaboration. Thus, we add the contract TowChain-Member to capture the interaction relationships between a Member and TowChain. The task TowToGarageOfMember is not supported by the TowChain. To capture this collaboration variation, we create a new behavior unit TowToGarageOfMember with a reference to the task TowChain.TowToGarageOfMember. The product Tenant3 is updated with a reference to this new behavior unit TowToGarageOfMember.

1. Change Scenario 5

The removal of the feature AccommodationProviding is realized by deleting the elements of the collaboration for that feature. This collaboration consists of the roles RoadsideResidence, SupportCentre, and Member. We cannot remove the last two roles as they participate in proving other features, e.g., Repair. The role RoadsideResidence and the related player binding are removed. The behavior unit AccommodationProviding and the reference to in the product that use it (Tenant1) are also deleted. The removal of the contracts RoadsideResidence\_Member and SupportCentre\_ RoadsideResidence are automatically performed due to the propagation of the indented impacts of the removal of the role RoadsideResidence.

1. Change Scenario 6

The removal of the feature BankTransfer is realized by deleting the elements of the collaboration for that feature, which are the same elements introduced in the change scenario 3.

1. Change Scenario 7

In this scenario, we need to split to an already existing collaboration into two. This does not require structural changes. We only need to split the behavior unit that captures the related collaboration. In this case, we create a new behavior unit ProvidingLegalAdvice and move (copy and delete the original one) task reference RoadsideLawFirm.ProvideLegalAdvice from the behavior unit Towing to the behavior unit ProvidingLegalAdvice.

1. Change Scenario 8

In this scenario, we need to merge two separate collaborations into create a new one. This also does not require structural changes. We need to move the task references in the behavior unit VehicleInspection to the behavior unit ProvidingExpertAdvice and delete the behavior unit VehicleInspection.

1. Change Scenario 9

In this scenario, we need to extend an already established collaboration for providing the feature *EmergencyFuel*. It consists of the roles GarageChain, SupportCenter, AccountingFirm, and CreditCardCompany. Now, we need to extend this by incorporating a new participant RoadsideServiceStation. We add the role RoadsideServiceStation and the related player binding. We add the contract RoadsideServiceStation-AccountingFirm to allow billing fuel delivery (the interaction billFuelDelivery), and the contract GarageChain-RoadsideServiceStation to allow ordering fuel from the service station. In addition, we update the contract RoadsideServiceStation-AccountingFirm to enable asking to pay for fuel delivery (the interaction term payFuelDeliveryByCreditCard). The task DeliverFuel to role RoadsideServiceStation, the task BillFuelDelivery to the role AccountingFirm, and the task PayFuelDeliveryByCreditCard to the CreditCardCompany are added. The task OrderRepair of the GarageChain was updated. A new behavior unit FuelDeliveryFromServiceStation is created by extending the behavior unit FuelDelivery with adding new task references RoadsideServiceStation.DeliverFuel, AccountingFirm.BillFuelDelivery, and CreditCardCompany.PayFuelDeliveryByCreditCard. The product Tenant1 is updated to include a reference to the new behavior unit FuelDeliveryFromServiceStation.

1. Change Scenario 10

This scenario is implemented by removing the interaction NotifyCompletion from the contract SupportCenter\_Member, and adding a new contract GarageChain\_Member with the same interaction. Additionally, the tasks GarageChain.OrderRepair and SupportCenter.AckRepairing are updated to reflect the interaction changes, and the new task Member.AckRepairin is added. These modifications are confined to the collaboration for the feature Repair.

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| **CS**  **No** | **Player-Binding** | | | **role** | | | **contract** | | | **Behavior unit** | | |
| ***add*** | ***remove*** | ***modify*** | ***add*** | ***remove*** | ***modify*** | ***add*** | ***remove*** | ***modify*** | ***add*** | ***remove*** | ***modify*** |
| CS1 | 0 | 0 | 0 | 0 | 0 | Member – NotifyReimbursementCompletion  Accounting Firm – ValidateReimbursementBills  CreditCardCompany-PayBillsByCreditCard | Member-AccountingFirm – reimburse | 0 | AccountingFirm-CreditCardCompany  payBillsByCreditCard | Reimbursing | 0 | 0 |
| CS2 | RoadsideTaxiChain | 0 | 0 | RoadsideTaxiChain - RentVehicle and EndLease |  | Support Center - AnalyseAssistRequest, AckReparing | SupportCentre-RoadsideTaxiChain : rentVehicle and endVehicleLease | 0 | 0 | RentingVehicle | 0 | 0 |
| CS3 | RoadsideBank | 0 | 0 | RoadsideBank – PayTow,Repair,LegalAdvice, PayRentVehicle | 0 | AccountingFirm – BillRepair, BillTow, BillRentVehicle, and BillLegalAdvice | AccountingFirm-RoadsideBank  payLegalAdviceByBankTransfer  payRentVehicleByBankTransfer  payTowByBankTransfer  payRepairByBankTransfer | 0 | 0 | PayingByBankTransfer | 0 | 0 |
| CS4 | 0 | 0 | 0 | 0 | 0 | TowChain - TowToGarageOfMember | TowChain-Member - notifyTowCompletion | 0 |  | TowToGarageOfMember | 0 | 0 |
| CS5 | 0 | RoadsideResidence | 0 | 0 | RoadsideResidence – rentRoom and endLease | Support Center - AnalyseAssistRequest, AckReparing | 0 | SupportCentre-RoadsideResidence - rentRoom and endLease | 0 | 0 | AccommodationProviding | 0 |
| CS6 | 0 | RoadsideBank | 0 | 0 | RoadsideBank – PayTow,Repair,LegalAdvice, PayRentVehicle | AccountingFirm – BillRepair, BillTow, BillRentVehicle, and BillLegalAdvice | 0 | AccountingFirm-RoadsideBank  payLegalAdviceByBankTransfer  payRentVehicleByBankTransfer  payTowByBankTransfer  payRepairByBankTransfer | 0 | 0 | PayingByBankTransfer | 0 |
| CS7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ProvidingLegalAdvice | 0 | Remove RoadsideLawFirm.ProvideLegalAdvice from Towing |
| CS8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ProvidingVehicleInspection | Add GarageChain.InspectVehicle to ProvidingExpertAdvice |
| CS9 | RoadsideServiceStation | 0 | 0 | RoadsideServiceStation | 0 | TowChain – OrderRepair  Accounting Firm – BillFuelDelivery  CreditCardCompany - PayFuelDeliveryByCreditCard | RoadsideServiceStation-AccountingFirm  GarageChain-RoadsideServiceStation | AccountingFirm – CreditCardCompany  payFuelDeliveryByCreditCard | 0 | FuelDeliveryFromServiceStation | 0 |  |
| CS10 | 0 | 0 | 0 | 0 | Support center - AckRepairing  Garage – OrderRepair  Member - notifyCompletion | 0 | GarageChain-Member  notifyCompletion | SupportCentre-Member - notifyCompletion | 0 | 0 | 0 | 0 |