Faculty of Computer Science Institute of Software and Multimedia Technology, Software Technology Group

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WS2019/20 – Design Patterns and Frameworks

Role-based Modeling of Design Patterns

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Professor: Prof. Dr. Uwe Aßmann
Lectuer: Dr.-Ing. Sebastian Götz
Tutor: Dr. rer. nat. Marvin Triebel

Task 1 Role-based Modeling

This exercise focuses on the *Compartment Role Object Model* (CROM) [2]. To illustrates CROM, the following figure showcases the role model of a banking application, extracted from [2, Fig. 2a].
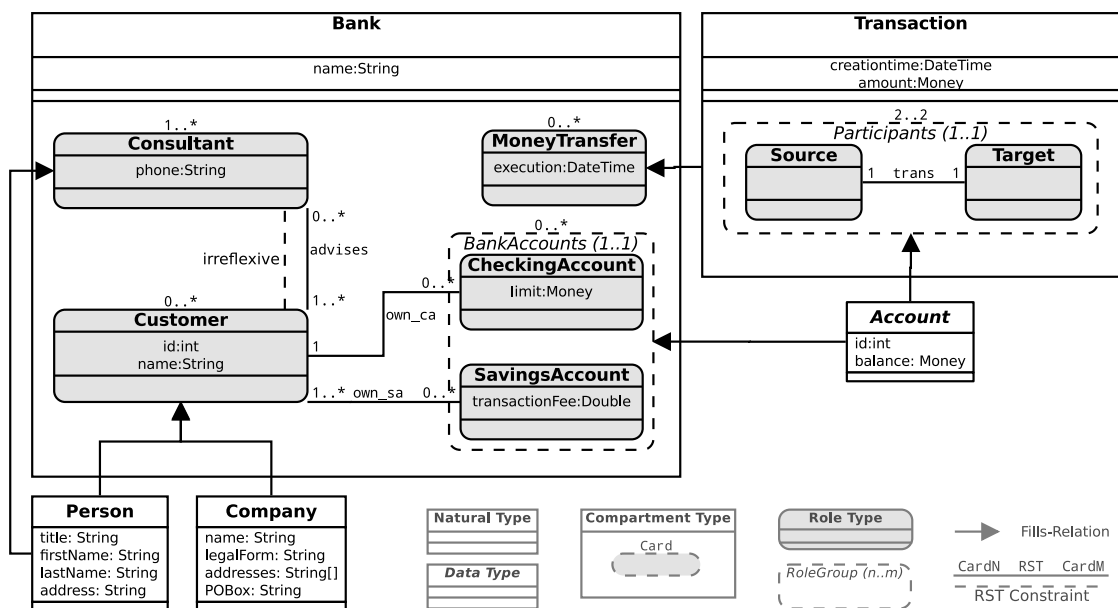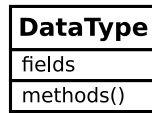
Furthermore, here is an overview of the notation of CROM highlighting all model elements, model relations, and model constraints.
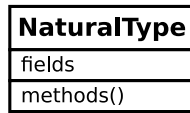
The core entities and relations of CROM models are depicted below:
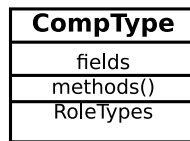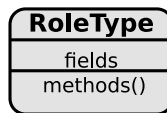
Entities

Data Types

DataType
fields
methods()

Natural Types

NaturalType
fields
methods()

Compartment Types

CompType
fields
methods()
RoleTypes

Role Types

RoleType
fields
methods()

Relations

Participation (participates-Relation)

CompType

RoleType1 ... **RoleTypeN**
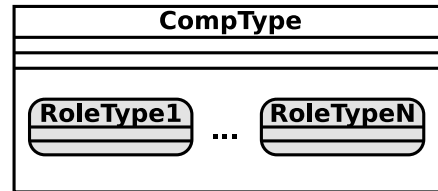
Binary Relationship

A — cardA — cardB — B
RelType
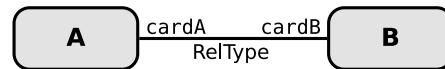
Fulfilment (fills-Relation)

RoleType ◀ **RigidType**
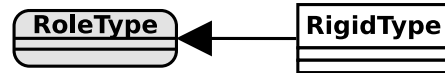
Additionally, CROM supports the following modeling constraints:

Local Role Constraints

Role Groups

RoleGroup (n..m)
RG_1   **RG_k**

Role Constraints

A — Role Implication — B
A — Role Equivalence — B
A — Role Prohibition — B

Occurence Constraints

Compartment Type
card1 ... cardk
RG_1 ... **RG_k**
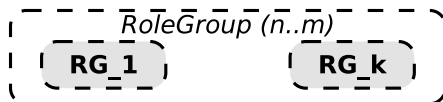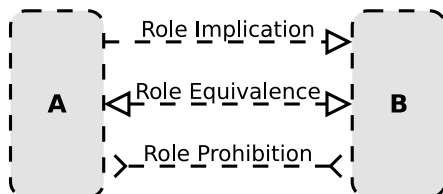
Relationship Constraints

Intra-Relationship Constraints

A — cardA — cardB — B
irreflexive, acyclic, total, ...

Inter-Relationship Constraints

cardB **B**
Rel. Implication
cardA
A — cardC — cardD — **C**
cardE
Rel. Exclusion
cardF **D**
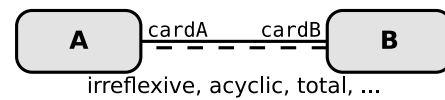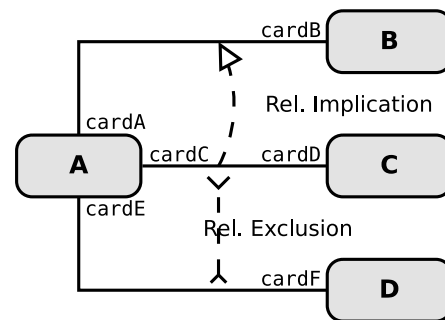
a) Read and understand Section 4 introducing CROM [2, Sect. 4].

Task 2 Role-based Horse Shows

To learn using the CROM language, the next task is to use roles to model *horse shows*.
   In the world of horse shows, there are horses, persons, teams, and shows. A team is encompasses exactly one *rider* (a person) and one *ridden* horse. Moreover, teams can enter a horse show as a *participant*, where they get a starting number . Furthermore, a horse show enrolls several *referees* (persons) to ensure that each team is examined by at least one referee. In fact, as the average horse show takes about two to three days, both horses and persons needed a place to stay. Consequently, the organization team is additionally tasked to provide *accommodations* for both horses and persons.

   a) Classify the various concepts in the *horse show* domain in accordance to the onto-logical foundation [2, Sect. 4.1] as either compartment, role, or natural type.

   b) Design a role model for the *horse show* including persons, horses, teams, and shows.

   c) Extend the previous role model to additionally model accommodations for horses and persons, such as hotels, tents, and horse stables.

   d) Finally, revise the role model and include the various constraints declared in the *horse show* domain.

Task 3 Homework (optional)

The homework assigns you to further familiarize yourself with the CROM language [2].

   a) As a formal modeling language, CROM supports the formal representation of role models. Using this formal notation, specify the role model designed in Task 2 by defining a corresponding CROM model $\mathcal{H}$ and constraint model $\mathcal{C}_{\mathcal{H}}$.

References

[1] Giancarlo Guizzardi. *Ontological foundations for structural conceptual models*. CTIT, Centre for Telematics and Information Technology, 2005.

[2] Thomas Kühn, Böhme Stephan, Sebastian Götz, and Uwe Aßmann. A combined formal model for relational context-dependent roles. In *Proceedings of the 2015 ACM SIGPLAN International Conference on Software Language Engineering*, pages 113–124. ACM, 2015. doi: 10.1145/2814251.2814255. URL http://dl.acm.org/citation.cfm?id=2814255.

[3] Dirk Riehle and Thomas Gross. Role model based framework design and integration. In *ACM SIGPLAN Notices*, volume 33, pages 117–133. ACM, 1998.