Gamified Marketing Application

Data Bases 2 Project

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POLITECNICO
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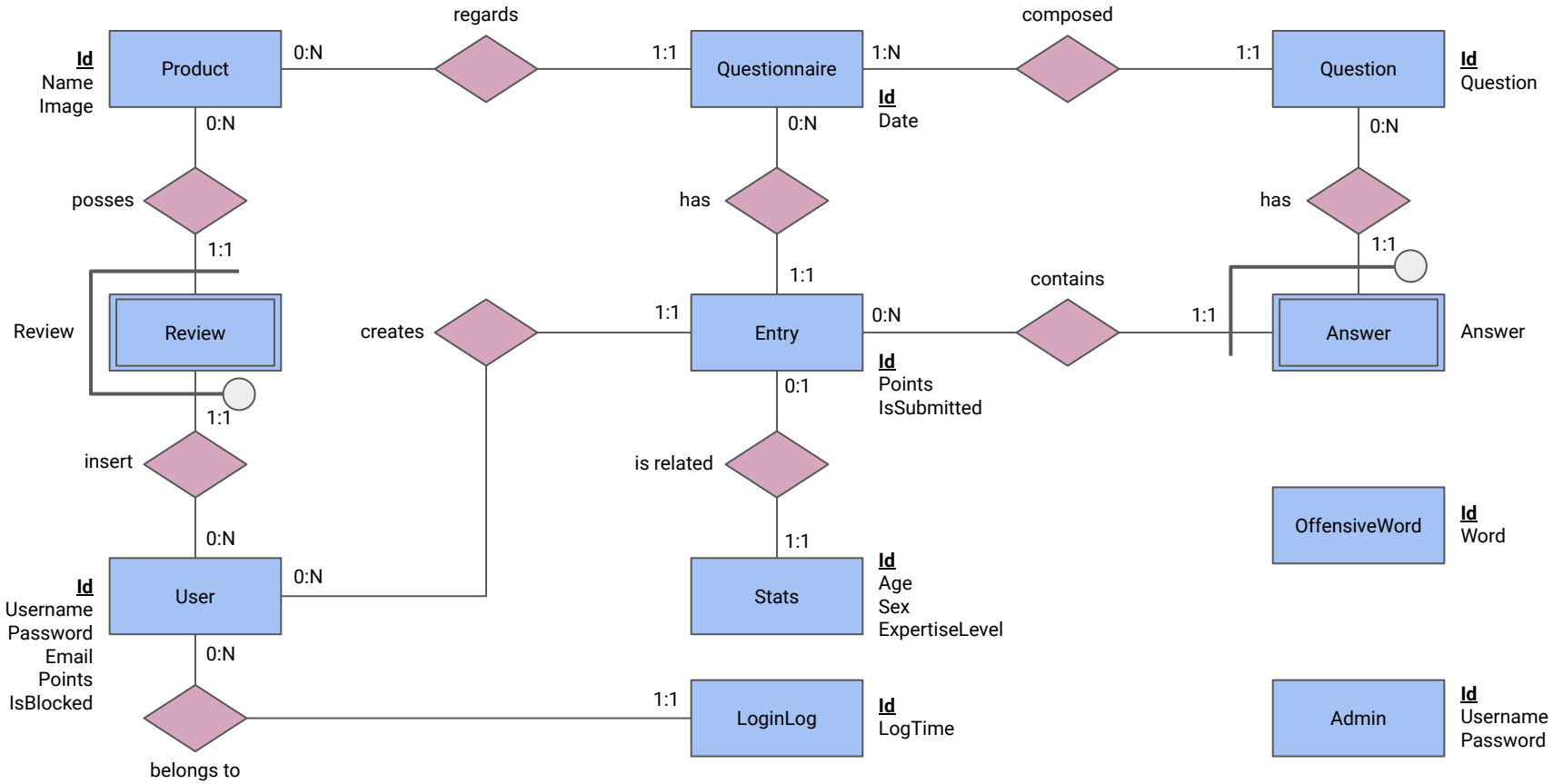
Introduction

These slides aim to explain the main design choices that have been adopted during the development of the project.

We decided to put our focus on the main relationships of the E/R diagram and on the triggers.

ER Diagram


Product
Id
Name
Image
0:N
regards
1:1
Questionnaire
1:N
Id
Date
composed
1:1
Question
Id
Question
0:N
posses
1:1
has
1:1
has
1:1
Review
Review
Review
1:1
creates
1:1
Entry
0:N
Id
Points
IsSubmitted
contains
1:1
Answer
Answer
0:1
insert
0:N
is related
1:1
OffensiveWord
Id
Word
User
Id
Username
Password
Email
Points
IsBlocked
0:N
0:N
Stats
Id
Age
Sex
ExpertiseLevel
belongs to
1:1
LoginLog
Id
LogTime
Admin
Id
Username
Password

Logical model in compact form

questionnaire(**Id**, ProductId, Date)

question(**Id**, QuestionnaireId, Question)

answer(**EntryId**, **QuestionId**, Answer)

entry(**Id**, UserId, QuestionnaireId, Points, IsSubmitted)

stats(**Id**, Age, Sex, ExpertiseLevel, EntryId)

user(**Id**, Username, Password, Email, Points, IsBlocked)

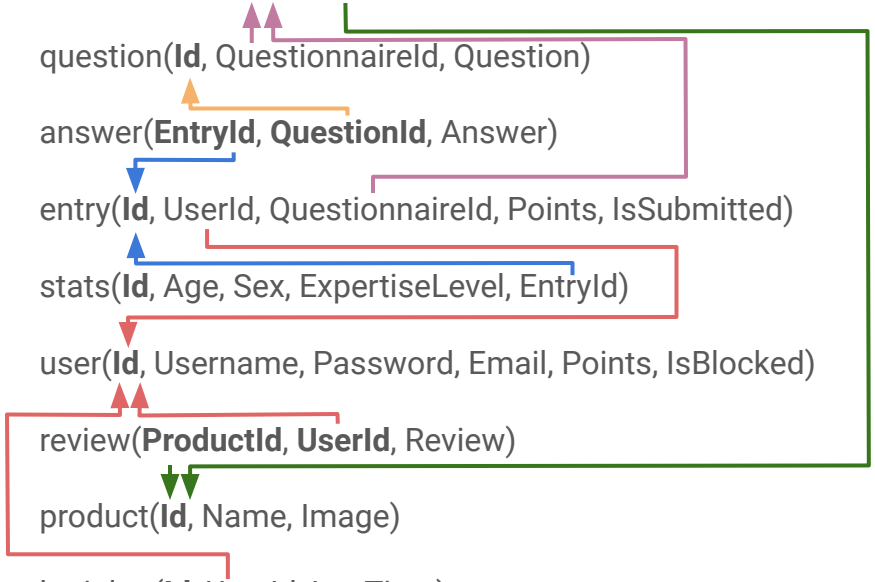
review(**ProductId**, **UserId**, Review)

product(**Id**, Name, Image)

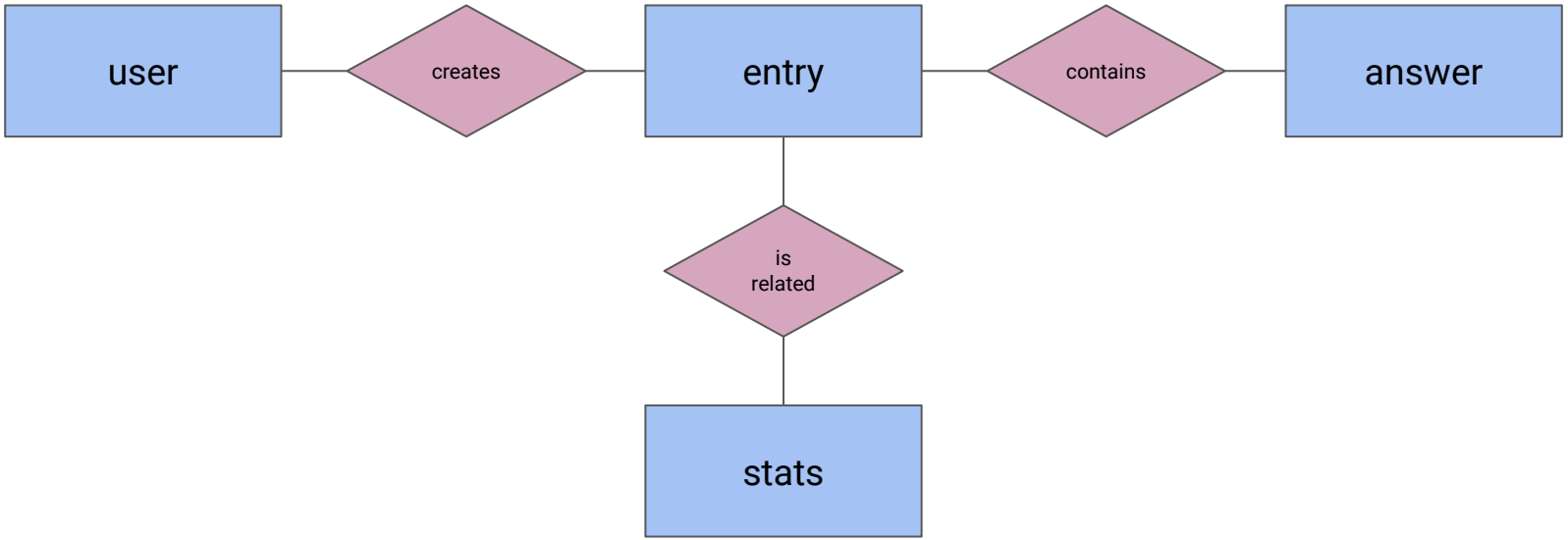
loginlog(**Id**, UserId, LogTime)

admin(**Id**, Username, Password)

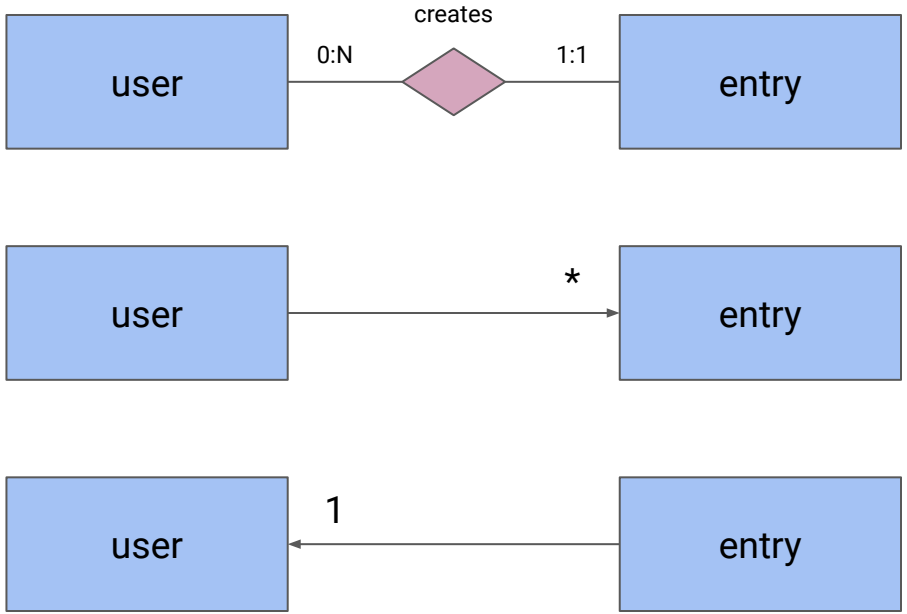
offensiveword(**Id**, Word)



Entry relationships



Relationship User **“creates”** Entry



user ➔ entry **@OneToMany** is necessary to get the entries of the logged user.

entry ➔ user **@ManyToOne** is not requested by the specifications but can be useful for future purposes.

User Entity

```
@Id
@GeneratedValue(strategy = GenerationType.IDENTITY)
@Column(name = "Id", nullable = false)
private int id;

@Column(name = "Username", nullable = false, length = 45)
private String username;

@Column(name = "Password", nullable = false, length = 45)
private String password;

@Column(name = "Email", nullable = false, length = 90)
private String email;

@Column(name = "Points", nullable = false)
private int points = 0;

@Column(name = "IsBlocked", nullable = false)
private Byte isBlocked = 0;

@OneToMany(mappedBy = "user", cascade = {CascadeType.PERSIST, CascadeType.REMOVE,
       CascadeType.REFRESH, CascadeType.MERGE}, orphanRemoval = true)
private List<ReviewEntity> reviews = new ArrayList<>();

@OneToMany(mappedBy = "user", cascade = {CascadeType.PERSIST})
private List<LoginlogEntity> loginlogs = new ArrayList<>();

@OneToMany(mappedBy = "user", cascade = {CascadeType.PERSIST, CascadeType.MERGE,
       CascadeType.REMOVE, CascadeType.REFRESH}, orphanRemoval = true)
private List<EntryEntity> entries = new ArrayList<>();
```

User Entity - Motivations

Bidirectional one-to-many association User to Entry.

- Entry is defined as the owner entity.
- PERSIST, REMOVE, REFRESH, MERGE are cascaded. Persisting or reloading from a database an already existing user also persists/loads any new entry associated to them.
  Removing a user also removes any entries associated with them.
- OrphanRemoval = true causes entries without user to be removed.

Bidirectional one-to-many association User to Loginlogs.

- Loginlogs is defined as the owner entity.
- Only PERSIST is cascaded.
- Other CascadeType are not cascaded because login logs shall not be modified in any way.

Bidirectional one-to-many association User to Review.

- Review is defined as the owner entity.
- PERSIST, REMOVE, REFRESH, MERGE are cascaded. Persisting or reloading from a database an already existing user also persists/loads any new review associated to them.
- OrphanRemoval = true allows to remove reviews when they are removed from the parent entity.

User Entity - Named Queries

```
// Returns the user with the provided login credentials in order to check the user login
@NamedQuery(name = "UserEntity.checkCredentials", query = "SELECT u FROM UserEntity u WHERE u.username = :username AND
u.password = :password")

// Returns the User from the username
@NamedQuery(name = "UserEntity.findByUsername", query = "SELECT u FROM UserEntity u WHERE u.username = :username")

// Returns the User from the email
@NamedQuery(name = "UserEntity.findByEmail", query = "SELECT u FROM UserEntity u WHERE u.email = :email")

// Returns the leaderboard rows of a specific date ordered by the points. A Data Transfer Object (DTO) is used to
simplify the access to data during templating.
@NamedQuery(name = "UserEntity.getLeaderboardByDate", query = "SELECT NEW
it.polimi.db2.gma.GMAEJB.utils.LeaderboardRow(u.username, e.points) FROM UserEntity u INNER JOIN u.entries e INNER JOIN
e.questionnaire q WHERE q.date = :date AND e.isSubmitted = 1 ORDER BY e.points DESC")

// Retrieves the users information of the users who completed the provided questionnaire. The users are filtered based on
the submit status of the entry. A DTO is used to simplify the access to data during templating.
@NamedQuery(name = "UserEntity.getEntriesUserInfo", query = "SELECT NEW it.polimi.db2.gma.GMAEJB.utils.UserInfo(u.id,
u.username) FROM UserEntity u INNER JOIN u.entries e WHERE e.questionnaire.id = :id AND e.isSubmitted = :submitted ORDER
BY u.id")
```

Entry Entity

```
@Id
@GeneratedValue(strategy = GenerationType.IDENTITY)
@Column(name = "Id", nullable = false)
private int id;

@Column(name = "Points", nullable = false)
private int points = 0;

@Column(name = "IsSubmitted", nullable = false)
private Byte isSubmitted = 0;

@ManyToOne
@JoinColumn(name = "UserId", nullable = false)
private UserEntity user;

@ManyToOne
@JoinColumn(name = "QuestionnaireId")
private QuestionnaireEntity questionnaire;

@OneToOne(mappedBy = "entry", cascade = {CascadeType.PERSIST, CascadeType.REMOVE,
        CascadeType.REFRESH, CascadeType.MERGE}, orphanRemoval = true)
private StatsEntity stats;

@OneToMany(mappedBy = "entry", fetch = FetchType.EAGER, cascade = {CascadeType.PERSIST, CascadeType.REMOVE,
        CascadeType.REFRESH, CascadeType.MERGE}, orphanRemoval = true)
private List<AnswerEntity> answers = new ArrayList<>();
```

Entry Entity - Motivations

Bidirectional many-to-one association to User (Entry is the owner entity).

Bidirectional many-to-one association to Questionnaire (Entry is the owner entity).

Bidirectional one-to-one association Entry to Stats.

- Stats is defined as the owner entity.
- PERSIST, REFRESH, MERGE, REMOVE are cascaded to the dependent entity Stats. In particular, REMOVE allows to delete all the stats associated with the entry when the latter is deleted.
- OrphanRemoval = true causes stats without entry to be removed.

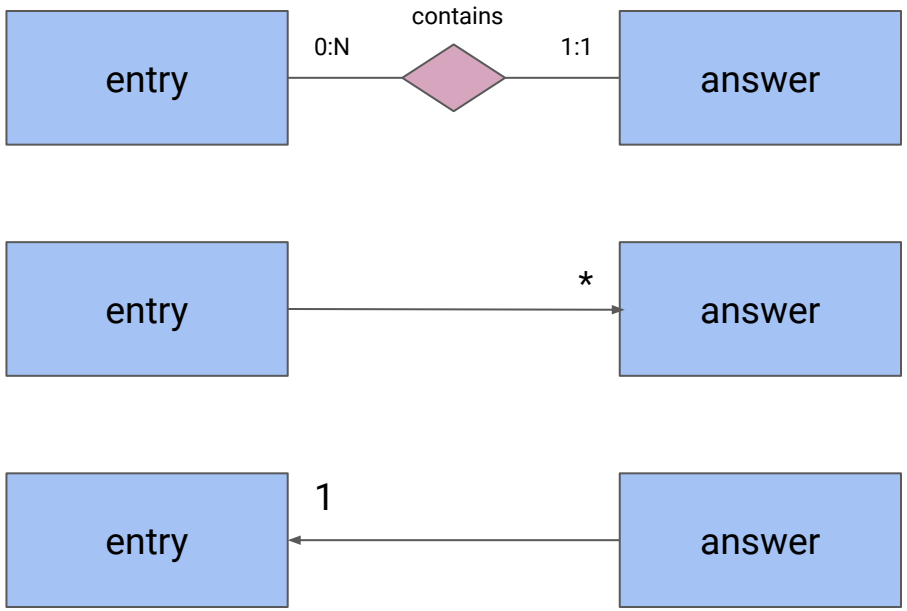
Bidirectional one-to-many association Entry to Answer.

- Answer is defined as the owner entity.
- PERSIST, REFRESH, MERGE, REMOVE are cascaded to the entity Answer. In particular, REMOVE allows to delete all the answers associated with the entry when the latter is deleted.
- OrphanRemoval = true allows to remove answers when they are removed from the parent entity.
- FetchType is set to EAGER in order to retrieve immediately the answers linked to the entry when the inspection page is loaded.

Entry Entity - Named Queries

```
// Returns the answers of an entry. A DTO is used to simplify the access to data during templating. The ORDER BY is used to display the questions in the order they were originally inserted.
@NamedQuery(name = "EntryEntity.getQuestionsAnswers", query = "SELECT NEW it.polimi.db2.gma.GMAEJB.utils.QuestionAnswer(q.question, a.answer) FROM EntryEntity e INNER JOIN e.answers a INNER JOIN a.question q WHERE e.questionnaire.id = :qid AND e.user.id = :uid ORDER BY q.id"),

// Returns the answered stats of an entry. A DTO is used to simplify the access to data during templating.
@NamedQuery(name = "EntryEntity.getStatsAnswers", query = "SELECT NEW it.polimi.db2.gma.GMAEJB.utils.StatsAnswers(s.age, s.sex, s.expertiseLevel) FROM EntryEntity e INNER JOIN e.stats s WHERE e.questionnaire.id = :qid AND e.user.id = :uid"),

// Returns the entry by means of his composite primary key (userId + questionnaireId)
@NamedQuery(name = "EntryEntity.findByUserAndQuestionnaire", query = "SELECT e FROM EntryEntity e WHERE e.user.id = :userId AND e.questionnaire.id = :questionnaireId")
```

Relationship Entry **“contains”** Answer



entry ➔ answer **`@OneToMany`** is necessary to get the answers of the entry.

answer ➔ entry **`@ManyToOne`** is not requested by the specifications but can be useful for future purposes.

Note: an entry may have no answers when a user chooses to “cancel” the questionnaire. In that case an entry will be saved with no answers linked to it and the flag “IsSubmitted” will be set to 0.

Answer Entity

```java
// Class AnswerEntityPK
@Embeddable

private int entryId;

private int questionId;


// Class AnswerEntity

@EmbeddedId
private AnswerEntityPK answerEntityPK;

@Column(name = "Answer", nullable = false, length = 45)
private String answer;

@ManyToOne
@JoinColumn(name = "EntryId")
@MapsId("entryId")
private EntryEntity entry;

@ManyToOne
@JoinColumn(name = "QuestionId")
@MapsId("questionId")
private QuestionEntity question;
```

Answer Entity - Motivations

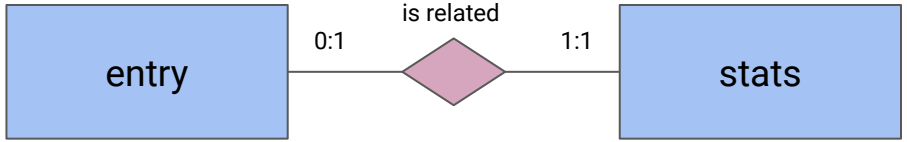
Bidirectional many-to-one association to Entry (Answer is the owner entity).

Bidirectional many-to-one association to Question (Answer is the owner entity).

The Answer entity has a composite primary key (userId + questionnaireId) which is implemented into JPA with the @Embeddable and @EmbeddedId annotations.

@MapsId annotates the relationship attribute to indicate that it is mapping the ID attribute as well. Note that physical mapping annotations (e.g., @Column) should not be specified on the attribute `entryId` nor `questionId` since @MapsId is indicating that the relationship attribute is where the mapping occurs.

Relationship Entry **“is related”** Stats



entry ➔ stats **@OneToOne** is necessary to retrieve the stats of users that filled in the questionnaire.

stats ➔ entry **@OneToOne** is not requested by the specifications but can be useful for future purposes.

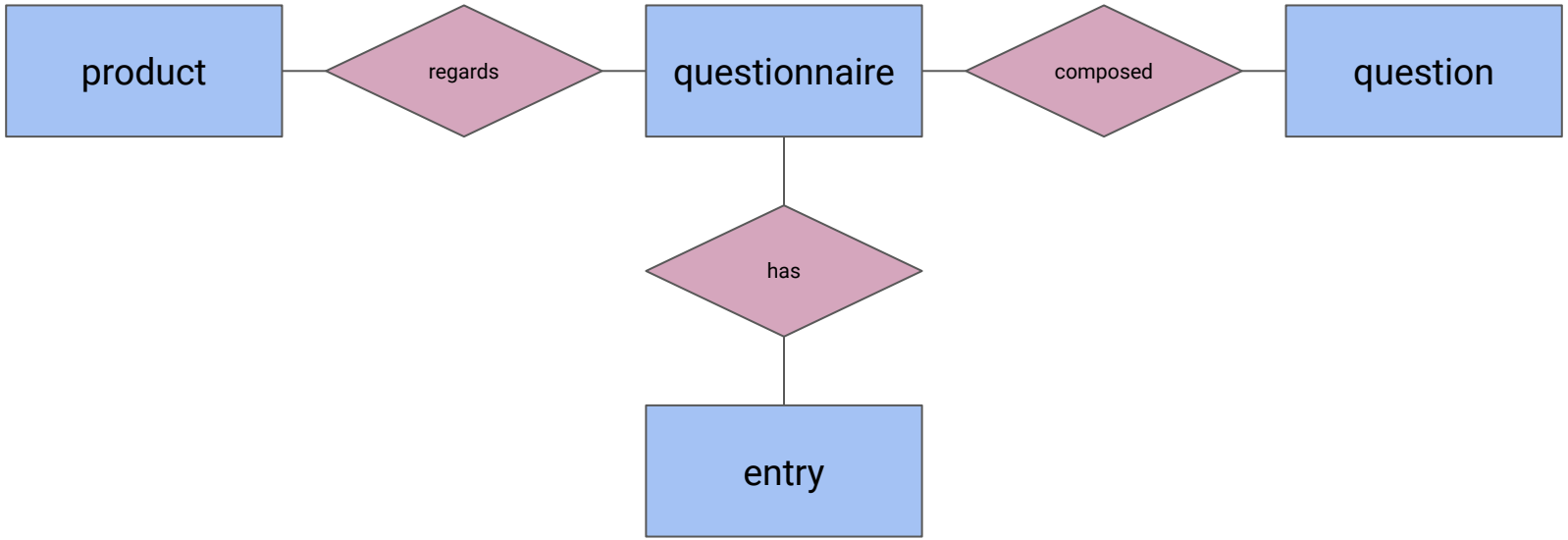
Note: an entry may have no stats because they are optional.

Stats Entity

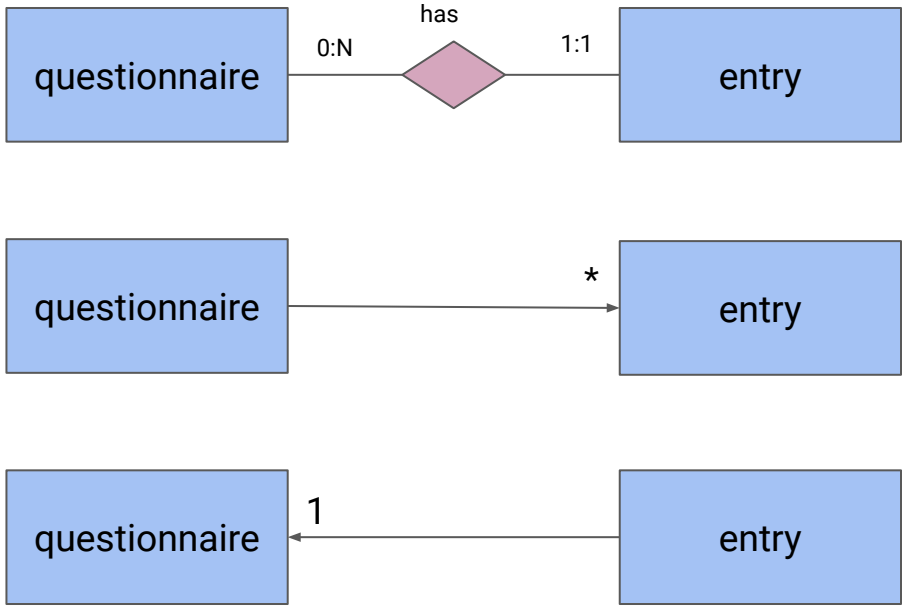
```
@Id
@GeneratedValue(strategy = GenerationType.IDENTITY)

@Column(name = "Id", nullable = false)
private int id;

@Column(name = "Age", nullable = true)
private Integer age;

@Column(name = "Sex", nullable = true)
@Enumerated(EnumType.STRING)
private Sex sex;

@Column(name = "ExpertiseLevel", nullable = true)
@Enumerated(EnumType.STRING)
private ExpertiseLevel expertiseLevel;

@OneToOne
@JoinColumn(name = "EntryId")
private EntryEntity entry;
```

Bi-directional one-to-one association to Entry (Stats is the owner entity).

Questionnaire relationships



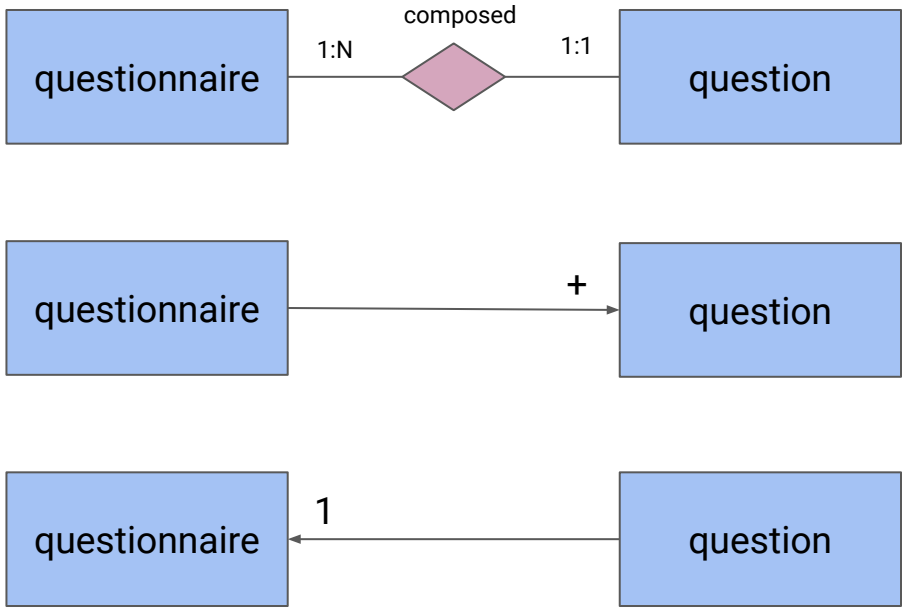
Relationship Questionnaire **“has”** Entry



questionnaire ➔ entry `@OneToMany`
is necessary to list all the entries inserted by users.

entry ➔ questionnaire `@ManyToOne`
is not requested by the specifications, but could be useful in the future.

Relationship Questionnaire **“composed”** Question



questionnaire ➔ question `@OneToMany` is necessary to list the questions a user needs to answer.

question ➔ questionnaire `@ManyToOne` is not requested by the specifications, but could be useful in the future.

Note: a questionnaire is always composed of at least one question.

Questionnaire Entity

```
@Id
@GeneratedValue(strategy = GenerationType.IDENTITY)
@Column(name = "Id", nullable = false)
private int id;

@Column(name = "Date", nullable = false)
private Date date;

@ManyToOne
@JoinColumn(name = "ProductId")
private ProductEntity product;

@OneToMany(mappedBy = "questionnaire", fetch = FetchType.EAGER, cascade = {CascadeType.PERSIST, CascadeType.REMOVE,
       CascadeType.REFRESH, CascadeType.MERGE}, orphanRemoval = true)
private List<QuestionEntity> questions = new ArrayList<>();

@OneToMany(mappedBy = "questionnaire", cascade = {CascadeType.PERSIST, CascadeType.REMOVE,
       CascadeType.REFRESH, CascadeType.MERGE}, orphanRemoval = true)
private List<EntryEntity> entries = new ArrayList<>();
```

Questionnaire Entity - Motivations

Bidirectional many-to-one association to Product (Questionnaire is the owner entity).

Bidirectional one-to-many association Questionnaire to Question.

- Question is defined as the owner entity.
- PERSIST, REFRESH, MERGE, REMOVE are cascaded to the entity Question. In particular, REMOVE allows to delete all the questions associated with the questionnaire when the latter is deleted.
- OrphanRemoval = true allows to remove questions when they are removed from the parent entity.
- FetchType is set to EAGER in order to retrieve immediately the questions linked to the questionnaire when the questionnaire of the day is shown to the user.

Bidirectional one-to-many association Questionnaire to Entry.

- Entry is defined as the owner entity.
- PERSIST, REFRESH, MERGE, REMOVE are cascaded to the entity Entry. In particular, REMOVE allows to delete all the entries associated with the questionnaire when the latter is deleted.
- OrphanRemoval = true allows to remove entries when they are removed from the parent entity.

Questionnaire Entity - Named Queries

```
// Retrieves the Questionnaire belonging to a specific date
@NamedQuery(name = "QuestionnaireEntity.findByDate", query = "SELECT q FROM QuestionnaireEntity q WHERE q.date = :date")

// Retrieves a list of the Questionnaires existing before a given date
@NamedQuery(name = "QuestionnaireEntity.findAllUntilDate", query = "SELECT q FROM QuestionnaireEntity q WHERE q.date <
:date ORDER BY q.date DESC")

// Returns the list of all the Questionnaires present in the DataBase
@NamedQuery(name = "QuestionnaireEntity.findAll", query = "SELECT q FROM QuestionnaireEntity q")

// Retrieves the information about a Questionnaire. A DTO is used to simplify the access to data during templating.
@NamedQuery(name = "QuestionnaireEntity.getQuestionnairesInfos", query = "SELECT NEW
it.polimi.db2.gma.GMAEJB.utils.QuestionnaireInfo(q.id, q.date, p.name) FROM QuestionnaireEntity q INNER JOIN q.product p
ORDER BY q.date DESC")
```

Question Entity

```
@Id
@GeneratedValue(strategy = GenerationType.IDENTITY)
@Column(name = "Id", nullable = false)
private int id;

@Column(name = "Question", nullable = false, length = 200)
private String question;

@ManyToOne
@JoinColumn(name = "QuestionnaireId")
private QuestionnaireEntity questionnaire;

@OneToMany(mappedBy = "question", cascade = {CascadeType.PERSIST, CascadeType.REFRESH,
        CascadeType.MERGE, CascadeType.REMOVE}, orphanRemoval = true)
private List<AnswerEntity> answers = new ArrayList<>();
```

Question Entity - Motivations

Bidirectional many-to-one association to Questionnaire (Question is the owner entity).

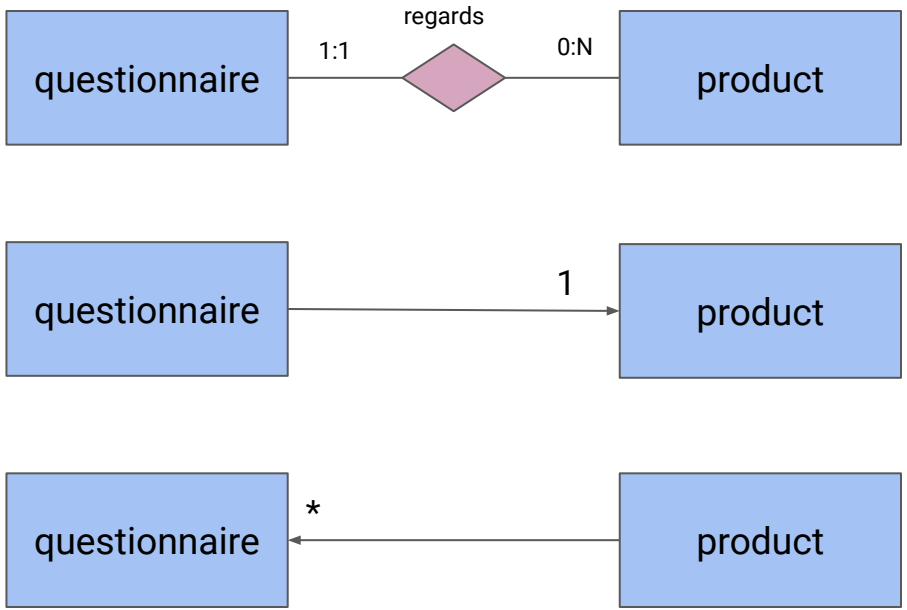
Bidirectional one-to-many association Question to Answer.

- Answer is defined as the owner entity.
- PERSIST, REFRESH, MERGE, REMOVE are cascaded to the entity Answer. In particular, REMOVE allows to delete all the questions associated with the questionnaire when the latter is deleted.
- OrphanRemoval = true allows to remove answers when they are removed from the parent entity.

Question Entity - Named Queries

```
// Returns all the Questions belonging to a questionnaire given the questionnaire Id
@NamedQuery(name = "QuestionEntity.findAllByQuestionnaire", query = "SELECT q FROM QuestionEntity q WHERE q.id =
:questionnaireId")
```

Relationship Questionnaire “**regards**” Product



product ➔ questionnaire **`@OneToMany`**
is used to add and remove a questionnaire related to a product.

questionnaire ➔ product **`@ManyToOne`**
is necessary to access a product by the questionnaire.

Product Entity

```java
@Id
@GeneratedValue(strategy = GenerationType.IDENTITY)
@Column(name = "Id", nullable = false)
private int id;

@Column(name = "Name", nullable = false, length = 45)
private String name;

@Column(name = "Image", nullable = false, length = 45)
private String image;

@OneToMany(mappedBy = "product", fetch = FetchType.EAGER)
private List<ReviewEntity> reviews = new ArrayList<>();

@OneToMany(mappedBy = "product", cascade = {CascadeType.PERSIST, CascadeType.REMOVE}, orphanRemoval = true)
private List<QuestionnaireEntity> questionnaires = new ArrayList<>();
```

Product Entity - Motivations

Bidirectional one-to-many association Product to Review.

- Review is defined as the owner entity.
- No operations are cascaded since it is not requested by the specifications.
- FetchType is set to EAGER in order to retrieve immediately the reviews linked to the product when the questionnaire of the day is shown to the user.

Bidirectional one-to-many association Product to Questionnaire.

- Questionnaire is defined as the owner entity.
- PERSIST, REMOVE are cascaded. Persisting or reloading from a database an already existing product also persists/loads any new questionnaire associated to it. Other cascading are not requested by the specifications.
- OrphanRemoval = true allows to remove questionnaires when they are removed from the parent entity.

Product Entity - Named Queries

```
// Returns the list of all the Products present in the DataBase
@NamedQuery(name = "ProductEntity.findAll", query = "SELECT p FROM ProductEntity p")

// Retrieve the Product belonging to a specific date
@NamedQuery(name = "ProductEntity.findByDate", query = "SELECT p FROM ProductEntity p INNER JOIN p.questionnaires q WHERE
q.date = :date")
```

Trigger - Offensive Words detection

```
CREATE DEFINER=`dev`@`localhost` TRIGGER `answer_BEFORE_INSERT` BEFORE INSERT ON `answer` FOR EACH ROW BEGIN
    IF (SELECT COUNT(*) FROM `offensiveword`
         WHERE LOWER(NEW.Answer) REGEXP CONCAT('\\b', LOWER(Word) ,'\\b'))
    THEN
            SIGNAL SQLSTATE '45000' SET MESSAGE_TEXT = 'Offensive word detected!';
    END IF;
END
```

Before the insert of a new answer, the text of the response is checked. If an offensive word is found an exception is thrown and the transaction is aborted.
The exception will be catched by the EJB and the user will be banned from it.

Trigger - Update entry points

```
CREATE DEFINER=`dev`@`localhost` TRIGGER `answer_AFTER_INSERT` AFTER INSERT ON `answer` FOR EACH ROW BEGIN
    UPDATE `entry` e
    SET e.Points = e.Points + 1
    WHERE e.Id = NEW.EntryId;
END

CREATE DEFINER=`dev`@`localhost` TRIGGER `stats_AFTER_INSERT` AFTER INSERT ON `stats` FOR EACH ROW BEGIN
    UPDATE `entry` e
    SET e.Points = e.Points + 2 * ((NOT ISNULL(NEW.Age)) + (NOT ISNULL(NEW.Sex)) + (NOT ISNULL(NEW.ExpertiseLevel)))
    WHERE e.Id = NEW.EntryId;
END
```

After the insert of a new answer or stats, the trigger computes the **new** total point of the current entry.

Trigger - Update user points

```
CREATE DEFINER=`dev`@`localhost` TRIGGER `entry_AFTER_UPDATE` AFTER UPDATE ON `entry` FOR EACH ROW BEGIN
    IF NEW.Points <> OLD.Points THEN
        UPDATE `user` u
        SET u.Points = u.Points - OLD.Points + NEW.Points
        WHERE u.Id = NEW.UserId;
    END IF;
END

CREATE DEFINER=`dev`@`localhost` TRIGGER `entry_AFTER_DELETE` AFTER DELETE ON `entry` FOR EACH ROW BEGIN
      UPDATE `user` u
    SET u.Points = u.Points - OLD.Points
    WHERE u.Id = OLD.UserId
              AND OLD.IsSubmitted = 1;
END
```

After the update of an entry, if the points of the entry changed, the points of the user are recomputed.
After the delete of an entry, the total score of the users who submitted the entry is decremented by the entry points.

Business Tier Components - I

```
@Stateless EntryService
public Entry getUserQuestionnaireAnswers(int questionnaireID, int userID) throws BadEntryException
public Entry getDefaultQuestionnaireAnswers(int questionnaireID) throws BadEntryException
public void addEmptyEntry(int userId, int questionnaireId) throws BadEntryException
public void addEmptyEntryToday(int userId, int questionnaireId) throws BadEntryException, BadQuestionnaireException
public void addNewEntry(int userId, int questionnaireId, List<String> strAnswers, Integer age, Sex sex, ExpertiseLevel
expLevel) throws BadEntryException, BadWordException
public void addNewEntryToday(int userId, int questionnaireId, List<String> strAnswers, Integer age, Sex sex,
ExpertiseLevel expLevel) throws BadEntryException, BadWordException, BadQuestionnaireException
public EntryEntity getEntryByIds(int questionnaireId, int userId) throws BadEntryException

@Stateless QuestionnaireService
public QuestionnaireEntity findQuestionnaireByDate(LocalDate localDate)
public QuestionnaireEntity addNewQuestionnaire(LocalDate localDate, int productId, List<String> strQuestions) throws
BadProductException, BadQuestionnaireException
public void deleteQuestionnaire(int questionnaireId) throws BadQuestionnaireException
public List<QuestionEntity> findAllQuestionsByQuestionnaire(int questionnaireId)
public List<QuestionnaireInfo> getQuestionnairesInfos()
public List<QuestionnaireEntity> findQuestionnairesUntil(LocalDate localDate)
```

Business Tier Components - II

```
@Stateless ProductService
public List<ProductEntity> findAllProducts()
public ProductEntity findProductByDay(Date date)

@Stateless AdminService
public AdminEntity checkCredentials(String username, String password) throws CredentialsException,
NonUniqueResultException

@Stateless UserService
public UserEntity findUserById(int userId)
public UserEntity findUserByUsername(String username)
public UserEntity findUserByEmail(String email)
public UserEntity checkCredentials(String username, String password) throws CredentialsException,
NonUniqueResultException
public UserEntity addNewUser(String username, String password, String email) throws CredentialsException
public List<LeaderboardRow> getLeaderboardByDate(Date date)
public List<UserInfo> getQuestionnaireUserInfo(int questionnaireID, int isSubmitted) throws BadQuestionnaireException
public void blockUser(int userId)
public void addLoginLog(int userId) throws BadUserException
```

All components are stateless because all client requests are served independently and update the database, no main memory conversational state needs to be maintained.