

# Mobile Application Development

Higher Diploma in Science in Computer Science

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Produced  
by

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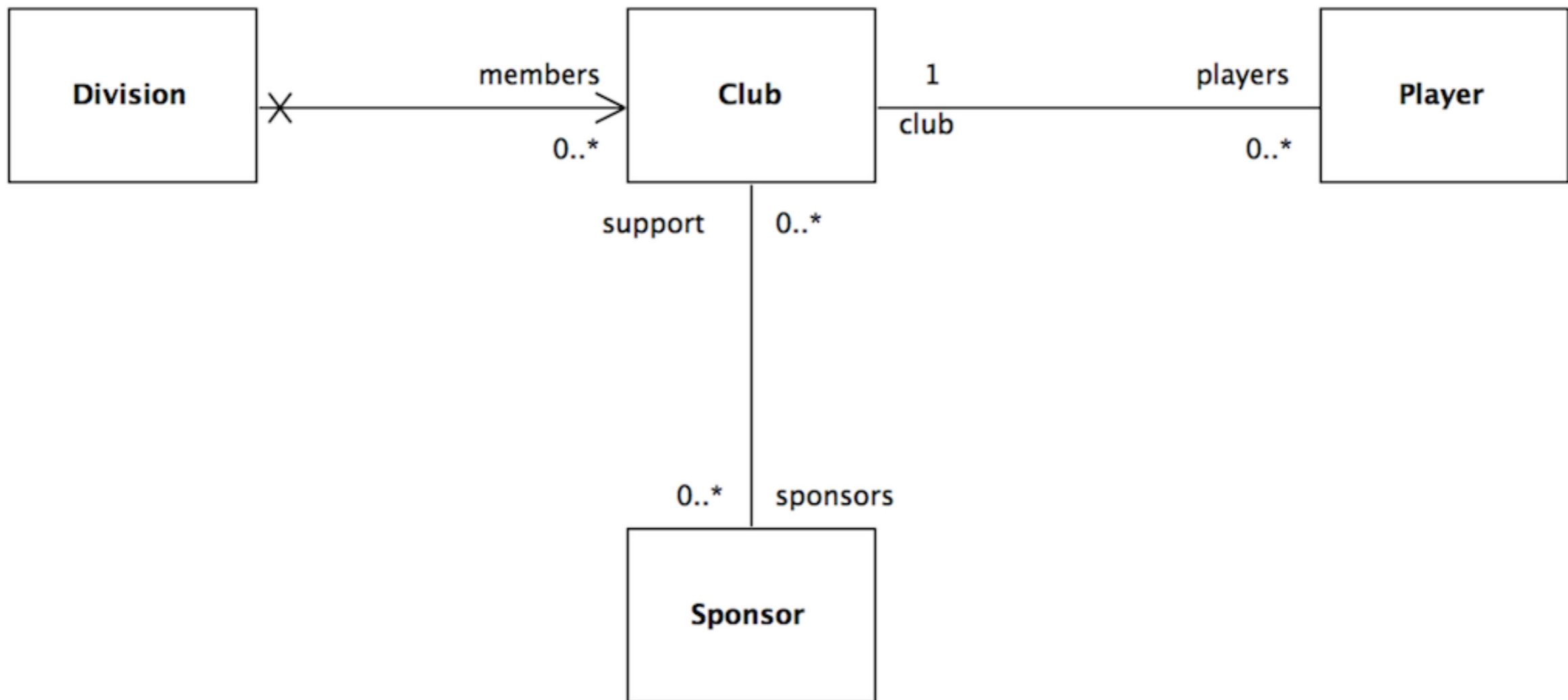


# JPA II - ManyToMany

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# OneToMany, ManyToOne, ManyToMany

---



# OneToMany

```
public class Division extends Model
{
    public String name;

    @OneToMany(cascade=CascadeType.ALL)
    public List<Club> members;

    public Division(String name)
    {
        this.name = name;
        members = new ArrayList<Club>();
    }

    public void addClub(Club club)
    {
        members.add(club);
    }

    public String toString()
    {
        return name;
    }

    public static Division findByName(String name)
    {
        return find("name", name).first();
    }
}
```

```
public class Club extends Model
{
    public String name;

    @OneToMany(mappedBy="club", cascade=CascadeType.ALL)
    public List<Player> players;

    @ManyToMany
    public List<Sponsor> sponsors;

    public Club(String name)
    {
        this.name = name;
        this.players = new ArrayList<Player>();
        this.sponsors = new ArrayList<Sponsor>();
    }

    public String toString()
    {
        return name;
    }

    public static Club findByName(String name)
    {
        return find("name", name).first();
    }

    public void addPlayer(Player player)
    {
        player.club = this;
        players.add(player);
    }

    public void addSponsor(Sponsor company)
    {
        sponsors.add(company);
    }

    public void removePlayer(Player player)
    {
        players.remove(player);
    }
}
```

# ManyToOne

```
public class Club extends Model
{
    public String name;

    @OneToMany(mappedBy="club", cascade=CascadeType.ALL)
    public List<Player> players;

    //..
}
```

```
public class Player extends Model
{
    public String name;

    @ManyToOne
    public Club club;

    public Player(String name)
    {
        this.name = name;
    }

    public String toString()
    {
        return name;
    }

    public static Player findByName(String name)
    {
        return find("name", name).first();
    }
}
```

# ManyToMany

```
public class Sponsor extends Model
{
    public String name;

    @ManyToMany (mappedBy="sponsors")
    public List<Club> support;

    public Sponsor(String name)
    {
        this.name = name;
        support = new ArrayList<Club>();
    }

    public void addSuport(Club club)
    {
        support.add(club);
    }

    public String toString()
    {
        return name;
    }
}
```

```
public class Club extends Model
{
    public String name;

    @OneToMany(mappedBy="club", cascade=CascadeType.ALL)
    public List<Player> players;

    @ManyToMany
    public List<Sponsor> sponsors;

    public Club(String name)
    {
        this.name = name;
        this.players = new ArrayList<Player>();
        this.sponsors = new ArrayList<Sponsor>();
    }

    public String toString()
    {
        return name;
    }

    public static Club findByName(String name)
    {
        return find("name", name).first();
    }

    public void addPlayer(Player player)
    {
        player.club = this;
        players.add(player);
    }

    public void addSponsor(Sponsor company)
    {
        sponsors.add(company);
    }

    public void removePlayer(Player player)
    {
        players.remove(player);
    }
}
```

# Tests

- For more complex models, create fixtures in data.yml.
- These models can be loaded in unit tests

```
Club(dunmore):  
  name: dunmore  
  
Club(tramore):  
  name: tramore  
  
Club(fenor):  
  name: fenor  
  
Player(jim):  
  name: jim  
  club: dunmore  
  
Player(mary):  
  name: mary  
  club: dunmore  
  
Player(sam):  
  name: sam  
  club: tramore  
  
Player(john):  
  name: john  
  club: tramore  
  
Player(mike):  
  name: mike  
  club: fenor  
  
Player(linda):  
  name: john  
  club: fenor  
  
Division(senior):  
  name: senior  
  members:  
    - tramore  
    - dunmore  
  
Division(junior):  
  name: junior  
  members:  
    - fenor  
  
Sponsor(newsagent):  
  name: newsagent  
  
Sponsor(pub):  
  name: pub
```

data.yml

data.yml

```
Club(dunmore):
  name: dunmore

Club(tramore):
  name: tramore

Club(fenor):
  name: fenor

Player(jim):
  name: jim
  club: dunmore

Player(mary):
  name: mary
  club: dunmore

Player(sam):
  name: sam
  club: tramore

Player(john):
  name: john
  club: tramore

Player(mike):
  name: mike
  club: fenor

Player(linda):
  name: john
  club: fenor

Division(senior):
  name: senior
  members:
    - tramore
    - dunmore

Division(junior):
  name: junior
  members:
    - fenor

Sponsor(newsagent):
  name: newsagent

Sponsor(pub):
  name: pub
```

# ComprehensiveTest

```
public class ComprehensiveTest extends UnitTest
{
  @Before
  public void setup()
  {
    Fixtures.loadModels("data.yml");
  }

  @After
  public void teardown()
  {
    Fixtures.deleteAllModels();
  }
}
```



Club(dunmore):  
name: dunmore

Club(tramore):  
name: tramore

Club(fenor):  
name: fenor

Player(jim):  
name: jim  
club: dunmore

Player(mary):  
name: mary  
club: dunmore

Player(sam):  
name: sam  
club: tramore

Player(john):  
name: john  
club: tramore

Player(mike):  
name: mike  
club: fenor

Player(linda):  
name: john  
club: fenor

Division(senior):  
name: senior  
members:  
- tramore  
- dunmore

Division(junior):  
name: junior  
members:  
- fenor

Sponsor(newsagent):  
name: newsagent

Sponsor(pub):  
name: pub

SELECT \* FROM CLUB;

ID	NAME
1	dunmore
2	tramore
3	fenor

(3 rows, 3 ms)

SELECT \* FROM SPONSOR;

ID	NAME
1	newsagent
2	pub

(2 rows, 2 ms)

SELECT \* FROM PLAYER;

ID	NAME	CLUB_ID
1	jim	1
2	mary	1
3	sam	2
4	john	2
5	mike	3
6	linda	3

(6 rows, 2 ms)

SELECT \* FROM DIVISION;

ID	NAME
1	senior
2	junior

(2 rows, 1 ms)

SELECT \* FROM DIVISION\_CLUB;

DIVISION_ID	MEMBERS_ID
1	2
1	1
2	3

(3 rows, 3 ms)

# Forward References

---

- In yaml files, representing many-to-many relationships cannot be easily represented.
- e.g:
  - dunmore->newsagent
  - newsagent->dunmore

```
Club(dunmore):  
  name: dunmore  
  
Player(jim):  
  name: jim  
  club: dunmore  
  
Player(mary):  
  name: mary  
  club: dunmore  
  
Division(junior):  
  name: junior  
  members:  
    - dunmore  
  
Sponsor(newsagent):  
  name: newsagent
```

# Forward References - Workaround

---

- Load the data.yaml model without ManyToMany
- Establish the relationship after the fixture is loaded

```
public class ComprehensiveTest extends UnitTest
{
    public static void loadSponsorships()
    {
        Club tramore = Club.find("byName", "tramore").first();
        Club dunmore = Club.find("byName", "dunmore").first();
        Sponsor newsagent = Sponsor.find("byName", "newsagent").first();

        tramore.addSponsor(newsagent);
        dunmore.addSponsor(newsagent);

        newsagent.addSupport(tramore);
        newsagent.addSupport(dunmore);

        tramore.save();
        dunmore.save();
        newsagent.save();
    }

    @Before
    public void setup()
    {
        Fixtures.loadModels("data.yml");
        loadSponsorships();
    }
}
```

# Test Strategy

---

- For each relationship:
  - ‘short’ test - quick sanity check
  - ‘long’ test - full exercise of relationship, in both directions if present
  - ‘edit’ test - perform change on objects

Club(dunmore):  
name: dunmore

Club(tramore):  
name: tramore

Club(fenor):  
name: fenor

Player(jim):  
name: jim  
club: dunmore

Player(mary):  
name: mary  
club: dunmore

Player(sam):  
name: sam  
club: tramore

Player(john):  
name: john  
club: tramore

Player(mike):  
name: mike  
club: fenor

Player(linda):  
name: john  
club: fenor

Division(senior):  
name: senior  
members:  
- tramore  
- dunmore

Division(junior):  
name: junior  
members:  
- fenor

Sponsor(newsagent):  
name: newsagent

Sponsor(pub):  
name: pub

# Test Data

```
public class ComprehensiveTest extends UnitTest
{
    public static void loadSponsorships()
    {
        Club    tramore    = Club.find("byName", "tramore").first();
        Club    dunmore    = Club.find("byName", "dunmore").first();
        Sponsor newsagent = Sponsor.find("byName", "newsagent").first();

        tramore.addSponsor(newsagent);
        dunmore.addSponsor(newsagent);

        newsagent.addSupport(tramore);
        newsagent.addSupport(dunmore);

        tramore.save();
        dunmore.save();
        newsagent.save();
    }

    @Before
    public void setup()
    {
        Fixtures.loadModels("data.yml");
        loadSponsorships();
    }
}
```

# 'Sanity' Tests

---

```
@Test
public void testPlayerClub()
{
    Club    dunmore = Club.find("byName", "dunmore").first();
    Player jim      = Player.find("byName", "jim").first();
    Player mary    = Player.find("byName", "mary").first();
    assertNotNull(mary);

    assertTrue (dunmore.players.contains(jim));
    assertTrue (dunmore.players.contains(mary));
}

@Test
public void testDivisionClub()
{
    Division senior = Division.find("byName", "senior").first();
    Club    dunmore = Club.find("byName", "dunmore").first();
    Club    tramore = Club.find("byName", "tramore").first();

    assertTrue (senior.members.contains(dunmore));
    assertTrue (senior.members.contains(tramore));
}

@Test
public void testClubSponsorShort()
{
    Sponsor newsagent = Sponsor.find("byName", "newsagent").first();
    Club    dunmore   = Club.find("byName", "dunmore").first();
    Club    tramore   = Club.find("byName", "tramore").first();

    assertTrue(newsagent.support.contains(dunmore));
    assertTrue(newsagent.support.contains(tramore));

    assertTrue(dunmore.sponsors.contains(newsagent));
    assertTrue(tramore.sponsors.contains(newsagent));
}
```

# 'Long' Tests

---

```
@Test
public void testPlayerClubLong()
{
    Player jim;
    Club    dunmore;

    jim = Player.find("byName", "jim").first();
    assertNotNull(jim);
    assertEquals(jim.name, "jim");

    dunmore = jim.club;
    assertEquals("dunmore", dunmore.name);

    dunmore = Club.find("byName", "dunmore").first();
    assertNotNull(dunmore);
    assertEquals("dunmore", dunmore.name);
    assertEquals(2, dunmore.players.size());

    Player p1 = dunmore.players.get(0);
    assertTrue (p1.name.equals("jim") || p1.name.equals("mary"));
    Player p2 = dunmore.players.get(1);
    assertTrue (p2.name.equals("jim") || p2.name.equals("mary"));
}

@Test
public void testDivisionClubLong()
{
    Division senior = Division.find("byName", "senior").first();
    assertNotNull(senior);
    assertEquals(2, senior.members.size());

    Club c1 = senior.members.get(0);
    Club c2 = senior.members.get(1);

    assertTrue (c1.name.equals("tramore") || c1.name.equals("dunmore"));
    assertTrue (c2.name.equals("tramore") || c2.name.equals("dunmore"));
}
```

# 'Edit' Tests

---

```
@Test
public void testEditPlayerClub()
{
    Club    dunmore = Club.find("byName", "dunmore").first();
    Player jim      = Player.find("byName", "jim").first();
    Player mary     = Player.find("byName", "mary").first();

    dunmore.players.remove(mary);
    mary.delete();
    dunmore.save();

    assertEquals (dunmore.players.size(), 1);
    assertTrue (dunmore.players.contains(jim));

    assertEquals(0, Player.find("byName", "mary").fetch().size());

    Player sara     = new Player("sara");
    dunmore.addPlayer(sara);
    dunmore.save();
    assertEquals (dunmore.players.size(), 2);
}

@Test
public void testEditClubSponsor()
{
    Sponsor newsagent = Sponsor.find("byName", "newsagent").first();
    Club    dunmore   = Club.find("byName", "dunmore").first();

    assertEquals(2, newsagent.support.size());

    newsagent.support.remove(dunmore);
    dunmore.sponsors.remove(newsagent);

    newsagent.save();
    dunmore.save();

    assertEquals(1, newsagent.support.size());
}
```



# Yaml file - Forward References

---

- Test data in Yaml file cannot refer to objects that have not been seen in the file yet (reading from top to bottom)
- Bidirectional references can be included by including the objects twice
  - Once at top (partial)
  - Once at end (complete)

```
Sponsor(pub):  
  name: pub  
  
Sponsor(newsagent):  
  name: newsagent
```

```
Club(tramore):  
  name: tramore  
  sponsors:  
    - pub  
    - newsagent  
  
Club(fenor):  
  name: fenor  
  sponsors:  
    - newsagent
```

```
Sponsor(newsagent):  
  name: newsagent  
  support:  
    - tramore  
    - fenor  
  
Sponsor(pub):  
  name: pub  
  support:  
    - tramore
```

# Exploring the Database

```
Sponsor(pub):  
  name: pub  
  
Sponsor(newsagent):  
  name: newsagent  
  
Club(dunmore):  
  name: dunmore  
  
Club(tramore):  
  name: tramore  
  sponsors:  
    - pub  
    - newsagent  
  
Club(fenor):  
  name: fenor  
  sponsors:  
    - newsagent  
  
Division(senior):  
  name: senior  
  members:  
    - tramore  
    - dunmore  
  
Division(junior):  
  name: junior  
  members:  
    - fenor  
  
Sponsor(newsagent):  
  name: newsagent  
  support:  
    - tramore  
    - fenor  
  
Sponsor(pub):  
  name: pub  
  support:  
    - tramore
```

```
Player(jim):  
  name: jim  
  club: dunmore  
  
Player(mary):  
  name: mary  
  club: dunmore  
  
Player(sam):  
  name: sam  
  club: tramore  
  
Player(john):  
  name: john  
  club: tramore  
  
Player(mike):  
  name: mike  
  club: fenor  
  
Player(linda):  
  name: linda  
  club: fenor
```

```
jdbc:h2:mem:play  
- club  
  + id  
  + name  
  + Indexes  
- club_sponsor  
  + support_id  
  + sponsors_id  
  + Indexes  
- division  
  + id  
  + name  
  + Indexes  
- division_club  
  + division_id  
  + members_id  
  + Indexes  
- player  
  + id  
  + name  
  + club_id  
  + Indexes  
- sponsor  
  + id  
  + name  
  + Indexes
```

# Player & Club

```
Club(dunmore):  
  name: dunmore  
  
Club(tramore):  
  name: tramore  
  
Club(fenor):  
  name: fenor
```

```
Player(jim):  
  name: jim  
  club: dunmore  
  
Player(mary):  
  name: mary  
  club: dunmore  
  
Player(sam):  
  name: sam  
  club: tramore  
  
Player(john):  
  name: john  
  club: tramore  
  
Player(mike):  
  name: mike  
  club: fenor  
  
Player(linda):  
  name: linda  
  club: fenor
```

```
SELECT * FROM CLUB;
```

ID	NAME
1	dunmore
2	tramore
3	fenor

(3 rows, 2 ms)

```
SELECT * FROM PLAYER;
```

ID	NAME	CLUB_ID
1	jim	1
2	mary	1
3	sam	2
4	john	2
5	mike	3
6	linda	3

(6 rows, 5 ms)

# Club & Division

Club(dunmore):  
name: dunmore

Club(tramore):  
name: tramore

Club(fenor):  
name: fenor

Division(senior):  
name: senior  
members:  
- tramore  
- dunmore

Division(junior):  
name: junior  
members:  
- fenor

```
SELECT * FROM CLUB;
```

ID	NAME
1	dunmore
2	tramore
3	fenor

(3 rows, 2 ms)

```
SELECT * FROM DIVISION;
```

ID	NAME
1	senior
2	junior

(2 rows, 2 ms)

```
SELECT * FROM DIVISION_CLUB;
```

DIVISION_ID	MEMBERS_ID
1	2
1	1
2	3

(3 rows, 3 ms)

# Sponsor & Club

Sponsor(pub):  
name: pub

Sponsor(newsagent):  
name: newsagent

Club(dunmore):  
name: dunmore

Club(tramore):  
name: tramore  
sponsors:  
- pub  
- newsagent

Club(fenor):  
name: fenor  
sponsors:  
- newsagent

Sponsor(newsagent):  
name: newsagent  
support:  
- tramore  
- fenor

Sponsor(pub):  
name: pub  
support:  
- tramore

```
SELECT * FROM SPONSOR;
```

ID	NAME
1	pub
2	newsagent

(2 rows, 1 ms)

Edit

```
SELECT * FROM CLUB;
```

ID	NAME
1	dunmore
2	tramore
3	fenor

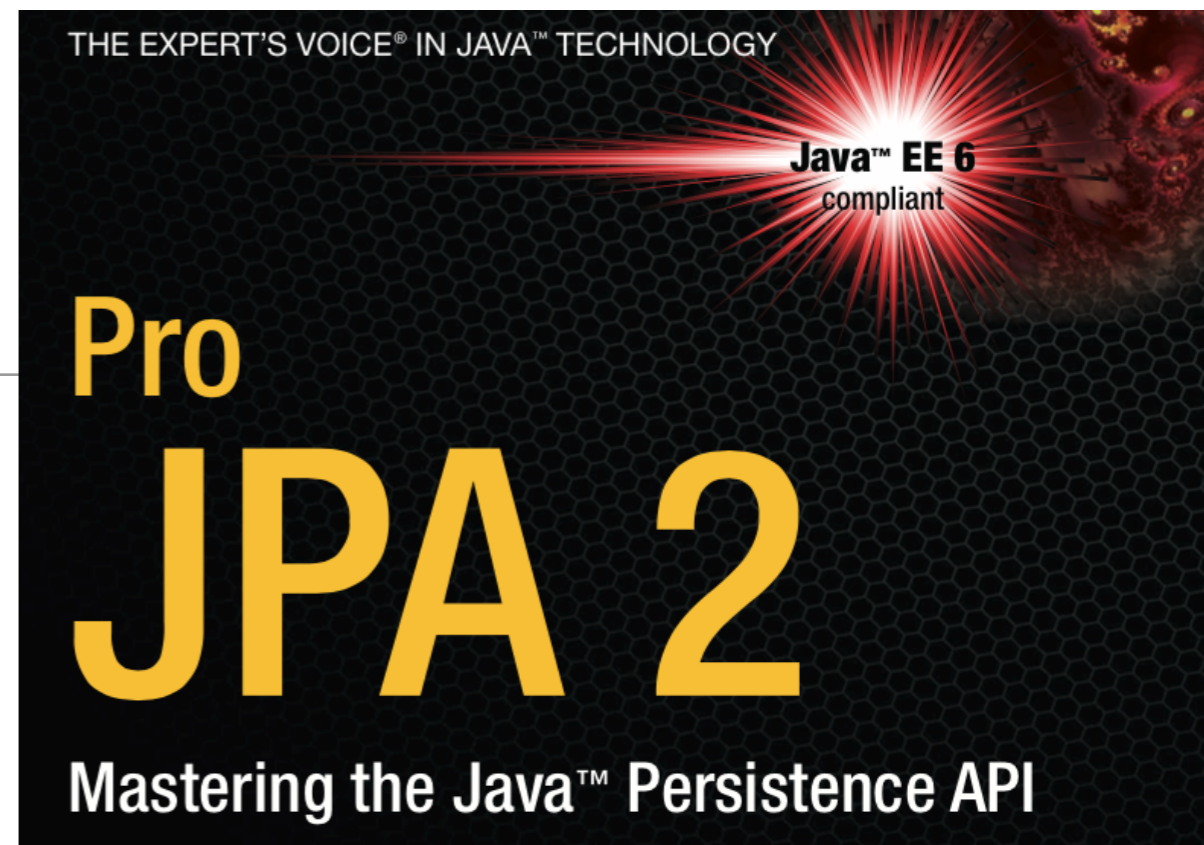
(3 rows, 2 ms)

```
SELECT * FROM CLUB_SPONSOR;
```

SUPPORT_ID	SPONSORS_ID
2	1
2	2
3	2

(3 rows, 3 ms)

# Definitive Reference



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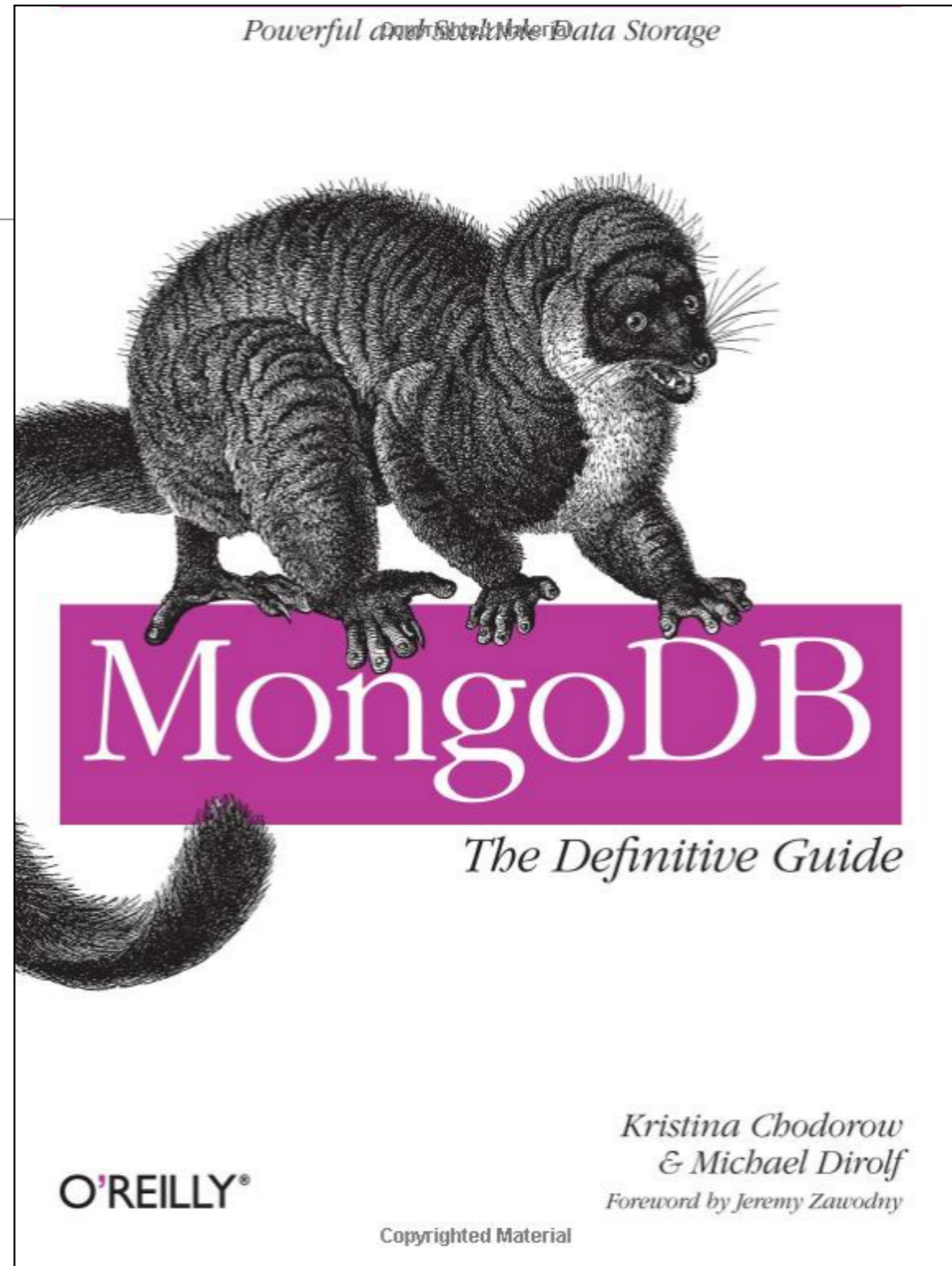
David Merrick Schincariol  
JPA Specification Lead

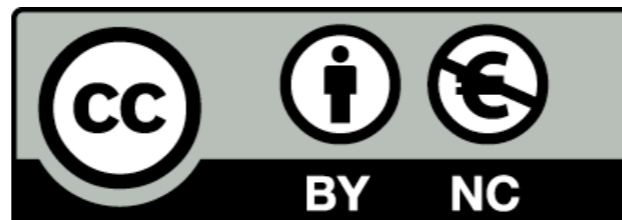
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# Alternatives?

---

- NoSQL -
  - Document Oriented
  - Simpler for many use cases
  - Less powerful in some ways “aggregates” instead of “relations”
  - Faster and easier to scale





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