Database Design

8-1
Modeling Historical Data

Objectives

- This lesson covers the following objectives:

- Identify the need to track data that changes over time

- Construct ERD models that incorporate elements of "data over time"

- Identify the UID of an entity that stores historical data; explain and justify the choice of UID

Purpose

- How tall were you at age 5? How tall were you at age 10? How tall are you right now?

- If your parents wrote this down when you were young, they were keeping track of historical data.

- Most businesses need to track some historical data.

- This helps them find trends and patterns that are the basis for business innovations or process improvements.

- For example, rental history of a movie is useful to a video store. It tells managers which movies are popular and which should be moved to the back shelf.

Model Data Over Time

- When is it necessary to model data over time?

- Ask your client:
  - Is an audit trail required?
  - Can attribute values change over time?
  - Can relationships change over time?
  - Do you need to produce reports on older data?
  - Do you need to keep previous versions of the data? If so, for how long?

Data Over Time Example

- An organization needs to keep data about employees' salaries.

- All employees are paid weekly.

- Initially, the following EMPLOYEE entity was modeled.

- Additional requirements now specify that the organization needs to keep a historical record of how and when employees' salaries have changed during their employment.

EMPLOYEE
id
* first name
* last name
* weekly salary amount
* salary start date
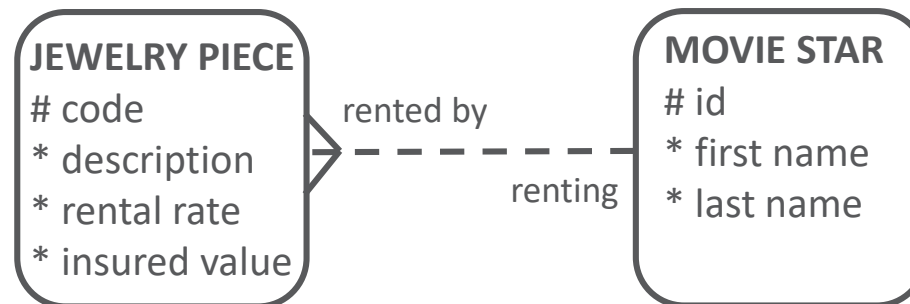
Model Salary Changes

- To model salary changes over time, add a SALARY HISTORY entity.
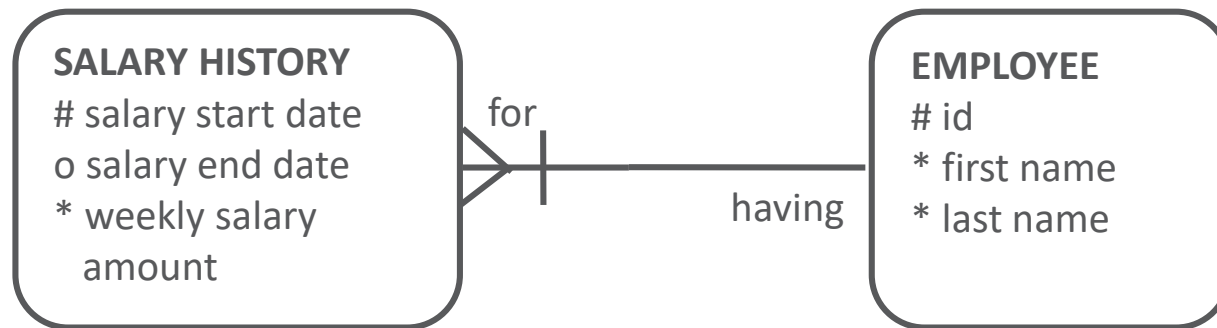
- The UID of the SALARY HISTORY entity is the related EMPLOYEE id and the salary start date.

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Modeling Historical Data
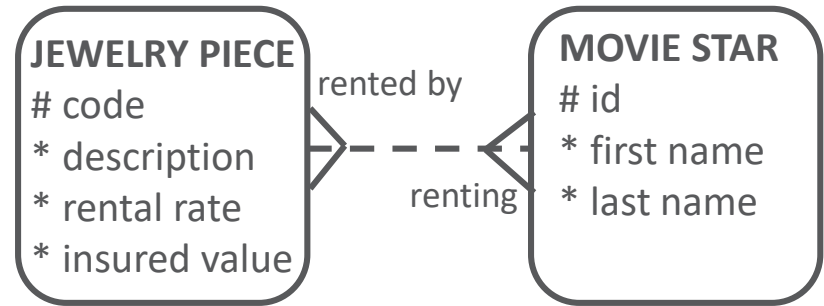
Model Rental Over Time

- A jewelry store rents pieces (necklaces, bracelets and so on) to movie stars for special occasions, such as award ceremonies or movie premieres.

- They would like to track the rental history of a jewelry piece.

- The following ER model will only track the current renter of a piece of jewelry.

- How would you revise the relationship to track history?

JEWELRY PIECE
\# code
* description
* rental rate
* insured value

rented by

renting

MOVIE STAR
\# id
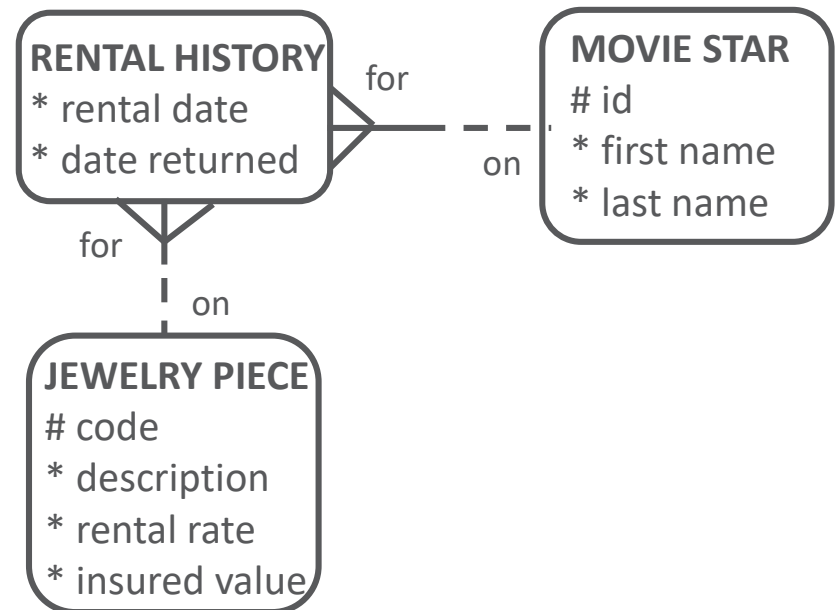* first name
* last name

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Resolve M:M

- The relationship between JEWELRY PIECE and MOVIE STAR should be revised to a M:M, which is then resolved with an intersection entity RENTAL HISTORY.

- Next we need to determine the UID of RENTAL HISTORY.

JEWELRY PIECE
code
* description
* rental rate
* insured value

rented by

renting

MOVIE STAR
id
* first name
* last name

The M:M relationship is resolved with an intersection entity.

RENTAL HISTORY
* rental date
* date returned

for

on

for

on

MOVIE STAR
id
* first name
* last name

JEWELRY PIECE
code
* description
* rental rate
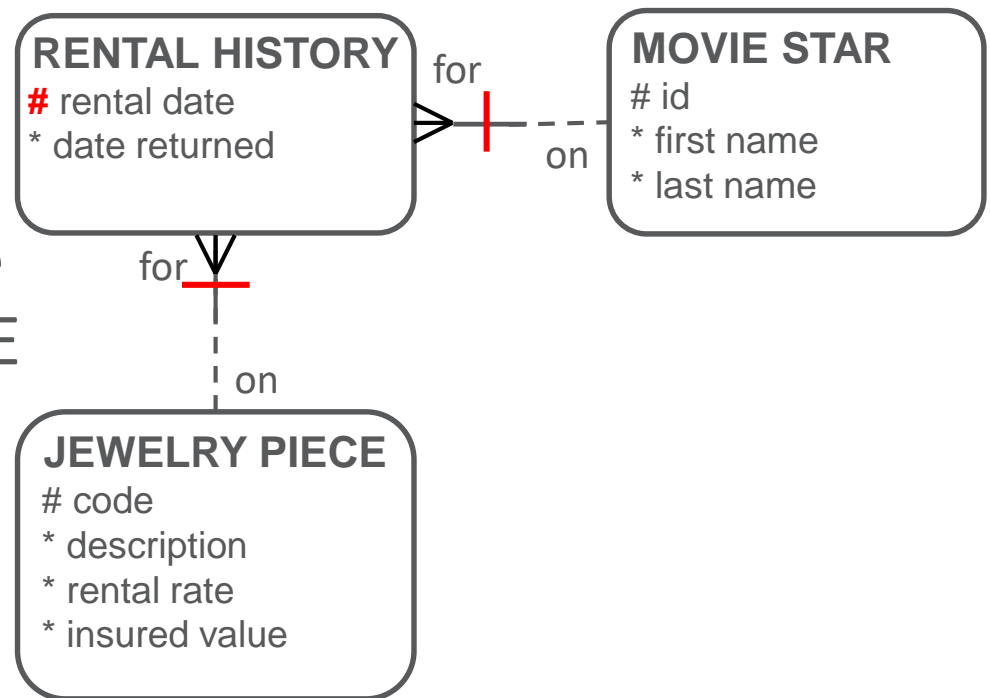* insured value

Determine UID

- Option 1: Barred relationship.

- Drawing a Barred relationship is not a suitable UID here, as this would not allow a MOVIE STAR to rent the same JEWELRY PIECE on different dates

RENTAL HISTORY
* rental date
* date returned

for

MOVIE STAR
id
* first name
* last name

on

for

on

JEWELRY PIECE
code
* description
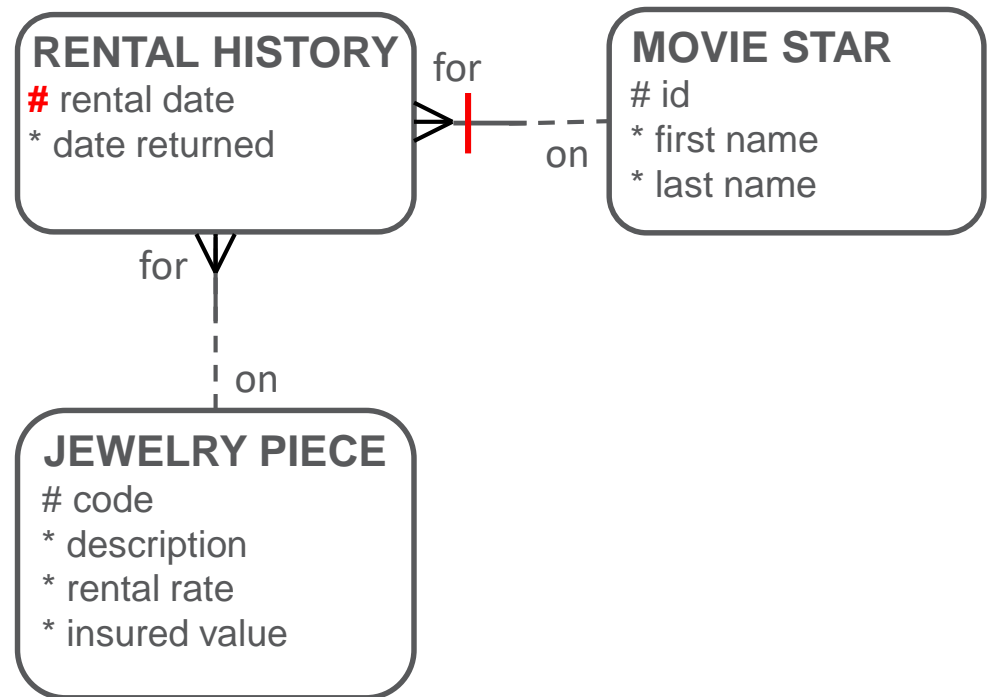* rental rate
* insured value
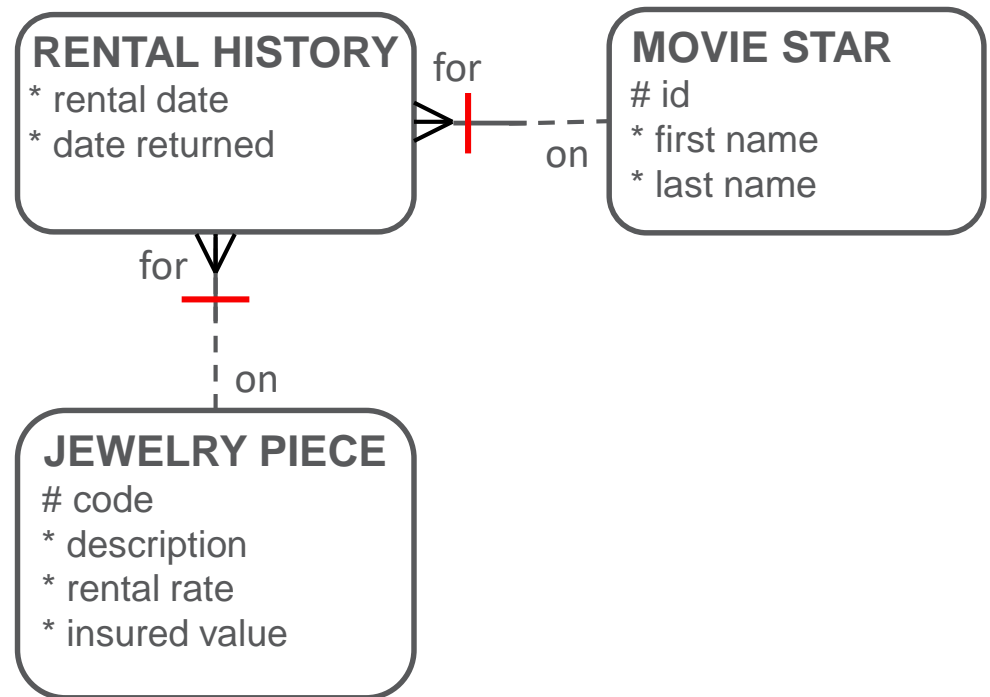
Determine UID

- Option 2: Barred relationship and Rental Date.

- Adding rental date to the UID would allow a MOVIE STAR to rent the same JEWELRY PIECE on different dates, but would also permit different MOVIE STARS to rent the same JEWELRY PIECE on the same date!

RENTAL HISTORY
rental date
* date returned

for

MOVIE STAR
id
* first name
* last name

on

for

on

JEWELRY PIECE
code
* description
* rental rate
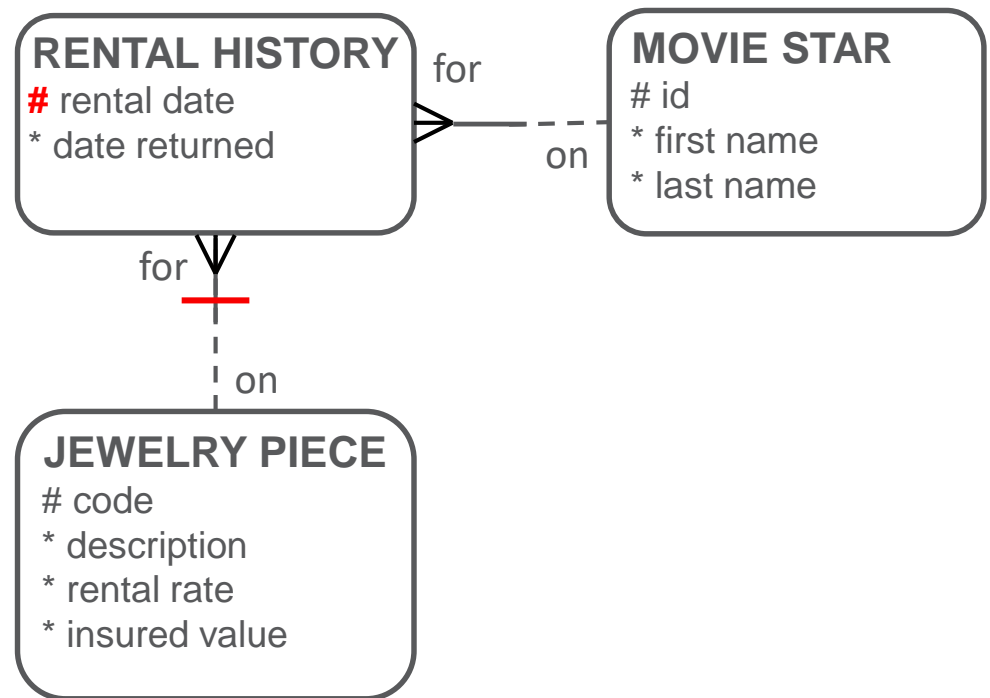* insured value

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Determine UID

- Option 3: Barred relationship between MOVIE STAR and RENTAL HISTORY with Rental Date.

- This model would not permit the same MOVIE STAR to rent more than one JEWELRY PIECE on a given day.

RENTAL HISTORY
rental date
* date returned

for

on

MOVIE STAR
id
* first name
* last name

for

on

JEWELRY PIECE
code
* description
* rental rate
* insured value

Determine UID

- Option 4: Barred relationship between JEWELRY PIECE and RENTAL HISTORY with Rental Date.

- This model says that a JEWELRY PIECE can be rented only once on the same date.

RENTAL HISTORY
rental date
* date returned

for

on

MOVIE STAR
id
* first name
* last name

for

on

JEWELRY PIECE
code
* description
* rental rate
* insured value

Terminology

Key terms used in this lesson included:

- Audit trail
- Historical data

Summary

In this lesson, you should have learned how to:

- Identify the need to track data that changes over time

- Construct ERD models that incorporate elements of "data over time"

- Identify the UID of an entity that stores historical data; explain and justify the choice of UID