

# Database Design

Modeling Change: Time

# Objectives

This lesson covers the following objectives:

- Distinguish between using date as an attribute and DAY as an entity in a data model, depending on business requirements
- Solve the problem of keeping characteristics of a date by constructing a model that uses DAY as an entity
- Identify at least three time-related constraints that can result from a time-sensitive model
- Define and give an example of conditional non-transferability in a time-constrained model

# Purpose

Time plays a role in many business models.

For example: A book may be checked out from the library several times, by different people, or by the same person. The model may need to track a history of borrowing for a book. Think about a florist-supply company or a city police department. How could time play a role in their information needs?

## Purpose (cont.)

Historical data is often used by businesses to find trends that can point the way to more efficient ways of doing business. Modeling time in a business allows such data to be captured.

Reports provide information that can be derived from the data. A well-designed report can provide valuable information that the business can use to improve its operations.

# Entity DAY vs. Attribute Date

Consider the entity PURCHASE.  
You would include an attribute “date” if you wanted to know when the item was purchased. However, if we want to identify trends -- such as purchasing coats vs. bathing suits vs. sneakers -- we may want to know the temperature during that time.

What is wrong with the revised entity shown here?

**PURCHASE**

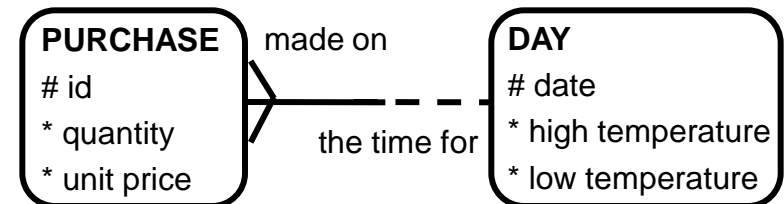
- # id
- \* date
- \* quantity
- \* unit price

**PURCHASE**

- # id
- \* date
- \* quantity
- \* unit price
- \* high temperature
- \* low temperature

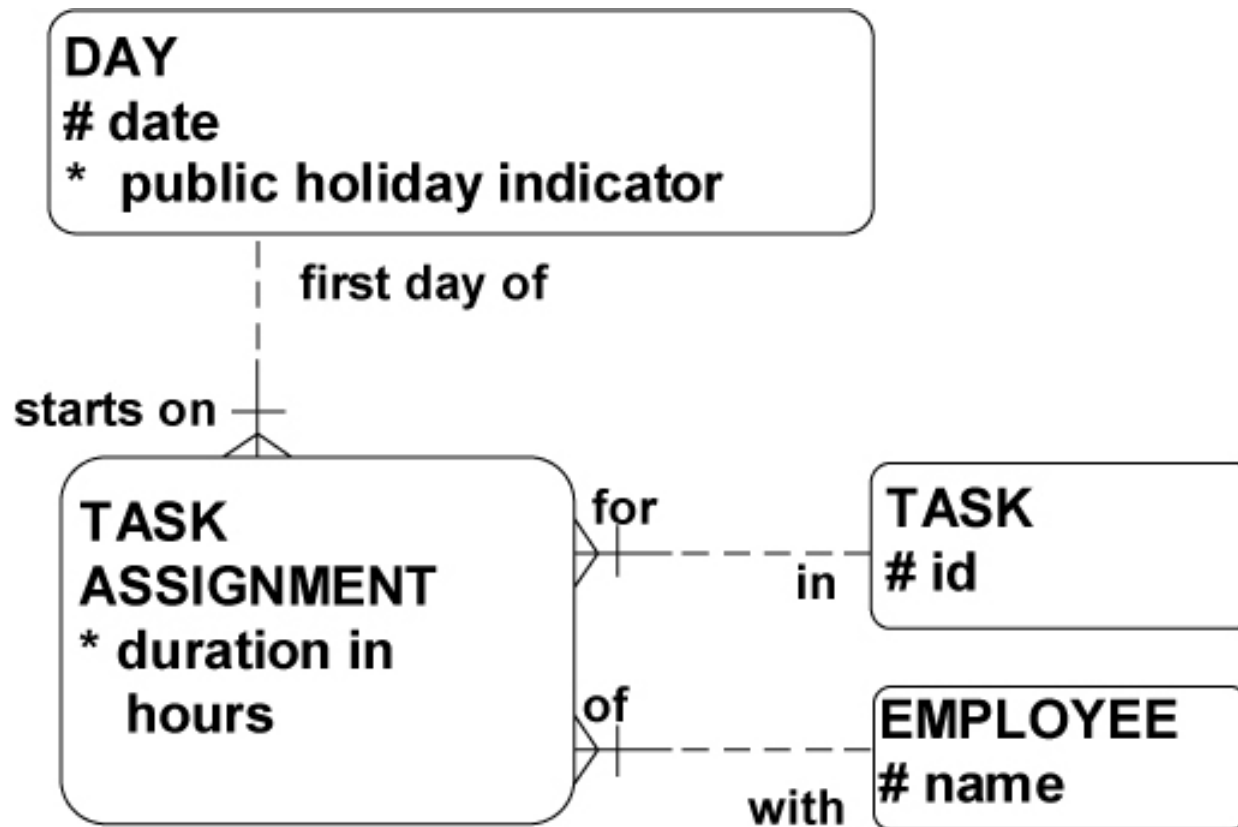
## Entity DAY vs. Attribute Date (cont.)

Remember Third Normal Form: a non-UID attribute cannot have attributes of its own. Because high and low temperature are attributes of the date, we need a separate entity DAY.



Can you think of a useful report that the business could produce from this data?

# Entity DAY vs. Attribute Date (cont.)



# Time-related Constraints

Be aware of constraints that can result from the need to track dates and times. Here is an example:

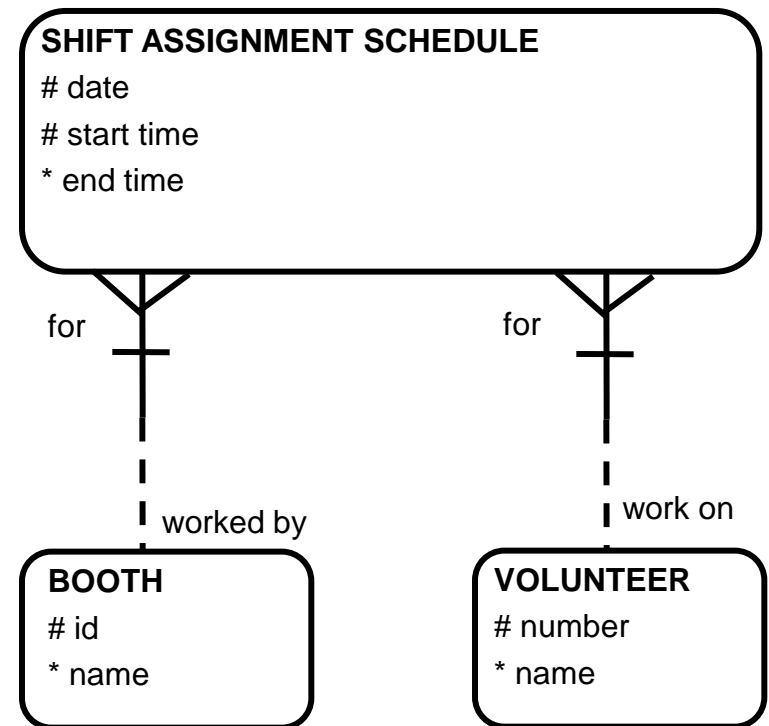
Consider a school fair that features several booths. The manager signs up volunteers to work different shifts at different booths. A booth is staffed by only one volunteer at a time. Some volunteers can work for several hours; others can work fewer hours depending on their free time. The schedule has to be determined in advance, so that the manager knows which times are not covered by any volunteers.



## Time-related Constraints (cont.)

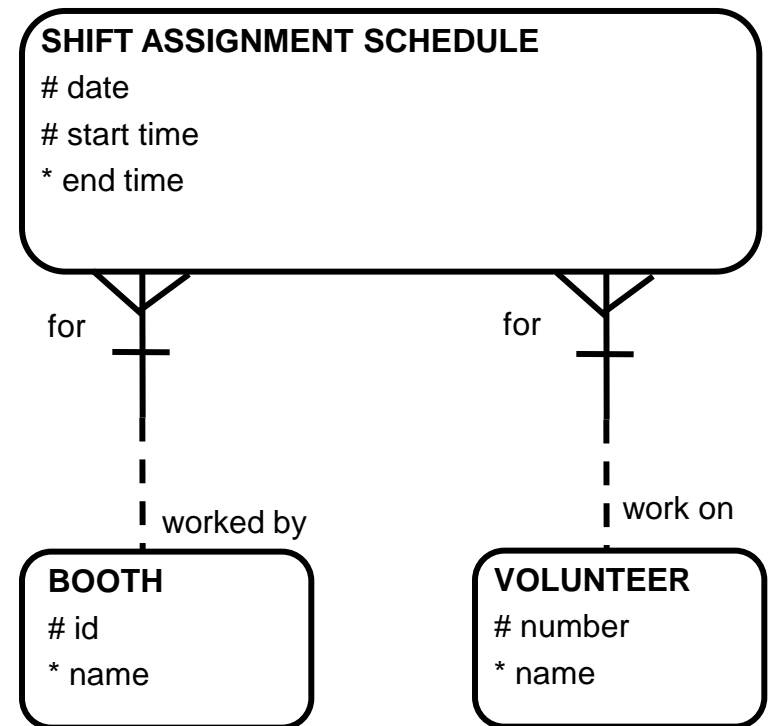
Here is a selection of time-related constraints that need to be considered for this model:

The obvious one: shift “end time” must be later than shift “start time.”



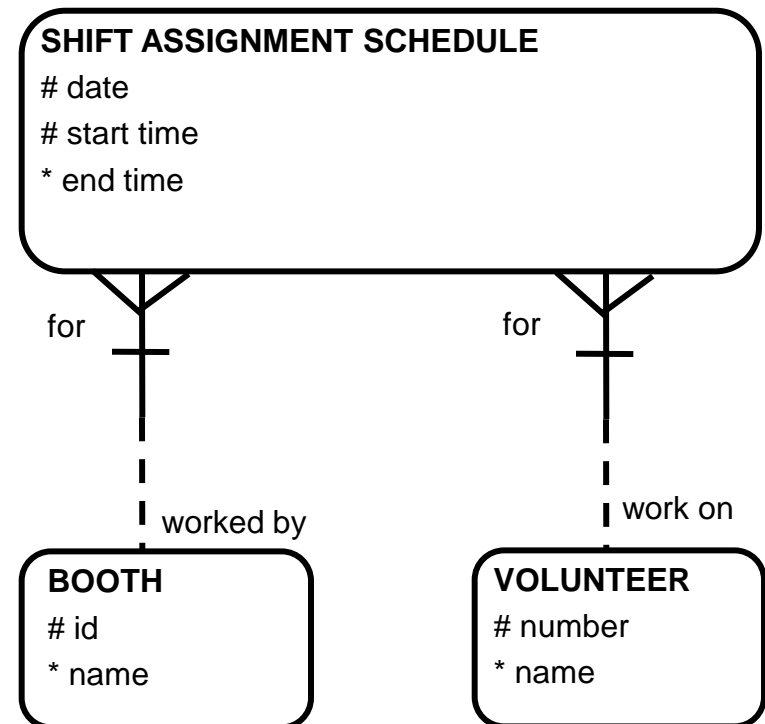
## Time-related Constraints (cont.)

Shift times may not overlap.  
The “start time” for a shift for a volunteer may not be between any “start time” and “end time” of another volunteer on the same booth. The same is true for the “end time.”



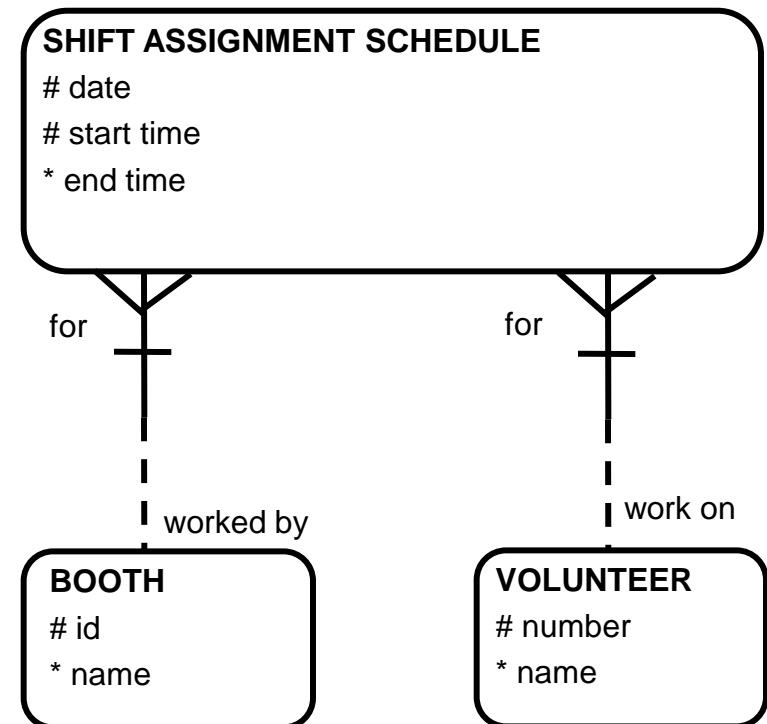
# Conditional Non-transferability

The “start time” for a shift may be updated to a later time, unless the shift has already begun. The “start time” for a shift may be updated to an earlier time, unless the shift has already begun.



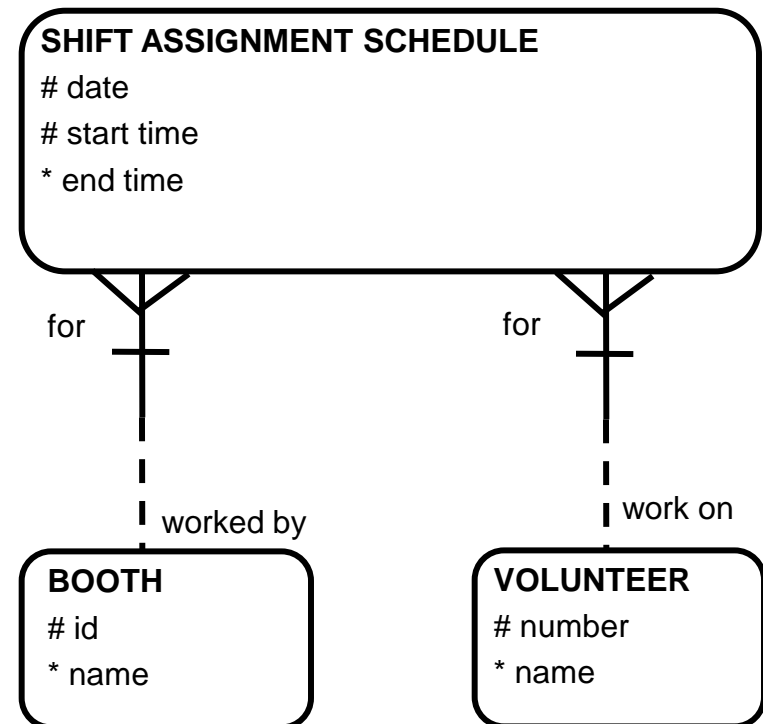
## Conditional Non-transferability (cont.)

You probably would not allow a shift to be reassigned to another volunteer or another booth, unless the shift had not yet started. This is an example of conditional non-transferability.



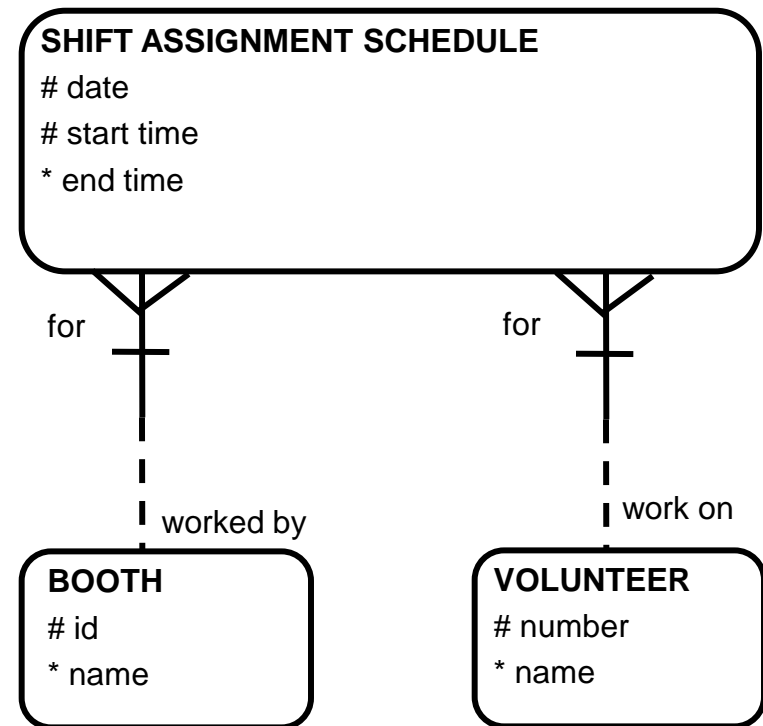
## Conditional Non-transferability (cont.)

Non-transferability: a SHIFT ASSIGNMENT cannot be changed to another BOOTH (or to another VOLUNTEER). Nontransferable relationships are represented by a diamond in the ERD.



## Conditional Non-transferability (cont.)

Conditional non-transferability: a SHIFT ASSIGNMENT can sometimes be changed – in this case, if the shift has not yet started. These relationships cannot be represented in the diagram, but must still be documented.



# Terminology

Key terms used in this lesson included:

- Conditional non-transferability
- Non-transferability
- Time-related constraint

# Summary

In this lesson, you should have learned how to:

- Distinguish between using date as an attribute and DAY as an entity in a data model, depending on business requirements
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- Identify at least three time-related constraints that can result from a time-sensitive model
- Define and give an example of conditional non-transferability in a time-constrained model