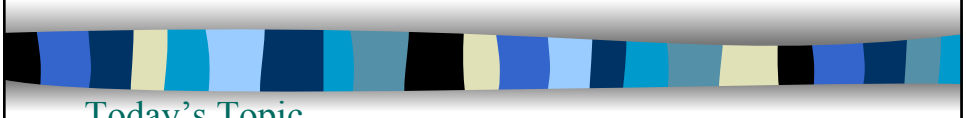
Principles of Database Systems With Internet and Java Applications



Today's Topic

Chapter 2: Representing Information with Data Models

Instructor's name and information goes here

Please see the notes pages for more information.

Chapter 2, Representing Information with Data Models

- Entity Relationship (ER) Model
  - high-level, conceptual data model
- Specify conceptual schema
  - conceptual database design
- Identify the data requirements of users and detailed descriptions of data types, relationships and constraints.
- Concentrate on specifying the properties of the data, not storage.

An Example of ER Modeling

- Company database
  - Department
    - name, number, manager (employee), start date of manager
  - Projects controlled by department
    - name, number, single location
  - Employees
    - name, ssn, address, salary, sex, birthdate
    - assigned to department, several projects
  - Dependents of employees

Principals of ER Modeling

- Entities and classes
  - **Entity**, a thing in the real world
  - **Entity Class**, the structure of a collection of similar entities
- Attributes
  - **Attribute**, a property of an entity
  - Each entity has a value for each of its attributes
- Types of attributes
  - simple vs. composite, single-valued vs. multi-valued, stored vs. derived
  - domains of attributes

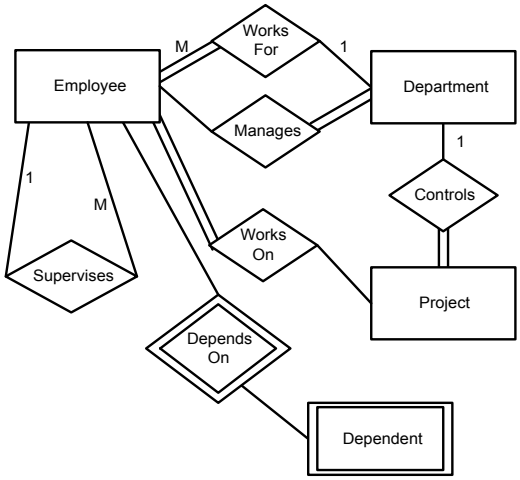
Relationships Between Entities

- **Relationship type** defines a set of associations among given types.
- **Relationsip Instances** are particular relationships among objects.
- Examples of relationship types in company database
  - Manages: 1:1 between employee and department
  - Works-for: 1:N between department and employee
  - Controls: 1:N between department and project

Relationships, Roles, and Structural Constraints

- **Roles** are attributes that signify the function of a particular entity (type) in a relationship
  - Employee manages department
  - Department is managed by employee
  - Employee works-for department
  - Department has employees who work for it
- **Constraints** can be
  - cardinality
    - Each department can have no more than one manager
  - participation
    - Each department must have a manager

ER schema diagram for Company



Entity Classes for BigHit Video

Entity Class	*Description*
Customer	A customer of the business
Videotape	An item in the rental inventory
Employee	A person who works in one or more stores
PayStatement	A record of the wages paid to an employee
TimeCard	A record of a block of time worked by an employee at a store
Store	One of the retail outlets of BigHit Video
Rental	The rental of a videotape by a customer for a specific period and cost
PurchaseOrder	A request to purchase an item
Vendor	A company that sells items to BigHit Video

Sample Attribute Specifications

Attribute	*Type*	*Domain of values*	*Description*
title	string	unbounded	The title of an item
lastName	string	30 characters	The last name of a person
firstName	string	30 characters	The first name of a person
ssn	string	10 digits	A social security number
accountId	number	4 byte integer	The identifier of a customer account
otherUsers	set	set of strings of 30 characters	Names of other people authorized to use this account
number Rentals	number	4 byte integer	Number of rentals for a customer
address	composite	2 strings of 30 characters, one string of 2 characters, and one string of 9 digits.	An address that consists of a street, city, state and zipcode

Entity Classes, Attributes and Constraints

Class	Attribute	Constraints or further description
Customer	accountId	key
	lastName	not null
	firstName	
	address	
	otherUsers	
	numberRentals	derived
Videotape	videotapeId	key
	title	not null
	genre	
PayStatement	datePaid	
	hoursWorked	
	amountPaid	

Entities, instances of classes

customerId	*lastName*	*firstName*	*address*				*otherUsers*	*numberRentals*
			street	*city*	*state*	*zipcode*		
101	Block	Jane	1010 Main St.	Apopka	FL	30458	Joe Block, Greg Jones	3
102	Hamilton	Cherry	3230 Dade St.	Dade City	FL	30555		1
103	Harrison	Kate	103 Dodd Hall	Apopka	FL	30457		0
104	Breaux	Carroll	76 Main St.	Apopka	FL	30458	Judy Breaux, Cyrus Lambeaux, Jean Deaux	2

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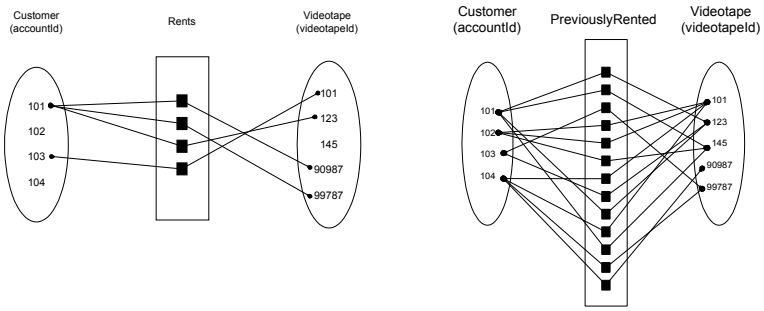
Relationship Types and Instances

- Marriage relationship type
  - Person related to Person
  - One person has the role of “wife” one has the role of “husband”
  - Relationship type may have one or more attributes
    - e.g. weddingDate
- Marriage relationship (instance)
  - Jane Block is married to Joe Block (relationship)
  - Jane Block is the wife of Joe Block (role)
  - Joe Block is the husband of Jane Block (role)
- Parent-child relationship type
  - A person may have zero or more children

Relationships are always one-to-one

- A relationship is an instance
- These pictures are sets of instances



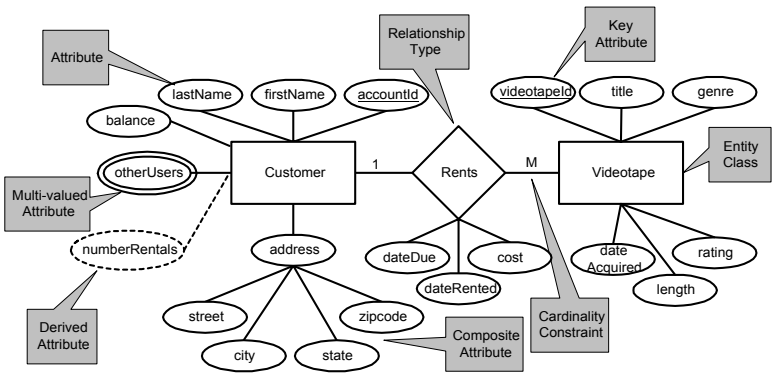
Find the Entities, Attributes and Relationships

BigHit Video

Rental Receipt

Account Id: 101 Jane Block 1010 Main St. Apopka, FL 30458	Videotape Id: 90987 Elizabeth	date: January 9, 1999 date due: January 11, 1999	cost: $2.99

ER schema diagram for BigHit Video



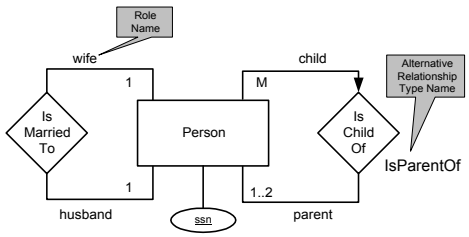
Keys of entities

- A *key* is a set of attributes that uniquely identify one entity within the class
  - accountId is a key for Customer
  - may be multiple attributes (examples follow)
- A *key constraint* specifies a restriction on a set of entities
  - no 2 entities in the set may have the same values for the key
  - an attempt to add a new entity with the same key as another entity is not allowed

Weak Entity Classes

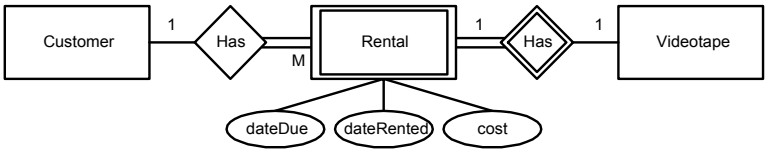
- An entity class that has no key is a *weak* entity class
  - A weak entity is identified by its relationships
  - The relationships are called *identifying relationships*
- A weak entity may exist only if it is related to other entities by its identifying relationships
- Examples
  - Rental
  - TimeCard

More facets of ER diagrams

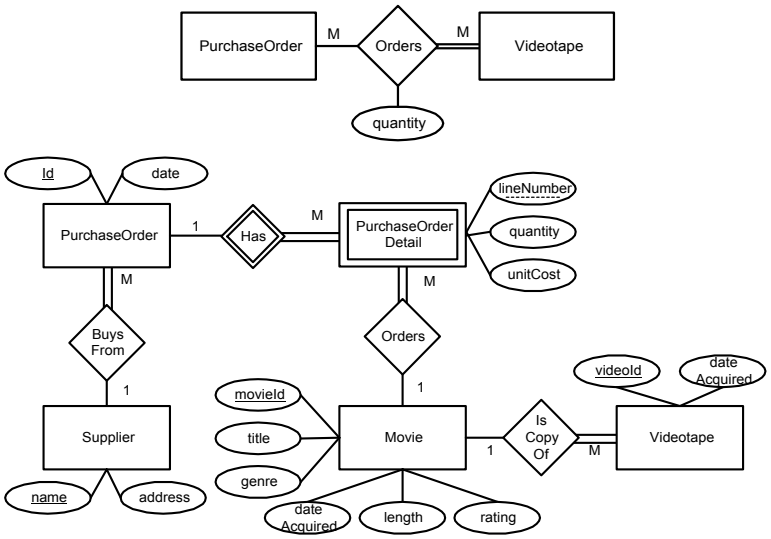


Treating Rents as an entity class

- Should Rental be an entity class?
  - instead of relationship type Rents
- A rental entity represents the possession of a videotape by a customer



Subtleties in Meaning of Purchase Order



Summary of Chapter 2

- Information system is a repository of facts about an organization
  - Discovery of the structure of information
- Data model specifies the structure and meaning of data
  - Limitations on systems created by faulty models
  - Options and alternatives are exposed by the process
  - Forms the basis for system development
  - Provides basis for agreement between developer and user
- Entity-relationship modeling
  - Entity is a thing, entity class is a set of things
  - Relationship type represents the possibility that two entities are related in a specific way
  - E-R diagram is an appropriate way to represent a data model
- E-R diagrams are the deliverables of the initial phase of information system development