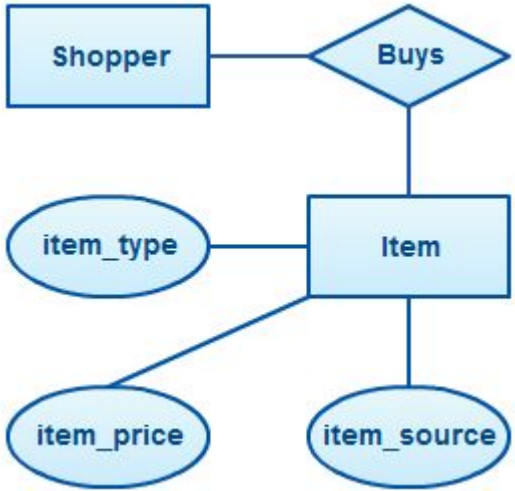

MONTANA
STATE UNIVERSITY

Elements of E/R

An Introduction To E/R Model & Diagrams

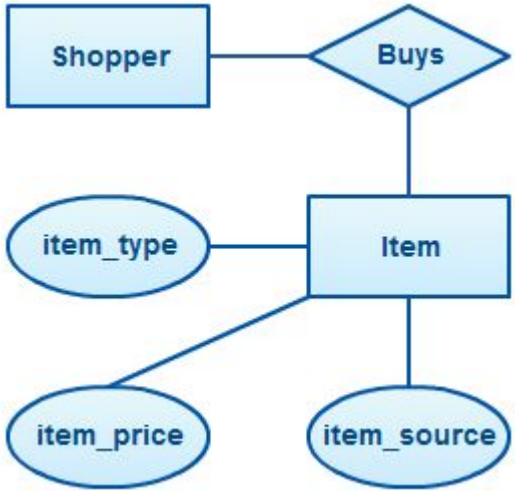
E/R Model

- Consists of three core things:
  - Entities - Things
  - Attributes - Properties of Things
  - Relationships - Relationships between things
- In this simple example
  - Entities: Shopper, Item
  - Attributes: item_type, item_price, item_source
  - Relationship: Buys



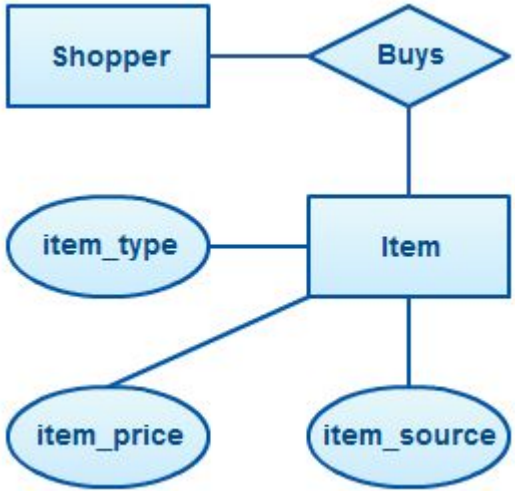
Entities

- The core Nouns of a system
- Somewhat akin to an Object in Object Oriented Languages
- Does not encode actions as in OO
- Represented by a rectangle in E/R Diagrams



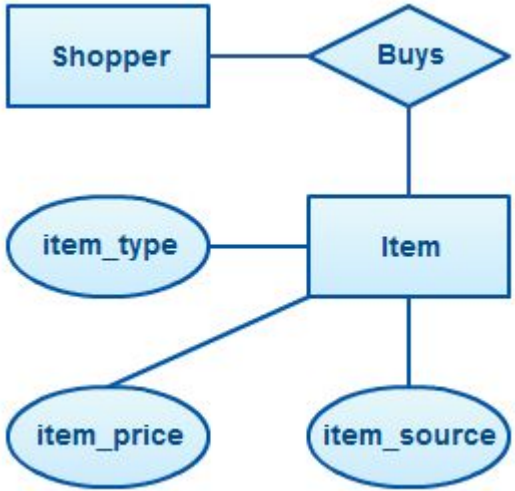
Attributes

- Information about an Entity
- Can be a gray area between Attributes and Entities
- Typically “primitive”
  - Integers, Strings, etc.
- Make up the “data” of the Entity
- Represented as an oval



Relationships

- Indicates a relationship between entities
- Represented by a diamond
- Might be hiding another entity
  - Is “Buys” really a Purchase here?



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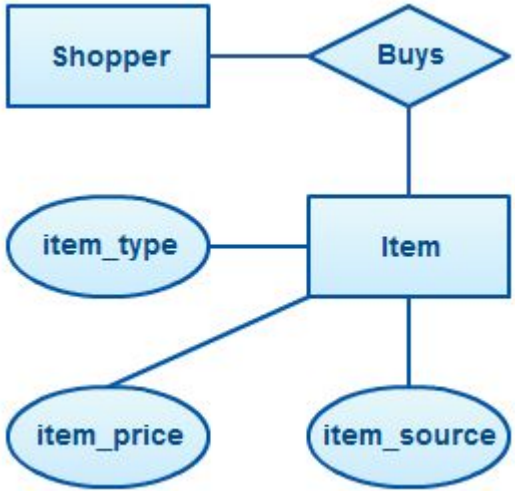
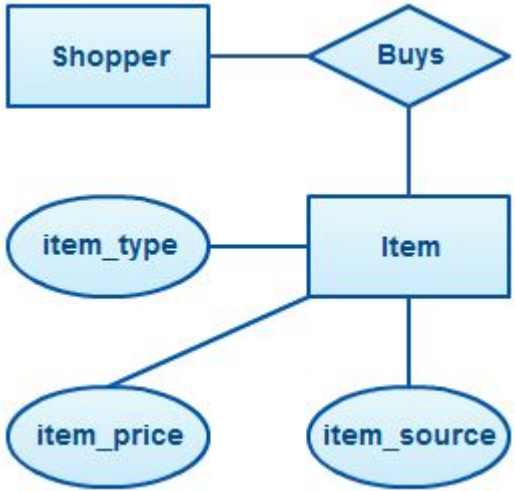


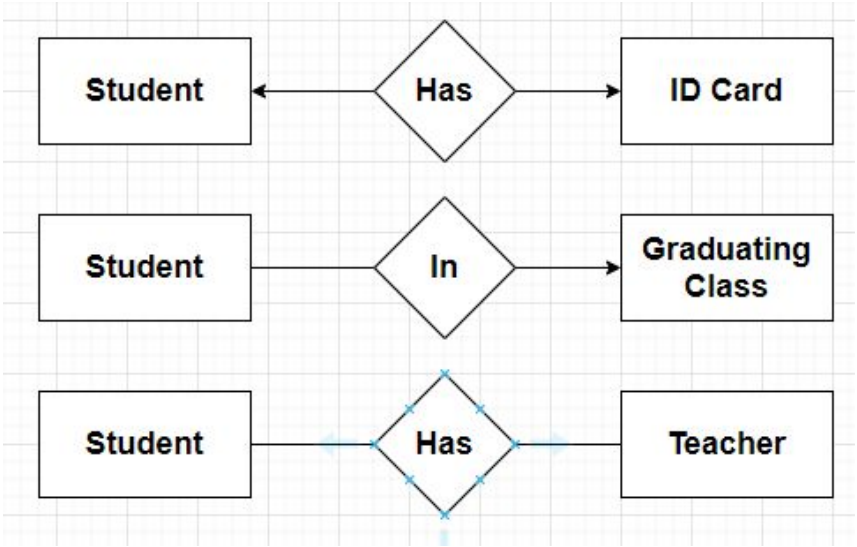
Relationship Multiplicity

- A relationship can have different multiplicity or cardinality
- One-to-one
  - Employee to Job Position
- One-to-many
  - Class to Student
- Many-to-many
  - Buildings to Students



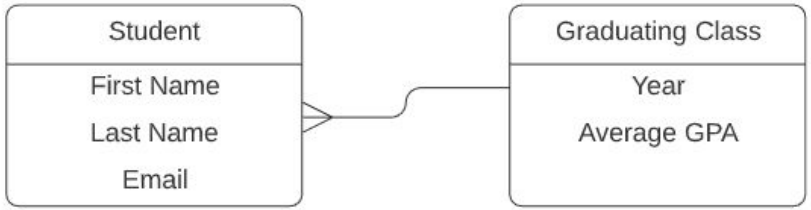
Relationship Notation

- There are a lot of different notations
- The book uses an older & infrequently used notation
- Arrow head to entity indicates it is singular
  - Hard to read!
  - Unintuitive



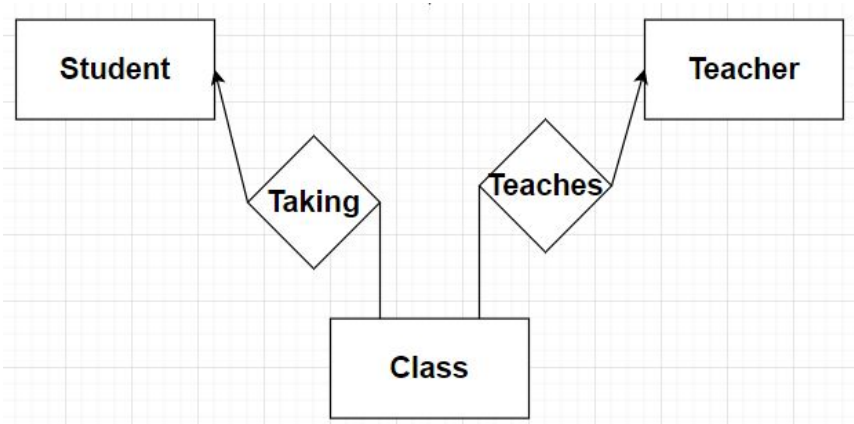
Relationship Notation

- Much more common today is the “crow’s feet” notation
- Less cluttered
- Puts the indicator on the obvious side of the relationship



Many-To-Many... An Entity?

- Many-to-many relationships are often an entity crying to get out
- Consider our Student-Teacher example
- This is really a Class Entity
- Look to replace many-to-many with Entities with one-to-many relationships

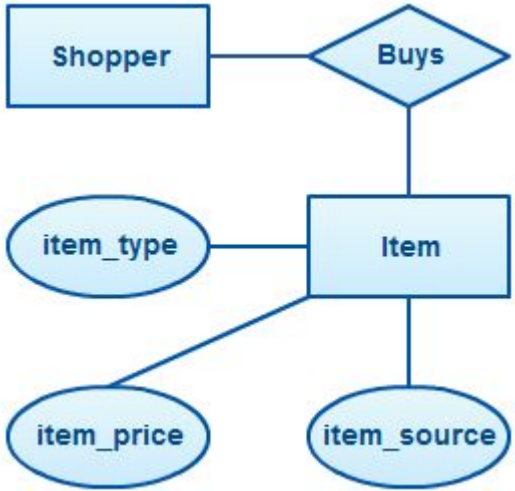


E/R Constraints

Keys And So Forth

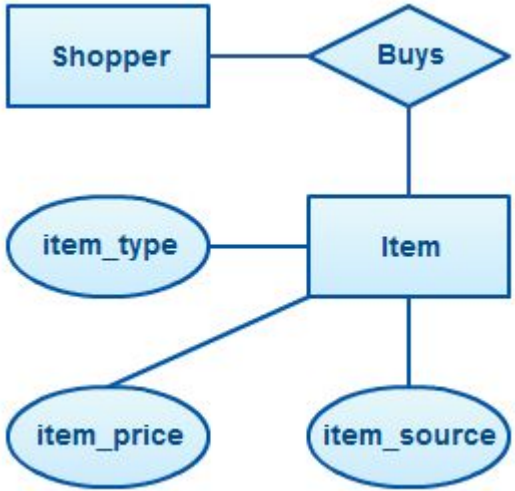
E/R Model

- Recall, an E/R Model consists of three core things:
  - Entities - Things
  - Attributes - Properties of Things
  - Relationships - Relationships between things



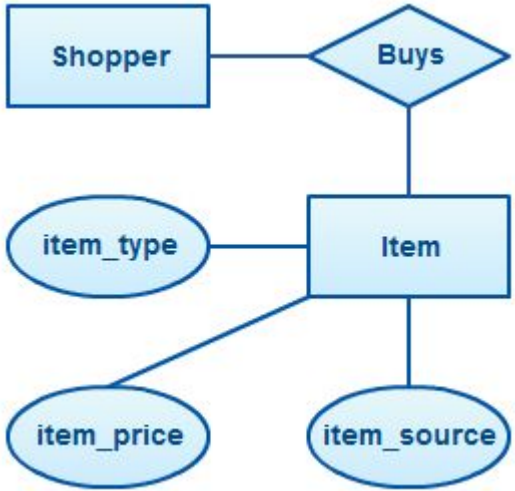
Constraints

- What about constraints on attribute values?
  - Is an attribute unique across instances?
  - Does an attribute refer to another attribute?
  - Must an attribute be one of a set of values?
- These are an important facts that need to be captures by a model



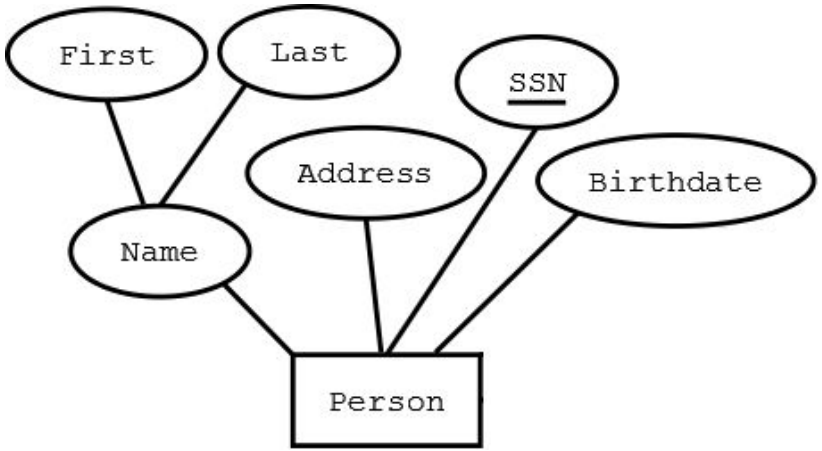
Keys

- Keys are a way to uniquely identify a entity in a set
- Can be one or many attributes
- May be multiple unique keys
- But there is usually a Primary Key
  - The main key used for identity
  - E.g. The Shopper entity might have a primary key `ShopperId`



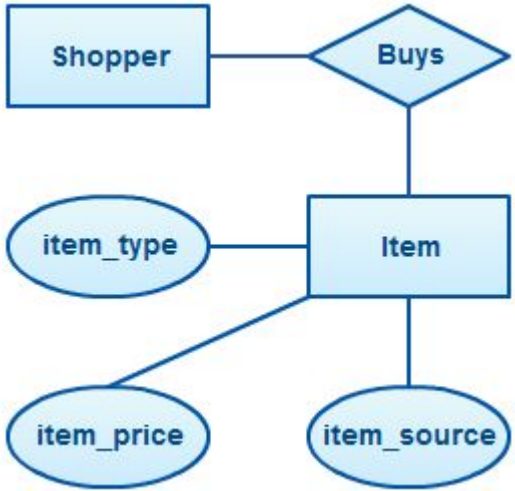
Keys

- Attributes that are keys are represented by underlining the attribute name
- Many of the book examples have entities with multiple keys
  - Rare in practice



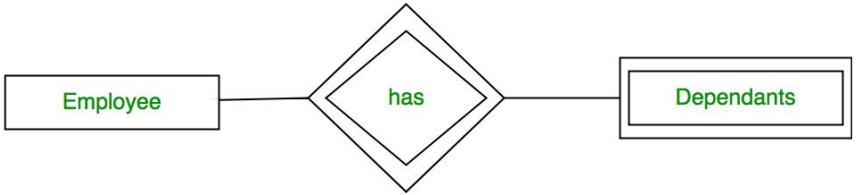
Referential Integrity

- A property of relationships
- What if a Shopper purchased and Item, but the Item then is deleted?
- This is clearer when we get into the Relational Model and how constraints are specified there



Weak Entities

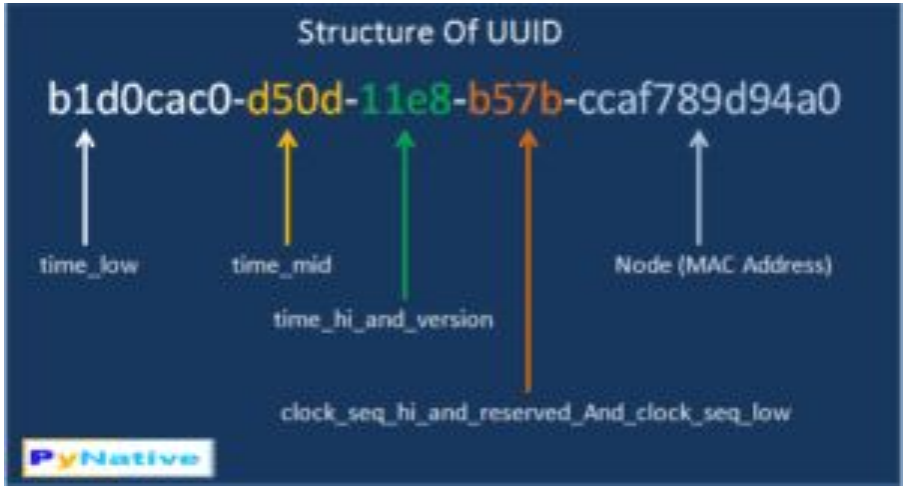
- A “weak entity” does not have a unique key of its own
- I must include another entity set for uniqueness
- Here, Dependants is a “weak entity”
  - Without the Employee, Dependent “Sam” is meaningless



In The Real World

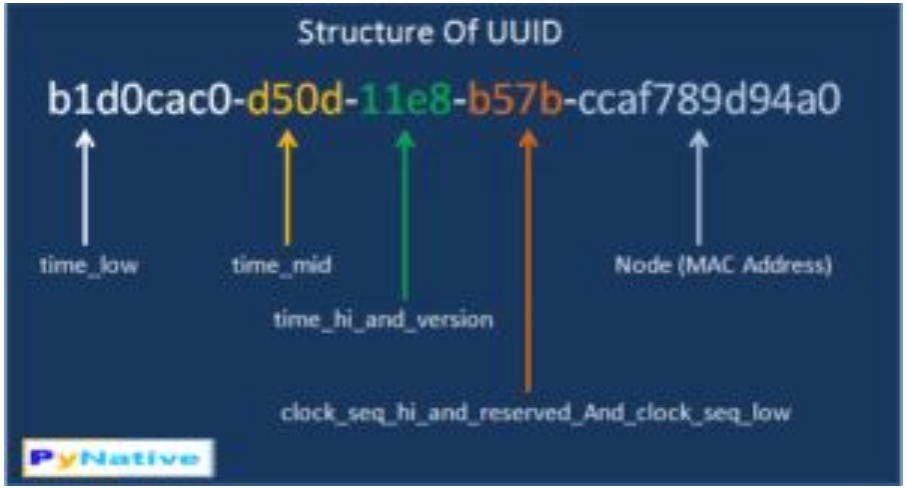
- Every entity has a single, unique attribute, an ID
- Traditionally this ID would be an unsigned integer
- Sometimes referred to as a “synthetic key”
- We are seeing more and more people use UUIDs

123e4567-e89b-12d3-a456-426614174000



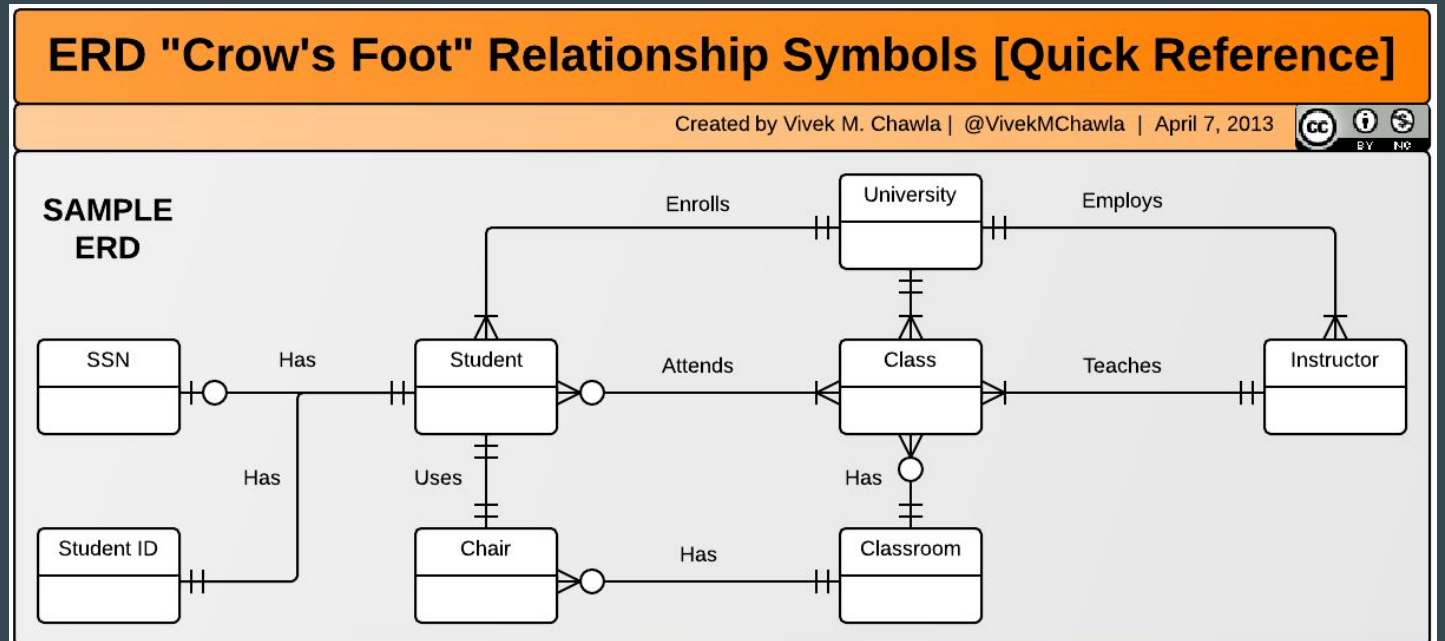
The Real World

- If everything has an ID…
  - No weak entities
  - No multi-key issues
- I have never seen SSN used as a key
  - I bet some folks in government have...
  - I have, however, seen it used as a *lookup*



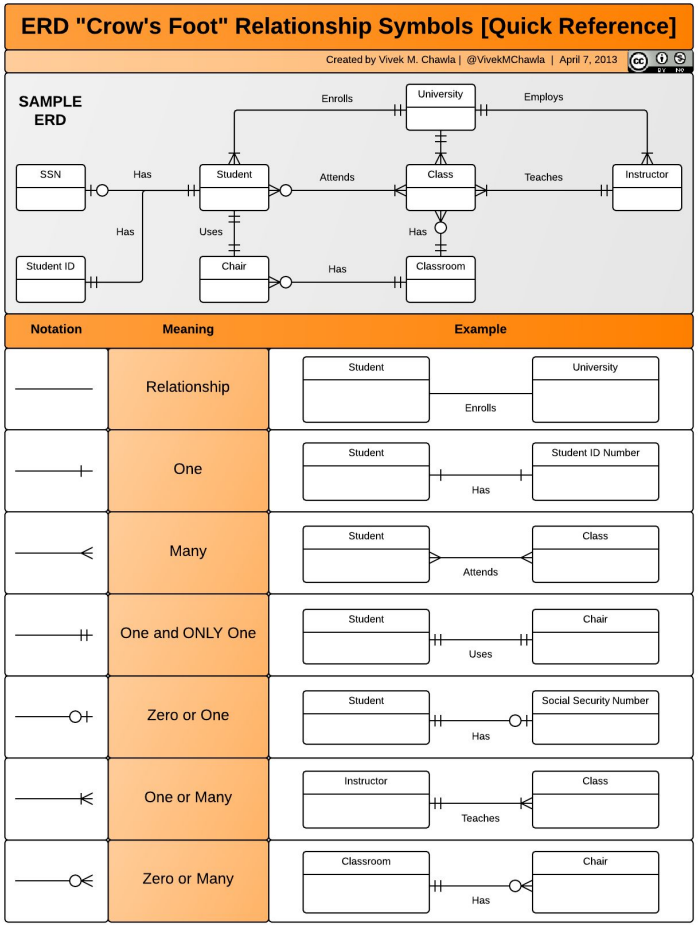
Modern “Crow’s Feet” Notation

- Much clearer
- Relationships are encoded in the lines directly



The Real World

- I have only ever seen Crow's Feet notation used
- Cheat sheet available here: https://www.vivekmchawla.com/erd-crows-foot-relationship-symbols-cheat-sheet/
- Please read over this E/R diagram over, it's very good!



Industry

- LucidChart is a popular tool

  https://www.lucidchart.com

- You can sign up for a free account and play with it
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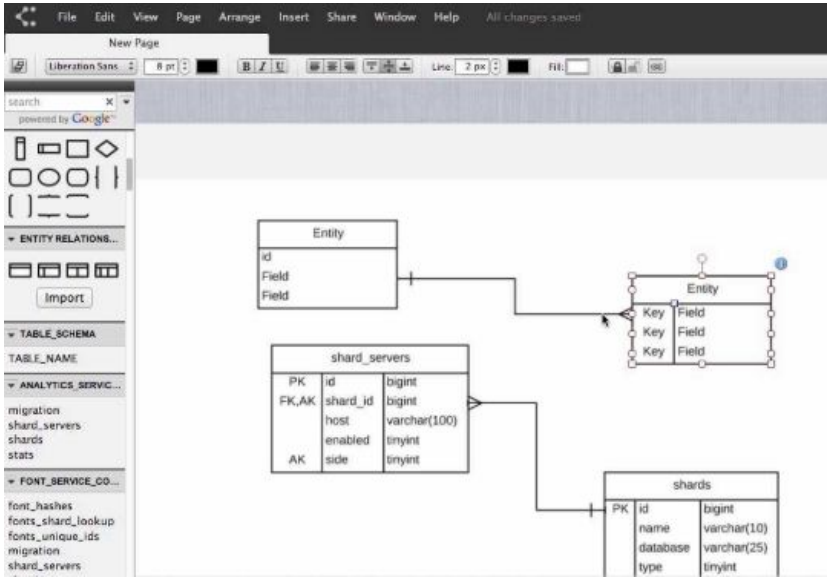
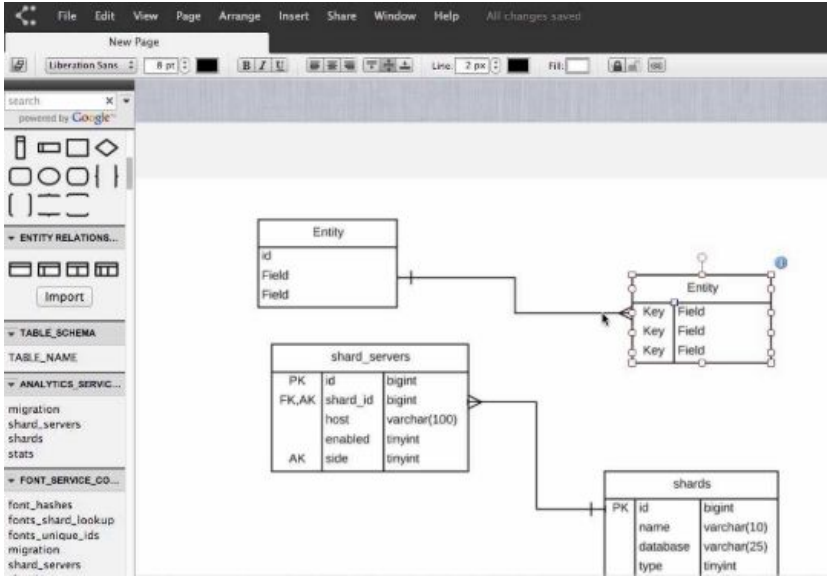
Lucidchart



Industry

- How *often* are E/R Diagrams used in industry?
- Sporadically
  - More frequent the larger the company is
  - Sometimes there is a stigma against E/R Diagrams
  - Often used at the start of a project, then abandoned as project matures

Lucidchart

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