Entity Relationship Model

• **Entity**: A thing of interest in the real world
  
  (e.g. employee, product)

• **Attribute**: A property of the entity
  
  (e.g. salary, sex, birthdate)
  - atomic attribute
  - composite attribute
  
  (e.g. **Name**(FirstName, MI, LastName, Suffix), **BirthDate**(M,D,Y))
• **Value: an instance of an attribute for a particular entity**

  (e.g. Employee(SSN, Sex, Bdate)

  ↓

  ↓

  ↓

  481-33-1766    F    2/17/66

  value of the attribute ‘sex’

  *single valued attribute*

  *multivalued attribute* – set of values (unordered sets)
  (e.g. Phones = \{Business-phone, home-phone, cell-phone\)

  *composite attributes* – structured fields (name)

• **Domain of an Attribute**

  the set of values that may be assigned to the attribute
Graphical Presentation of Entities

- Entity: Employee
  - Attributes:
    - SSN
    - Sex
    - Salary
    - Address
    - Phones
  - Composite Attribute: Name
    - FirstN
    - MI
    - LastN
    - Suffix
Relationship

An association among Entities E1 … En
by the n-tuple Rel (E1 …, En)

Or graphically as:

For example:
Degree of Relationship

⇒ number of participating entity sets
An entity can participate multiple timer in a relationship:

The semantics of the Relationship are defined by the Role Names.
A relationship can be represented as an attribute (and vice versa)
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Language Analogy

Entities = Nouns
Attributes = Adjectives
Relationships = Verbs
Language Analogy

Entities = Nouns
Attributes = Adjectives
Relationships = Verbs
?? = Adverbs
Attributes of relationships (Adverbs)
Entity Type (schema)

- **STUDENT**
  - NAME
  - SSN
  - BDATE
  - SEX

Entity Instance

- **STUDENT1**
  - Name: John Doe
  - SSN: 985-12-1789
  - Sex: M
  - Birth Date: 1-39-75

- **STUDENT2**
  - Name: Sally Smith
  - SSN: 321-41-1786
  - Sex: F
  - Birth Date: 10-26-55
Entity Sets

STUDENT1
- John Doe
- 985-12-1789
- M
- 1-39-75

STUDENT2
- Sally Smith
- 321-41-1786
- F
- 10-26-55

糖尿病
WEAK ENTITY SETS

Identify relationship: Relationship through which weak entity set can be uniquely identified

Identifying Owner: Entity that allows for unique id
WEAK/STRONG ENTITY SETS

```
<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Sex</th>
<th>Relation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sally Smith</td>
<td>5</td>
<td>F</td>
<td>Daughter</td>
</tr>
<tr>
<td>Johny Smith</td>
<td>3</td>
<td>M</td>
<td>Son</td>
</tr>
<tr>
<td>Sue Doe</td>
<td>1</td>
<td>F</td>
<td>Daughter</td>
</tr>
<tr>
<td>Billy Doe</td>
<td>8</td>
<td>M</td>
<td>Son</td>
</tr>
<tr>
<td>Sally Smith</td>
<td>5</td>
<td>F</td>
<td>Daughter</td>
</tr>
</tbody>
</table>
```
E-R Terminology

SUPERKEY ATTRIBUTES:
A Set of attributes that allows us to identify an entity uniquely
(eg: Name, Address…)

CANDIDATE KEYS: minimal superkeys
(I.e. no proper subset is a superkey)
{ SSN, Names – superkey
  SS = candidate key}

PRIMARY KEY:
Candidate key chosen as principal identifier for the entity (e.g. SSN)
WEAK/STRONG ENTITY SETS

Dependent

Name: Sally Smith, Age: 5, Sex: F, Relation: Daughter, SSN: 480-34-0771
Name: Johny Smith, Age: 3, Sex: M, Relation: Son, SSN: 192-76-3879
Name: Sue Doe, Age: 1, Sex: F, Relation: Daughter, SSN: 862-33-0112
Name: Billy Doe, Age: 8, Sex: M, Relation: Son, SSN: 114-39-3728
Name: Sally Smith, Age: 5, Sex: F, Relation: Daughter, SSN: 033-69-8791

Primary Key
WEAK/STRONG ENTITY SETS

If Primary Key exists  => Strong Entity Set
If Primary Key does not exist  => Weak entity Set

Dependent

Name | Age | Sex | Relation
--- | --- | --- | ---
Sally Smith | 5 | F | Daughter
Johny Smith | 3 | M | Son
Sue Doe | 1 | F | Daughter
Billy Doe | 8 | M | Son
Sally Smith | 5 | F | Daughter

Primary key
WEAK ENTITY SETS

Identify relationship: Relationship through which weak entity set can be uniquely identified

Identifying Owner: Entity that allows for unique id
MAPPING CONSTRAINTS

1:1 (one to one)

- OFFICE
  - WORKS IN ROOM
    - EMPLOYEE

- NEB 324
- NEB 215
- NEB 328

- D. Yarowsky
- G. Hager
- S. Smith
MAPPING CONSTRAINTS

1:1 (one to one)

Relationship mapping does not need to be total
MAPPING CONSTRAINTS

(cardinality constraints)

N:1 (many-to-1)

DEPARTMENT

WORKS FOR

EMPLOYEE

SALES

ACCOUNTING

MARKETING

John Smith

Adam Weller

Sue Weller

Jane Doe

Sally Smith

Danny Jones

E1

Name  12/85  889-26-6789
John Doe  Bdate  SSN
MAPPING CONSTRAINTS

(cardinality constraints)

N:1 (many-to-1)

DEPARTMENT

WORKS FOR

N

EMPLOYEE

SALES

ACCOUNTING

MARKETING

John Smith

Adam Weller

Sue Weller

Jane Doe

Sally Smith

Danny Jones

E1

Name  Bdate  SSN

John Doe  12/85  889-26-6789
MAPPING CONSTRAINTS

(cardinality constraints)

N:M (many – many)

PROJECT

WORKS ON

EMPLOYEE

PROJECT 1

PROJECT 2

PROJECT 3

John Smith

Adam Weller

Sue Weller

Jane Doe

Sally Smith

Danny Jones

E1

Name

12/85

889-26-6789

Bdate

SSN
PARTICIPATION CONSTRAINT

Total Participation:

-> Candidate for representation as an attribute

=> Existence Dependency (I.e. dependent in database without sponsoring employee)
Specialization

• Notation that avoids duplication of entity structure

• Inheritance of attributes

  - checking account - ISA - account
  - saving account - ISA - account
  - interest bearing - ISA - checking account

• Important in object-oriented model design