Entity-Relationship Event Network (EREN) Methodology

Key principle of EREN methodology

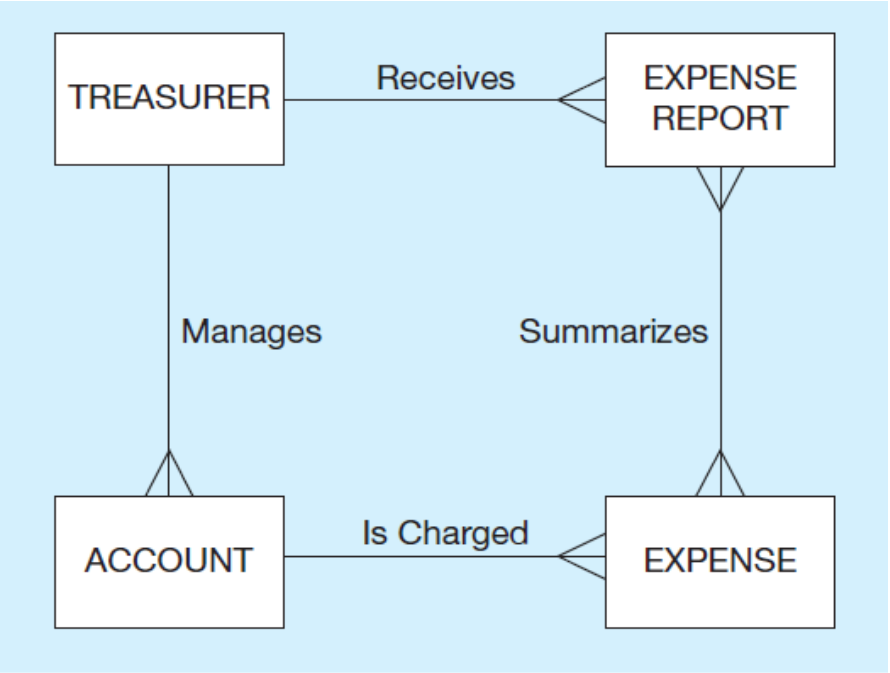
- Regard events as critical aspects of business processes
- Consider EVENT as a key construct when data modeling for business applications

Business Rules

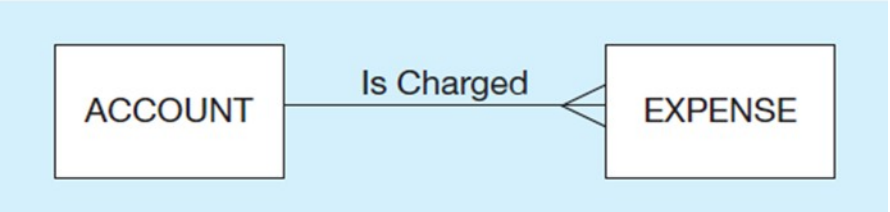
- Are statements that define or constrain some aspect of the business
- Are derived from policies, procedures, events, functions
- Assert business structure
- Control/influence business behavior
- Are expressed in terms familiar to end users
- Are automated through DBMS software

Figure 2-4 Example of Inappropriate Entities

(a) System user (Treasurer) and output (Expense Report) shown as entities



b) E-R diagram with only the necessary entities



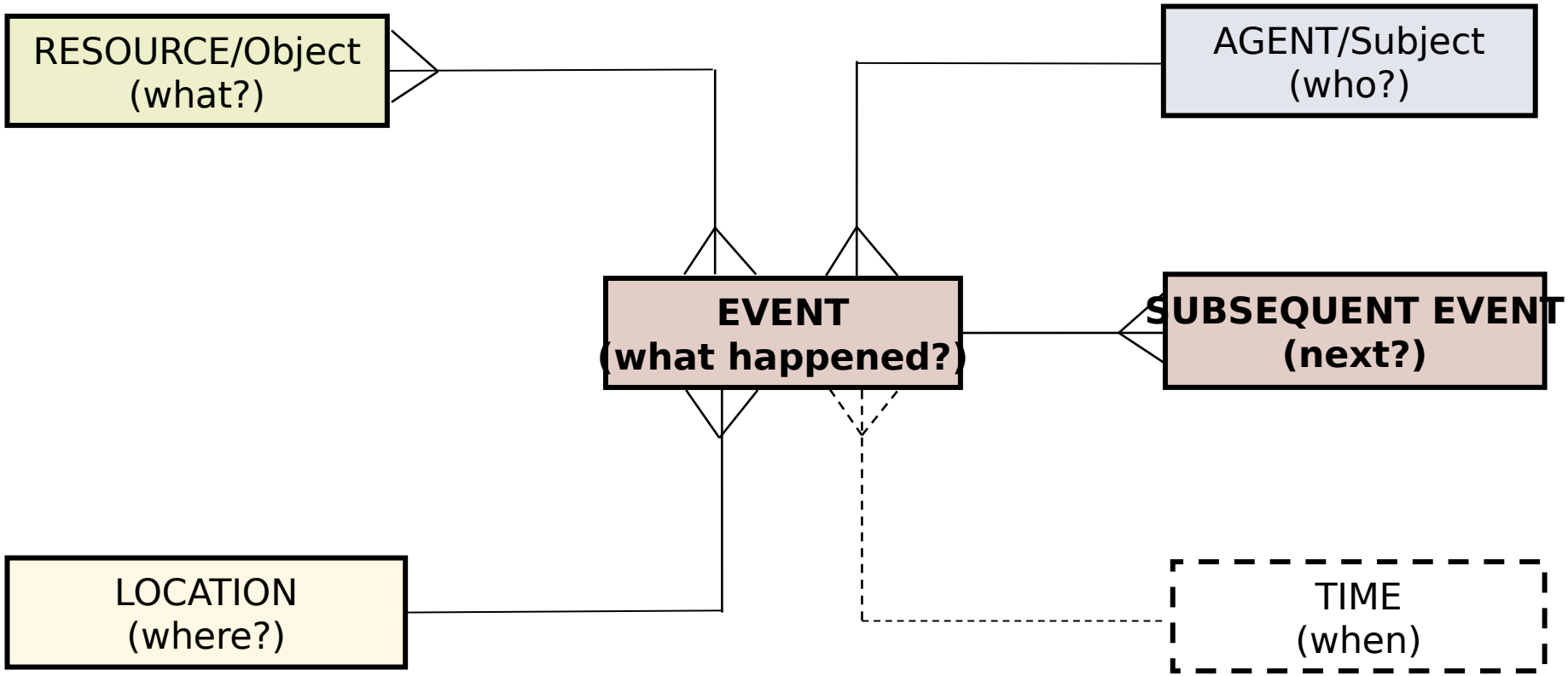
Definition of **Event**

- A data event is a change of state that **needs to be recorded.**
- The occurrence of an event affects at least one entity; usually an event affects many entities
  - A data event serves as a junction for various entities – agents (or actors), objects, location, and resources (products/services).
- The time of occurrence or the time interval of the event is an essential element of event.
  - An event occurs over a period of time or at a specific point in time
  - A process, transaction, or occurrence that has time element as a key aspect is an event or consists of events.

Concepts of EREN

1. EVENT – what occurred at a given time or over a time period
   - Activity, decision, or documentation of activity/decision
   - Could be a chain of events
2. AGENT/ACTOR -- who was involved
   - Person/machine/organization performing the action, making the decision
3. RESOURCE – products or services
   - Tangible or intangible things offered, transferred, assigned, allocated, usually within the context of a transaction event
4. SUBJECT/OBJECT – who or what was involved
   - Person or thing involved that is not clearly identifiable as an agent or a resource, usually within the context of non-transaction event, also known as an occurrence event
5. LOCATION – where
   - Physical or virtual place where event occurred
6. TIME – when
   - Point in time, or time interval

Logic of EREN



Steps in EREN Technique

1. Situate the event within the context of a business process depicted as a business function
2. Model each business function as an event entity
3. For each event:
   a. Specify date/time as attributes of the event entity
   b. Model agents/subjects – *actors or decision makers* involved
   c. Model the resource/object – what product, service, or thing is involved – **consider whether the service is another event where time is a critical consideration**
   d. Model physical or virtual location of the event – *where* does it occur

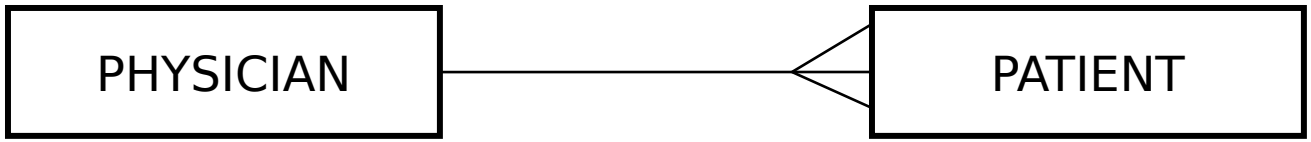
Exercise 1: Hospital Admission

Patients are admitted to the hospital by physicians.

Admission of the patient is authorized by only one admitting physician.

A physician may admit any number of patients.

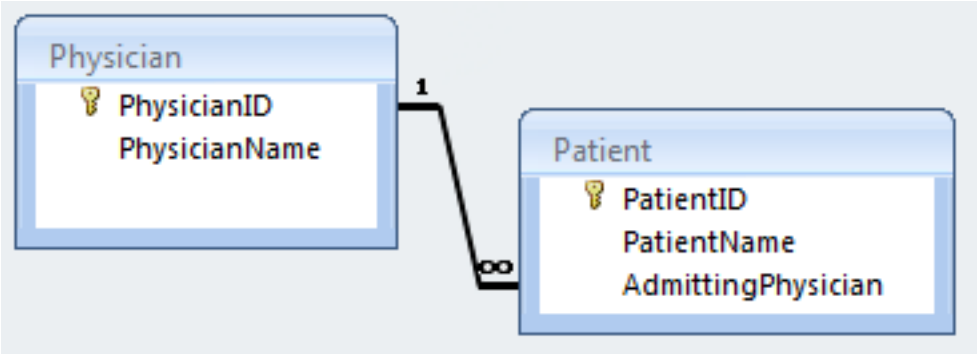
The Obvious Solution has an Error



Physician (PhysicianID, PhysicianName,…)
Patient (PatientID, PatientName, …,PhysicianID)

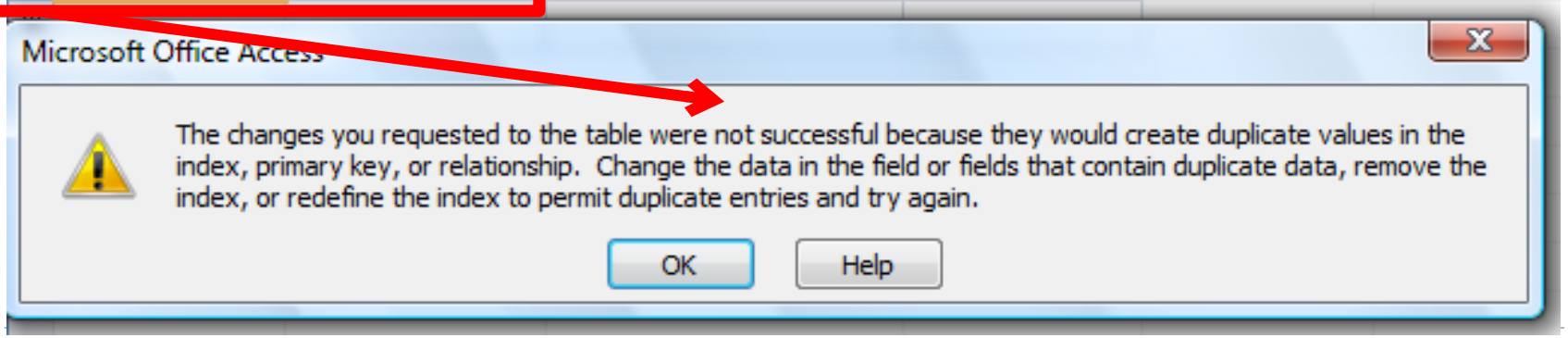
PatientID as the primary key would be unique and cannot be repeated, which implies that a patient could only be admitted once to the hospital

Cannot Admit a Patient more than once!

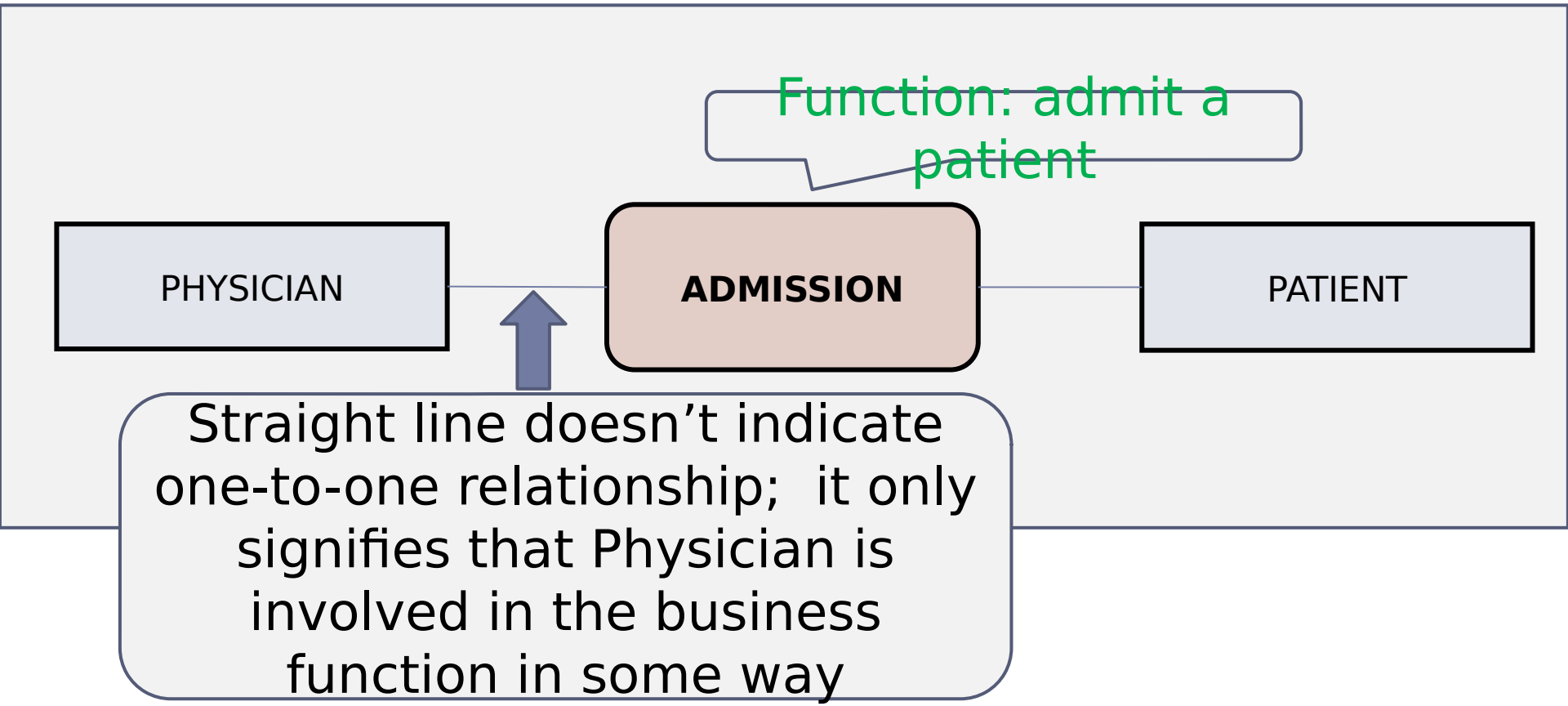


Patient

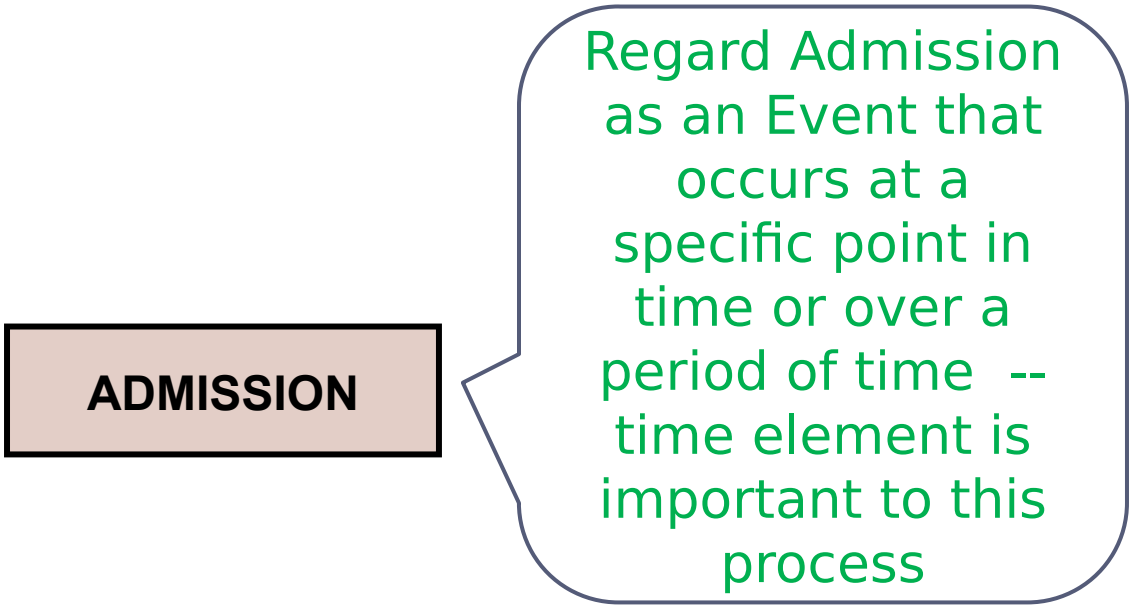
PatientID	PatientName	AdmittingPhysician	Add New Field
P01	Bruce	Frenzel	
P02	Patti	Frenzel	
P03	Alan	Carville	
P02	Patti	Murdoch	



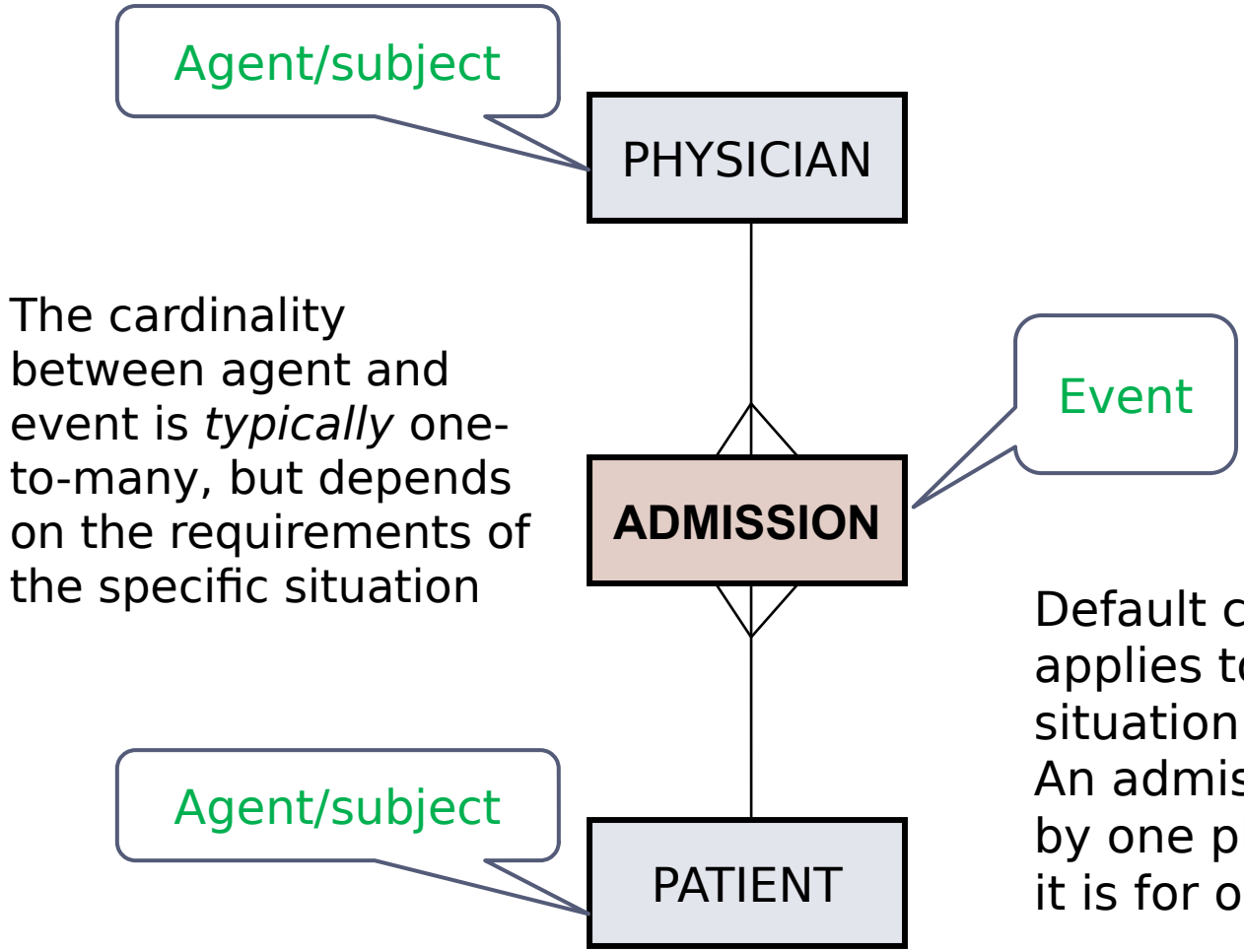
Business Function for hospital-admission task



Model Admission function as an Event entity



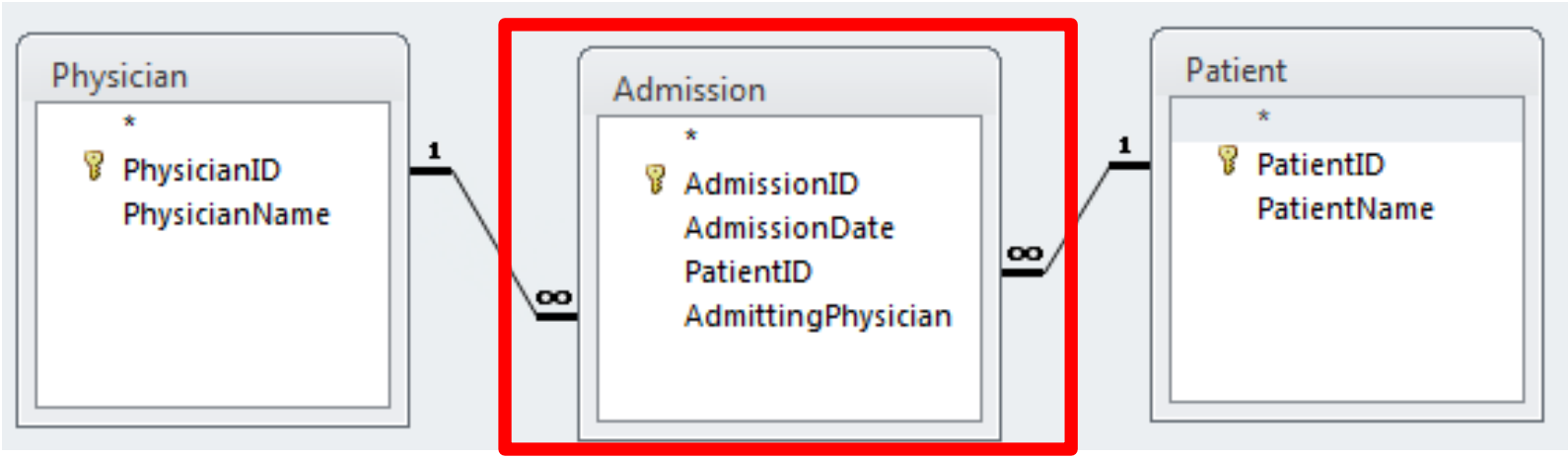
Model Physician and Patient as Agents/Subjects



The cardinality between agent and event is *typically* one-to-many, but depends on the requirements of the specific situation

Default cardinality applies to this situation:
An admission is made by one physician, and it is for one patient.

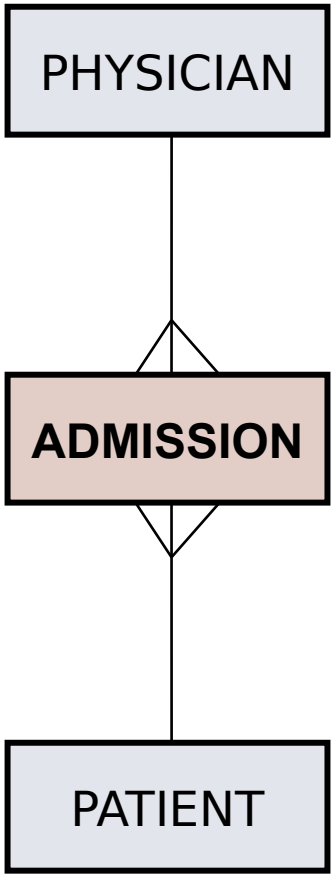
Sample Data for Modified **Admission** Solution



Admission

AdmissionID	PatientID	AdmittingPhysician
A1	P01	Frenzel
A2	P02	Frenzel
A3	P03	Carville
A4	P02	Murdoch
A5	P01	Frenzel

EREN Solution for hospital admission task



Physician (PhysicianID, PhysicianName,…)
Admission (AdmissionID, …, PatientID, PhysicianID)
Patient (PatientID, PatientName, …)

This model:

- captures the possibility that a given patient could be admitted to the hospital more than once
- fulfills the stated requirement -- a patient is admitted by only one physician – but adjusts it to be for a ***given admission***

Exercise 2 : Apartment Rental

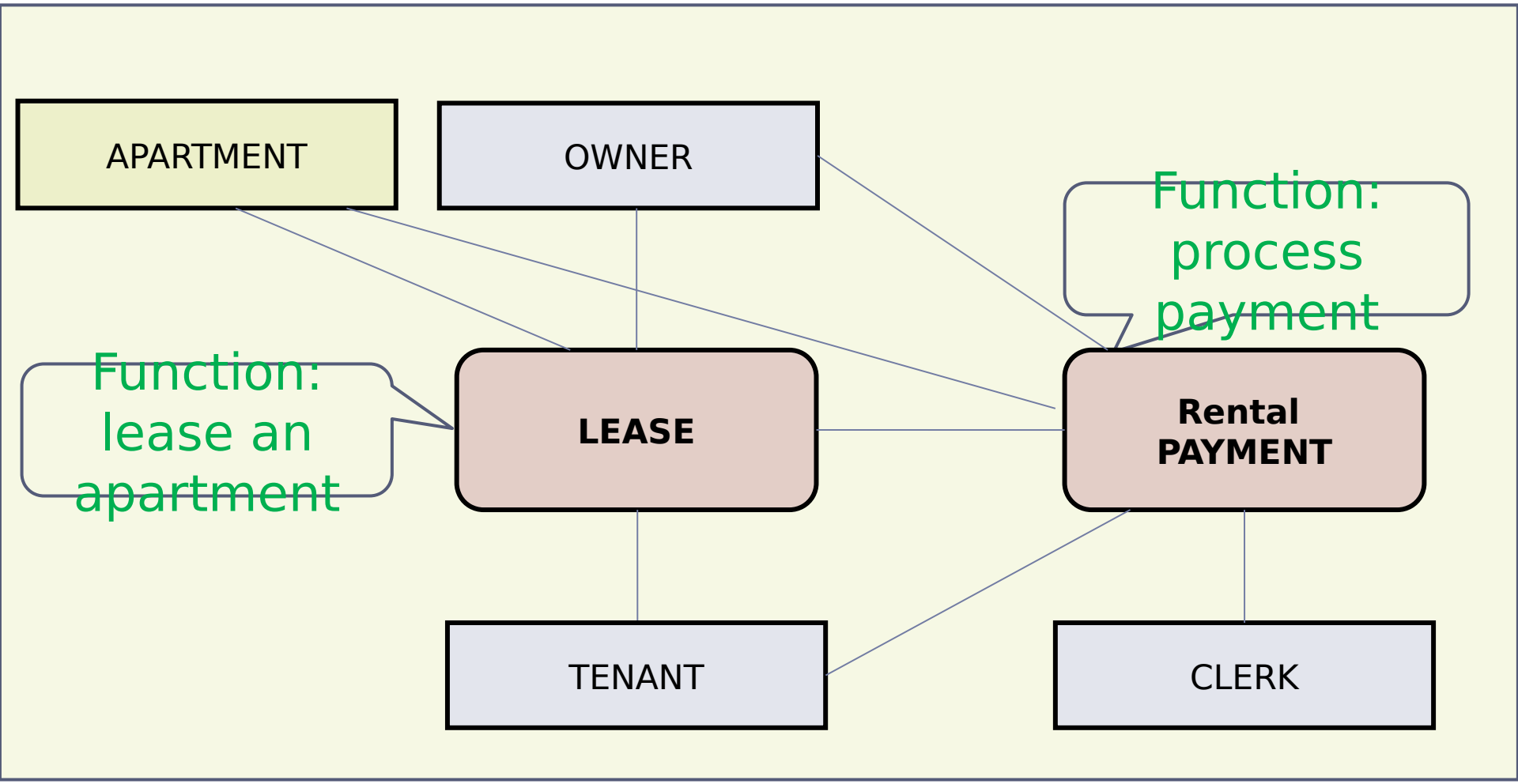
A firm manages leasing of apartments to tenants by owners.
An apartment is identified by a number; data such as square footage, number of bedrooms and baths are recorded. An owner is a company identified by a companyID, and described by name and contact information.

A tenant is identified by a number, and described by data such as name and phone number. A tenant can rent more than one apartment, and an apartment can be rented by more than one tenant.

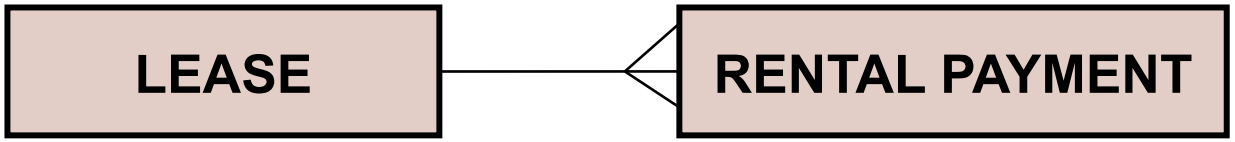
The rental lease records the duration, deposit, and rent. *The lease agreement can involve more than one tenant, but it is for one apartment and one owner.* When a lease expires, the owner and tenant(s) may mutually decide to continue the stay by writing a new lease.

Rental payments are periodically collected for each lease and the receipt date and period covered are recorded by a clerk.
A clerk is identified by clerkID and described by name.

Business Functions for apartment rental task



Model business functions as Event entities



In this exercise, Lease is the initial event in the apartment rental business process.

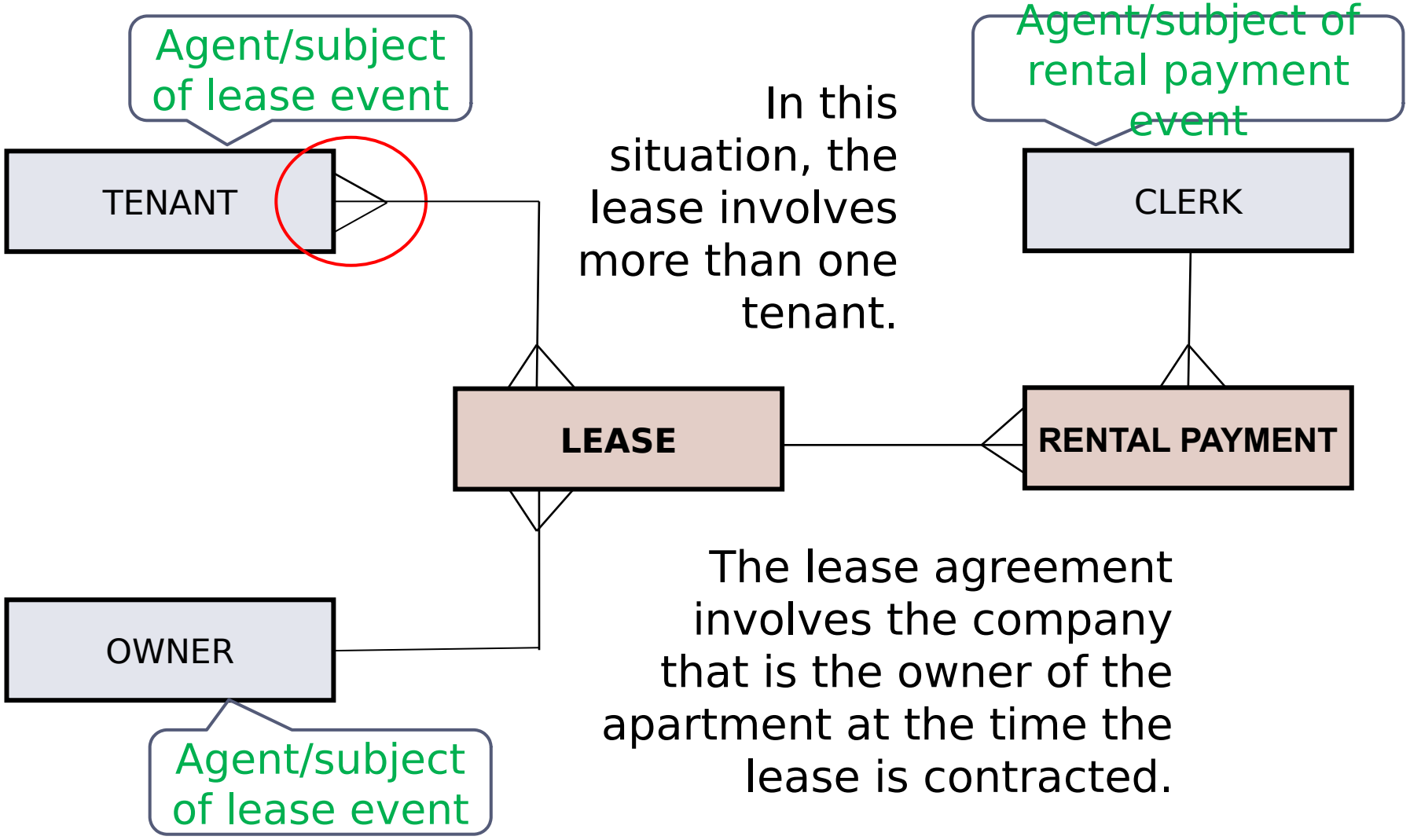
- Involves documentation of how resources (apartments) are assigned (to tenants)
- Tracks time -- date lease begins, duration of lease

Rental Payment is a subsequent event.

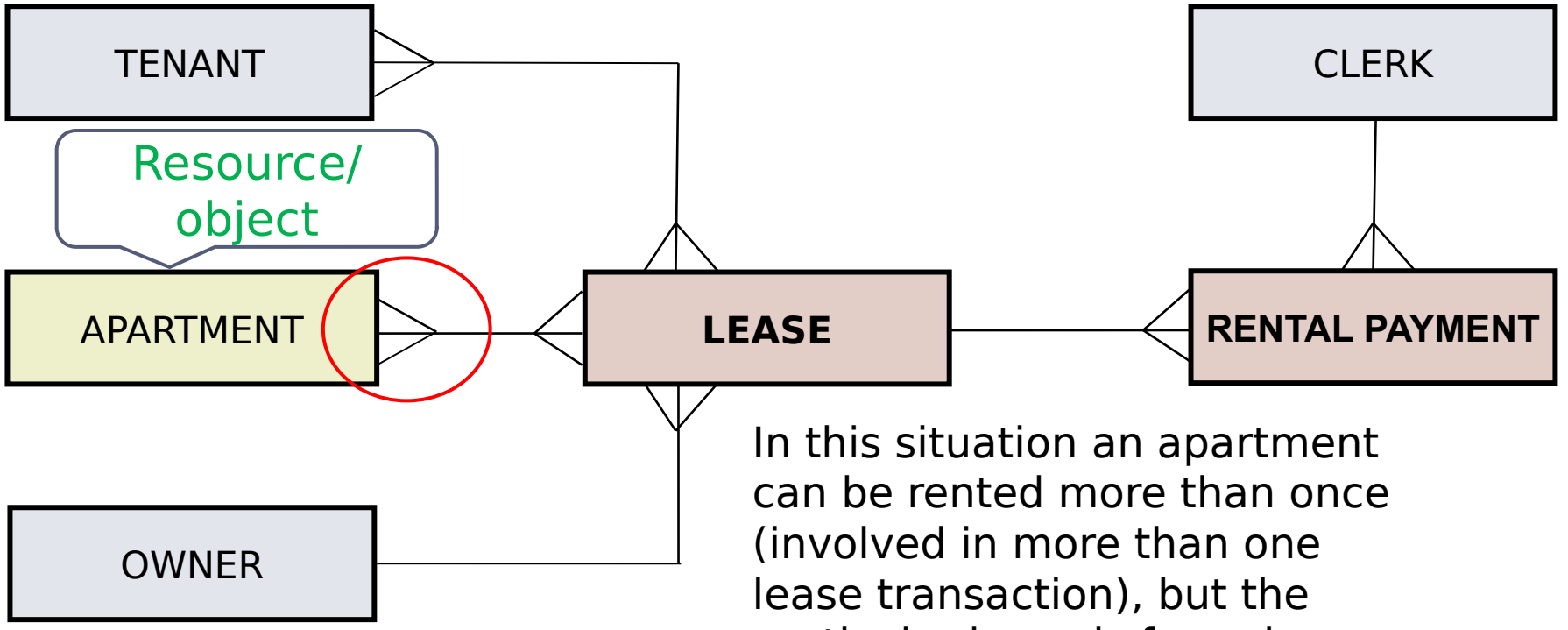
- Involves documentation of payments made toward the lease agreement
- Tracks time – when the payment was made

A rental payment pertains to one lease agreement. A lease can by paid for with multiple

Model Agent/subject entities for each event

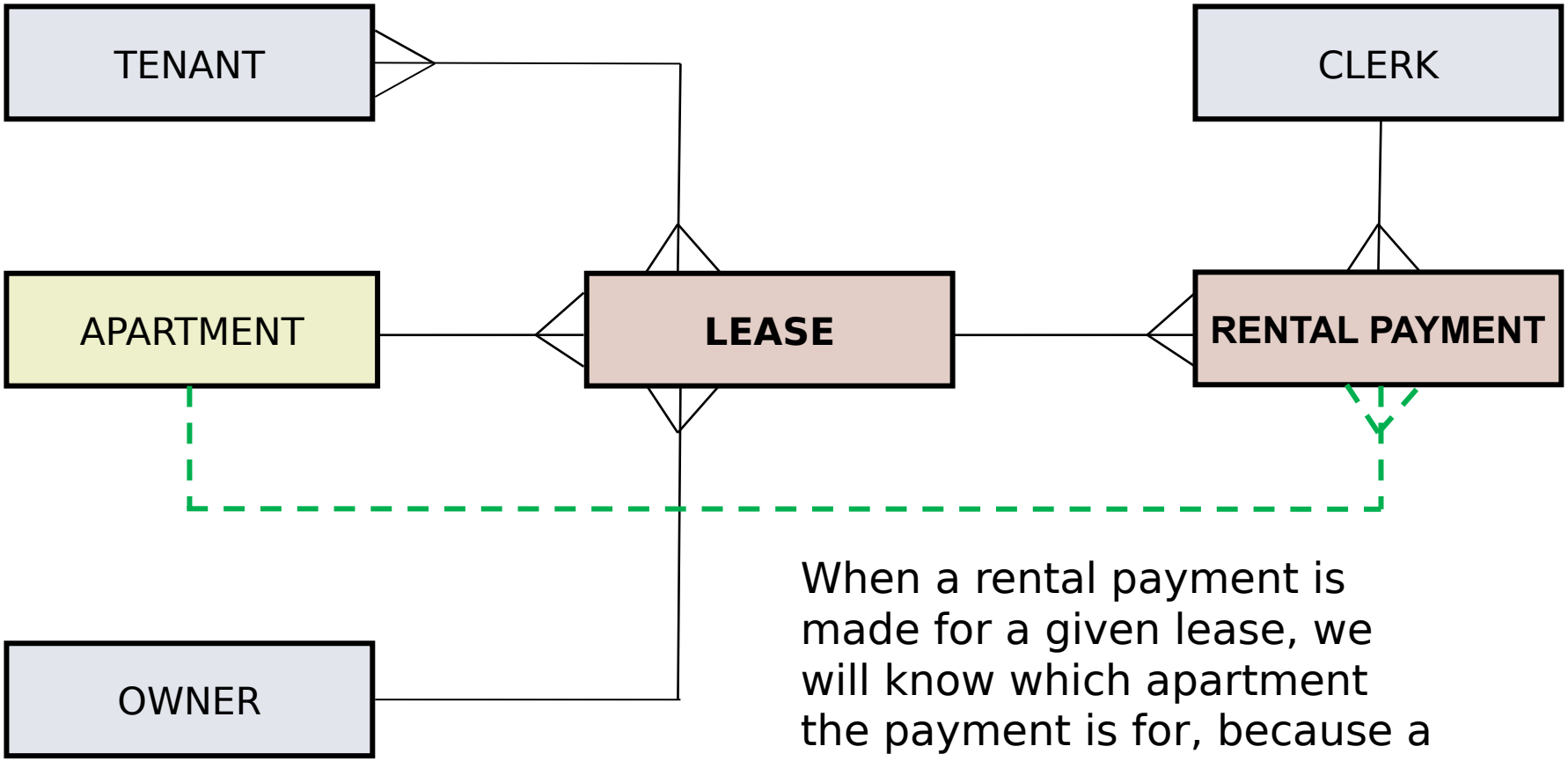


Model Resource/object entities for each event



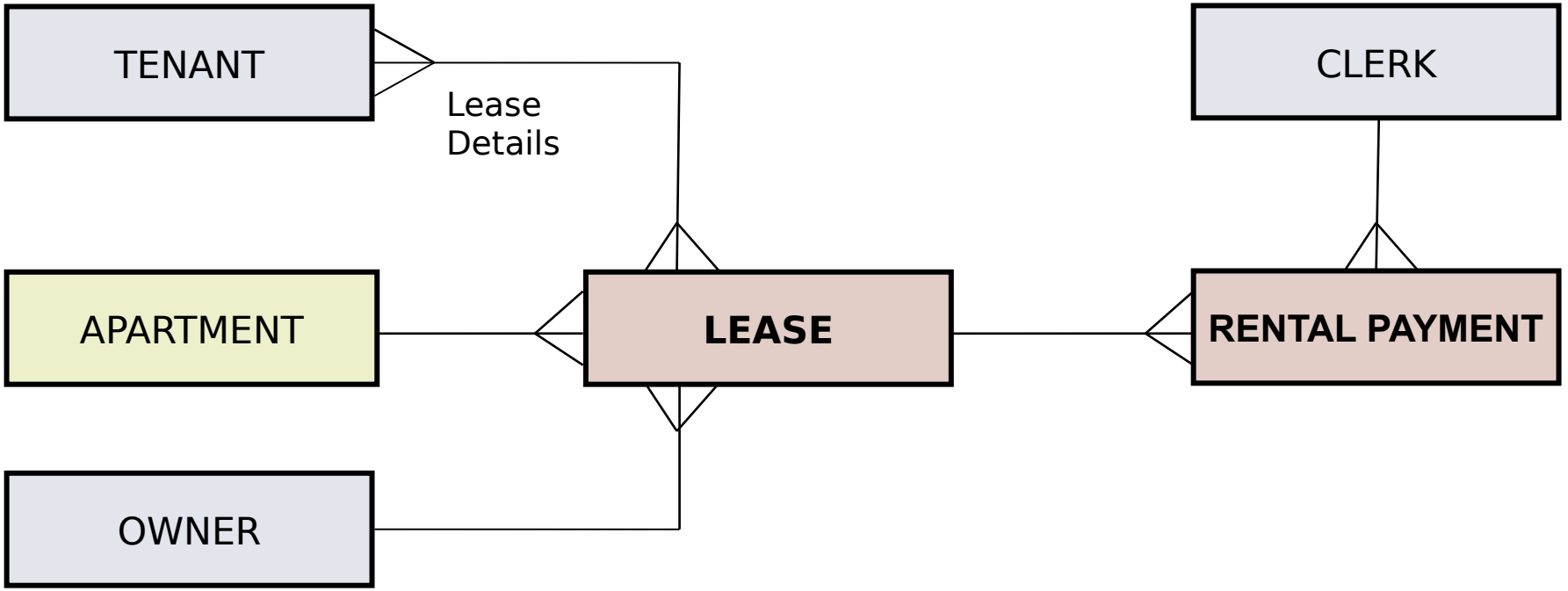
In this situation an apartment can be rented more than once (involved in more than one lease transaction), but the particular lease is for only one apartment – so need to adjust the cardinality of the relationship

Deriving rental payment_apartment



When a rental payment is made for a given lease, we will know which apartment the payment is for, because a rental payment is for one lease, and a lease is for one apartment.

EREN Solution for Apartment Rental task



Apartment (ApartmentID, Bathrooms, Bedrooms, Sq Footage, ...)
Owner (CompanyID, CompanyName, Contact,...)
Tenant (TenantID, TenantFirstName, TenantLastName, ...)
Lease (LeaseNum, LeaseDate, Duration, Deposit, Rent, ..., ApartmentID, OwnerID)
LeaseDetails (LeaseNum,TenantID, ...)
RentalPayment (PaymentNum, PaymentDate, Amount, ..., LeaseNum, ClerkID)
Clerk (ClerkID, ClerkName, ...)

An Entity…

- **Should Be**:
  - An object that will have many instances in the database
  - An object that will be composed of multiple attributes
  - An object that we are trying to model
- **Should Not Be**:
  - A user of the database system
  - An output of the database system (e.g., a report)

A Good Business Rule Is:

- Declarative – what, not how
- Precise – clear, agreed-upon meaning
- Atomic – one statement
- Consistent – internally and externally
- Expressible – structured, natural language
- Distinct – non-redundant
- Business-oriented – understood by business people

E-R Model Constructs

- Entities:
  - Entity instance – person, place, object, event, concept (often corresponds to a row in a table)
  - Entity Type – collection of entities (often corresponds to a table)
- Relationships:
  - Relationship instance – link between entities (corresponds to primary key–foreign key equivalencies in related tables)
  - Relationship type – category of relationship; link between entity types
- Attributes:
  - Properties or characteristics of an entity or relationship type (often corresponds to a field in a table)