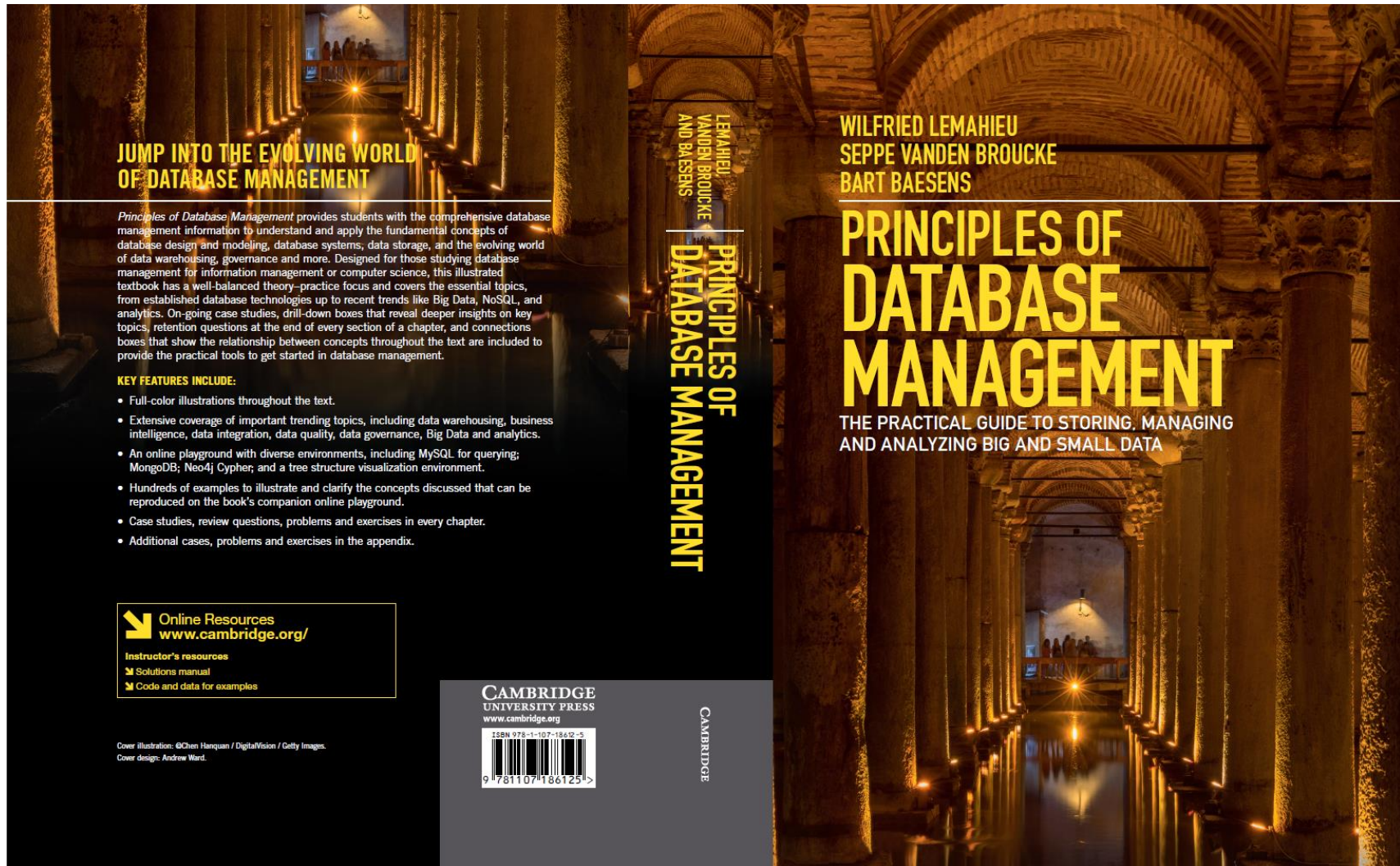


Legacy Databases



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Introduction

- Hierarchical Model
- CODASYL Model

Hierarchical Model

- The hierarchical model originated during the Apollo program conducted by NASA
 - IBM developed the Information Management System or IMS DBMS (1966-1968)
- No formal description available and lots of structural limitations (legacy)
- Two key building blocks: record types and relationship types

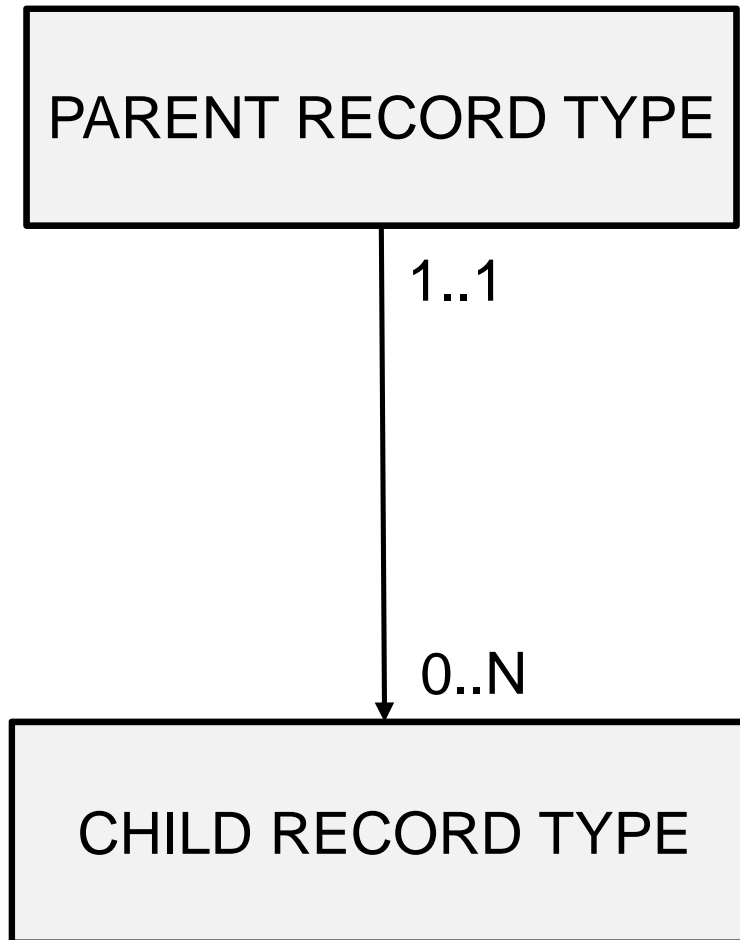
Hierarchical Model

- A record type is a set of records describing similar entities and has 0, 1 or more records
 - Examples: product record type, supplier record type
- A record type consists of fields or data items
 - Examples: product number, product name, product color

Hierarchical Model

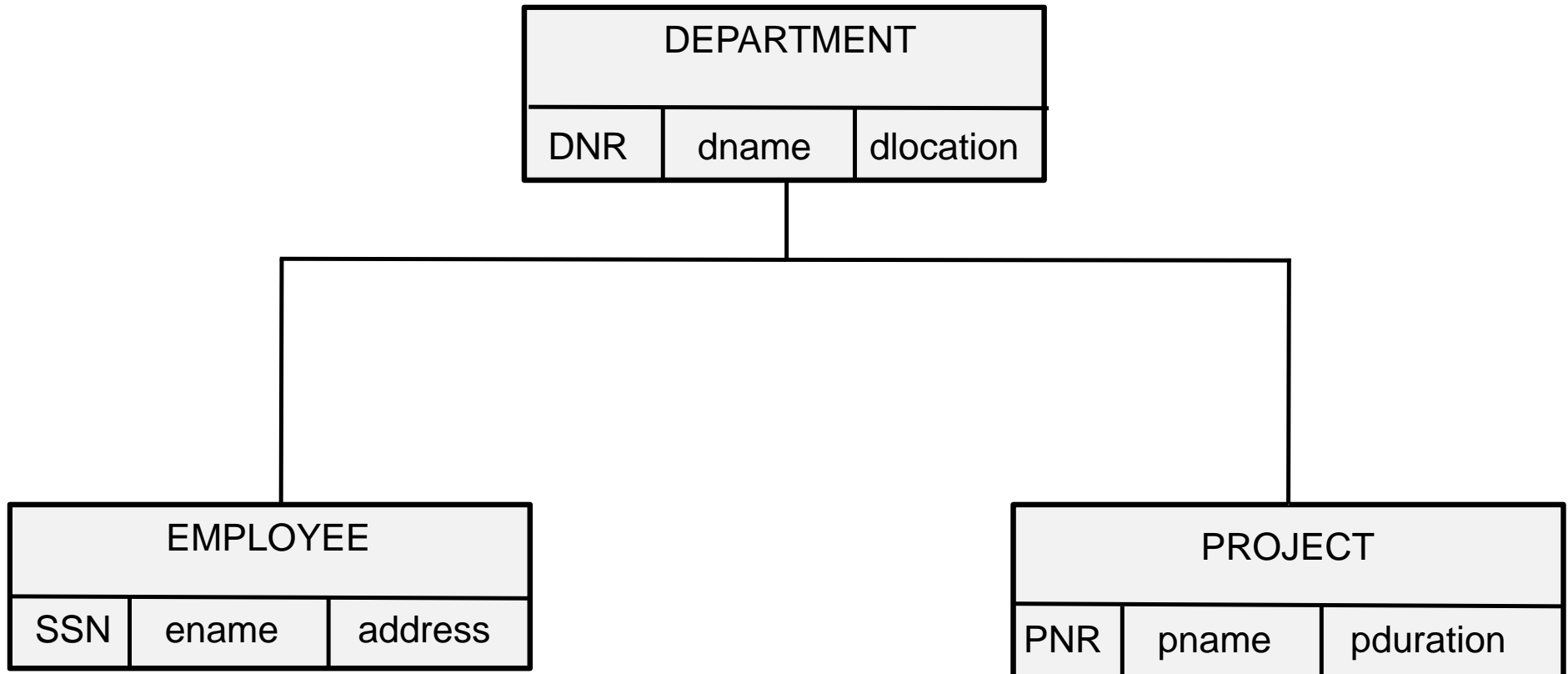
- A relationship type connects two record types
- Only hierarchical structures are allowed (1:N relationship types)
- A record type can be a parent in multiple parent/child relationship types, but it can participate in at most one relationship type as a child
- Relationship types can be nested
- Root record type sits as the top of the hierarchy, whereas leaf record type sits at the bottom

Hierarchical Model



1:N relationship type!

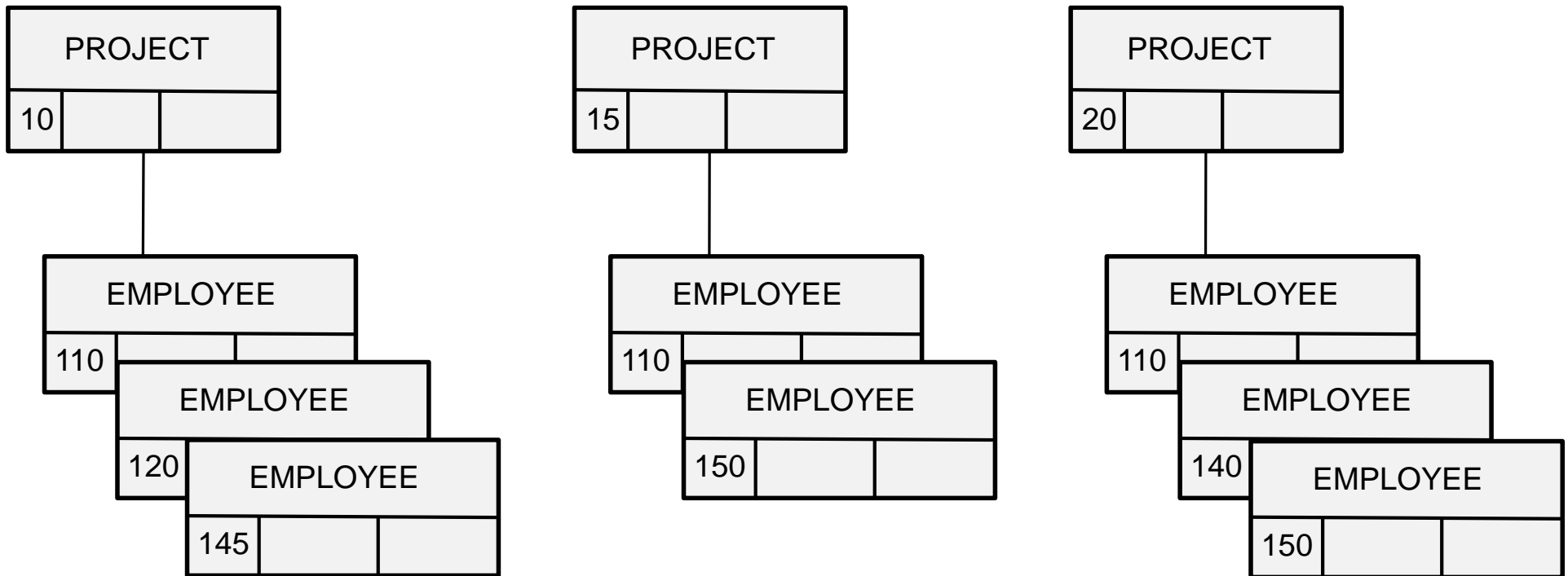
Hierarchical Model



Hierarchical Model

- All data needs to be retrieved by navigating down from the root node (procedural DML)
- The hierarchical model is also very rigid and thus limited in terms of expressive power
- No support for N:M or 1:1 relationship types
- N:M relationship type
 - assign one record type as the parent and the other as the child record type
 - put relationship type attributes in child record type
 - however: redundancy is introduced!

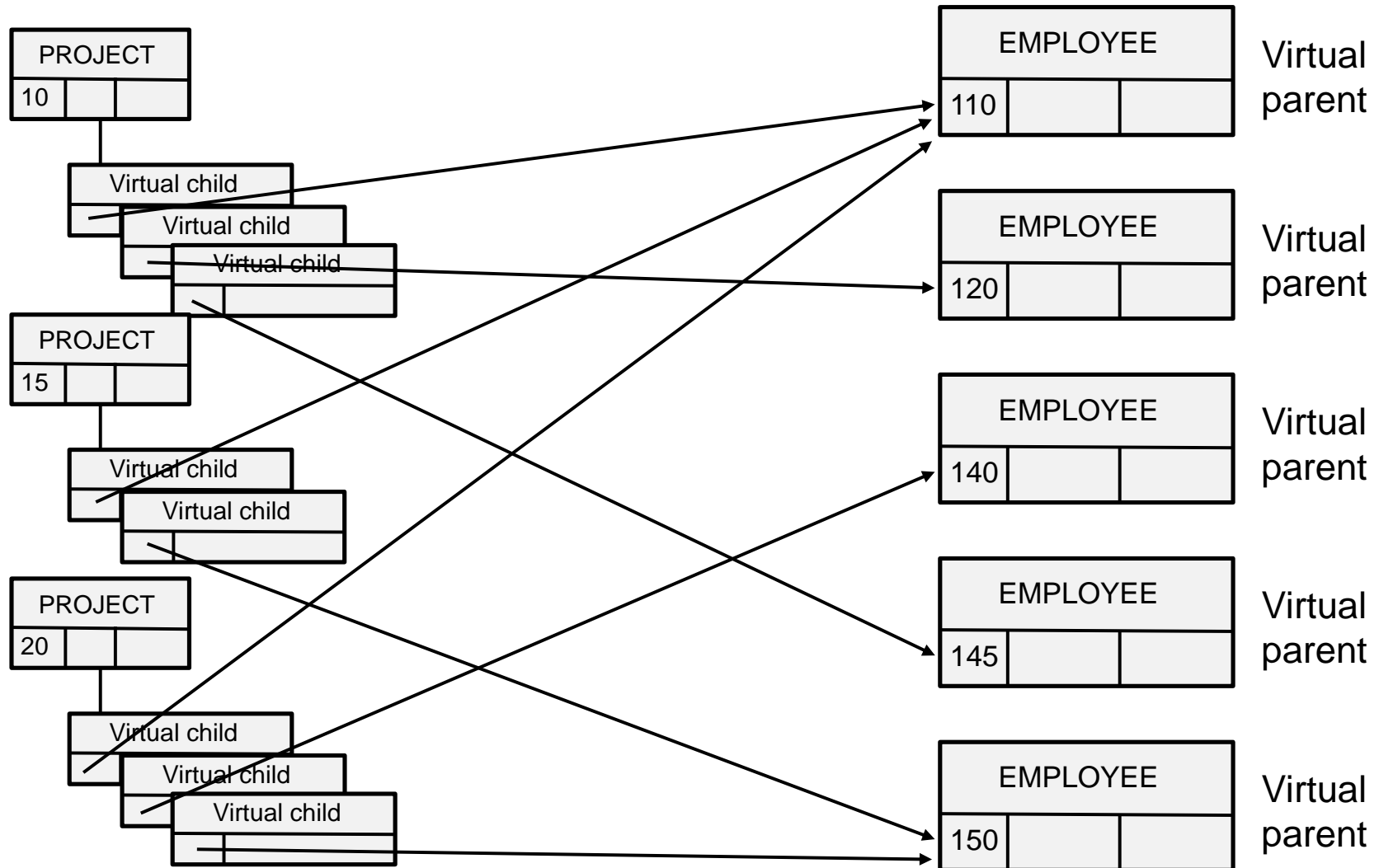
Hierarchical Model



Hierarchical Model

- Another option for an N:M relationship type is to create two hierarchical structures and connect them using a virtual child record type and a virtual parent/child relationship type
 - pointers can then be used to navigate between both structures
 - relationship type attributes can be put in the virtual child record type
 - no more redundancy

Hierarchical Model

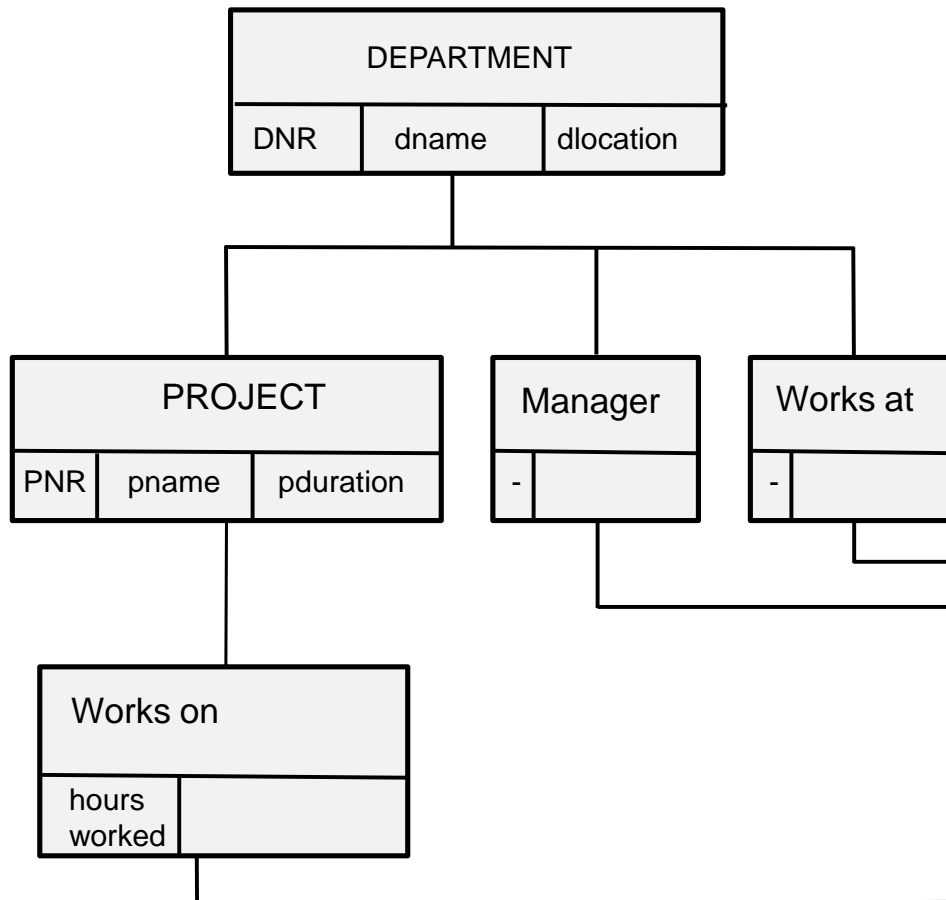


Hierarchical Model

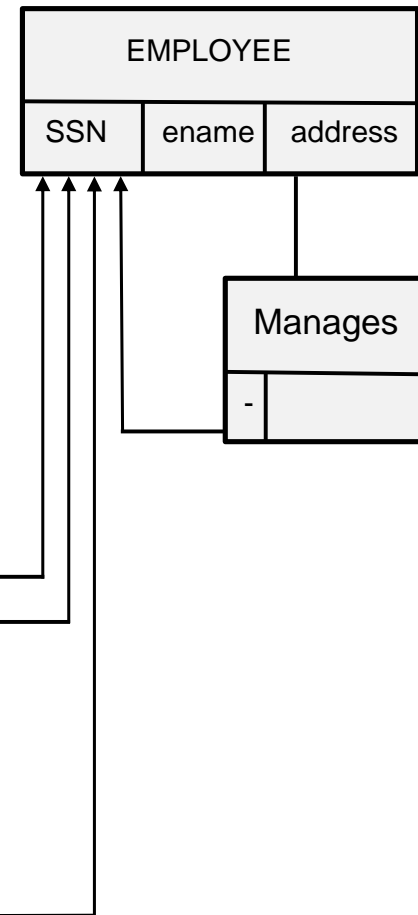
- 1:1 relationship types should be implemented in application programs
- The hierarchical model only allows relationship types of degree 2
 - Recursive relationship types or relationship types with more than 2 record types need to be implemented using virtual child record types
- A child can not be disconnected from its parent (on delete cascade)

Hierarchical Model

Hierarchical structure 1



Hierarchical structure 2



Hierarchical Model

- Model limitations
 - no guarantee that each department has exactly 1 manager
 - no guarantee that a department has at least 1 employee

CODASYL Model

- The CODASYL model was developed by the Data Base Task Group of the COnference on DAta SYstem Languages in 1969
- CA-IDMS (Computer Associates)
- Building blocks
 - record types
 - set types
- Lots of structural limitations (legacy)

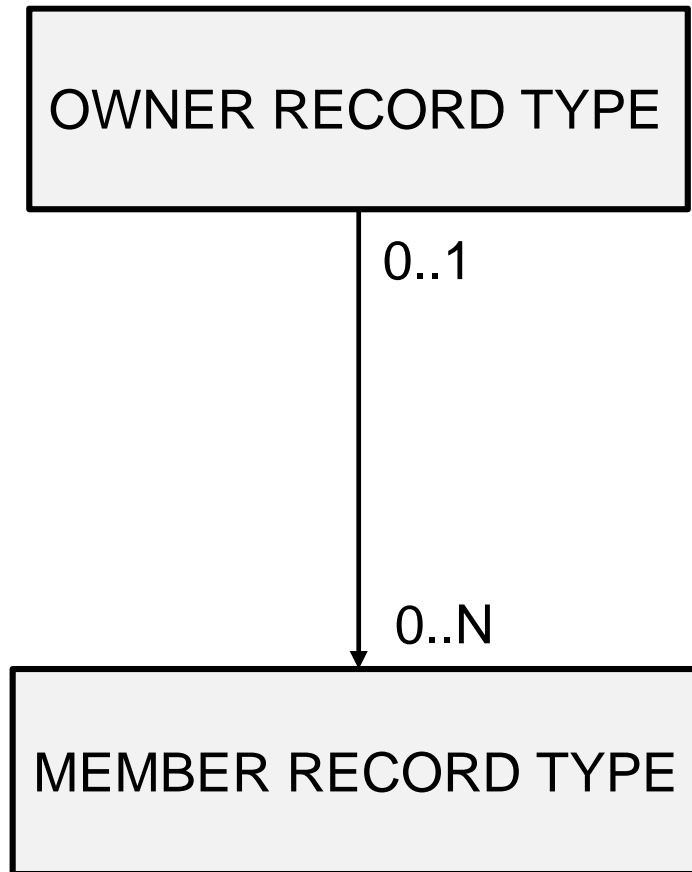
CODASYL Model

- A record type is a set of records describing similar entities and has 0, 1 or more records or record occurrences
- A record type consists of various data items
- A vector is a multivalued attribute type
 - Example: e-mail address
- A repeated group is a composite data item for which a record can have multiple values or a composite multi-valued attribute type
 - Example: address

CODASYL Model

- A set type models a 1:N relationship type between an owner record type and a member record type
- A set occurrence has 1 owner record and 0, 1 or more member records
- A CODASYL set has both owner and member records and it is also possible to order the member records (\leftrightarrow mathematical set)

CODASYL Model

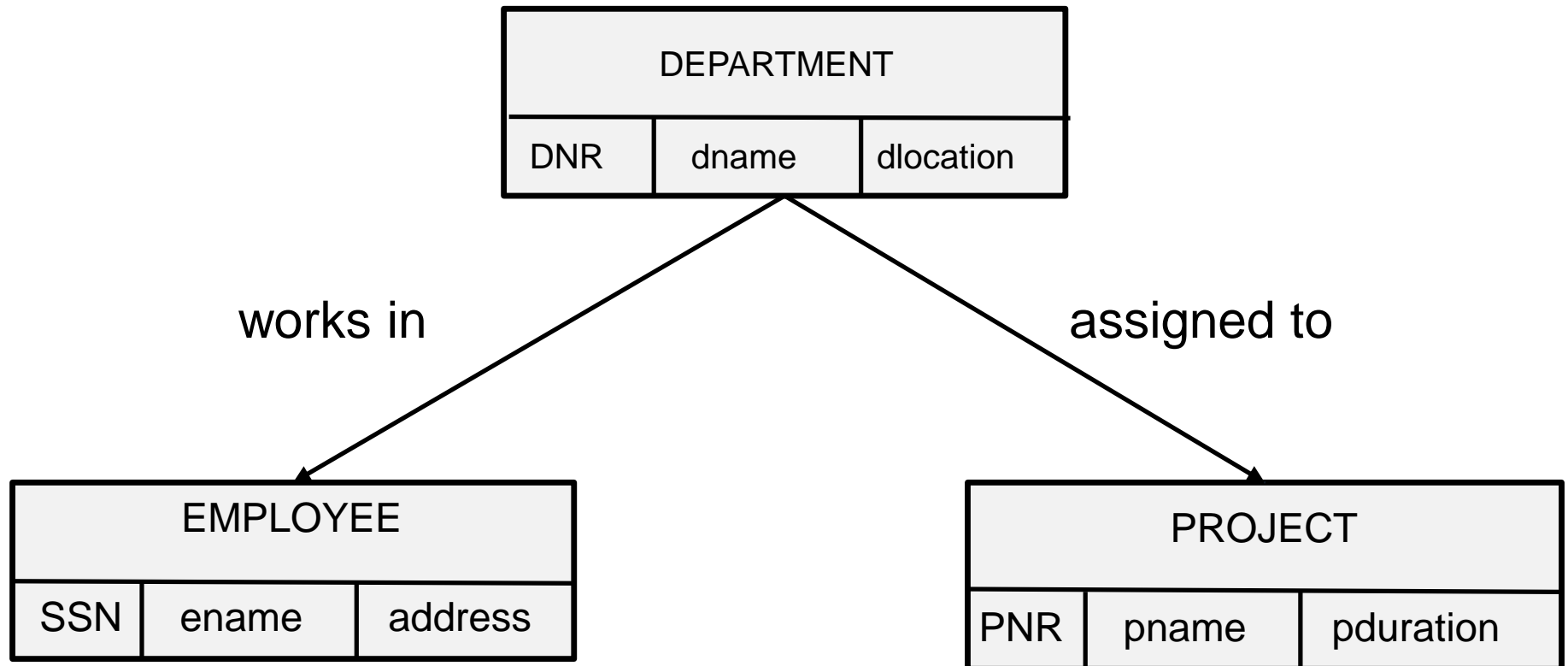


CODASYL Model

- A member record can exist without being connected to an owner record
- A record type can be a member record type in multiple set types (network structures)
- Multiple set types may be defined between the same record types

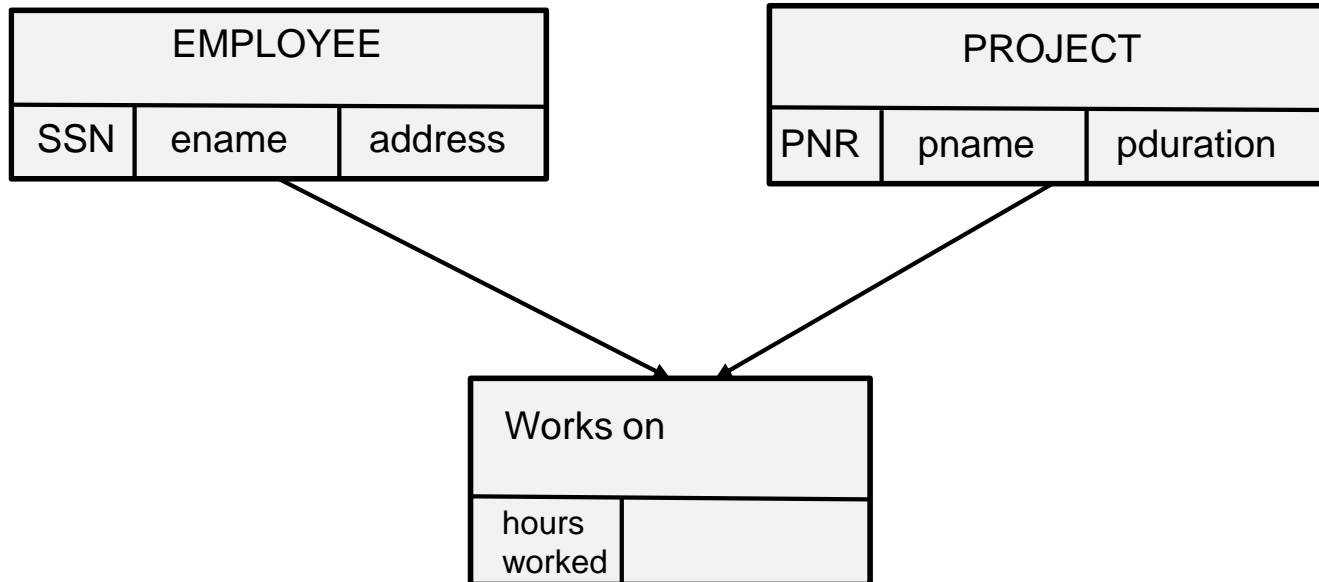
CODASYL Model

Bachmann diagram

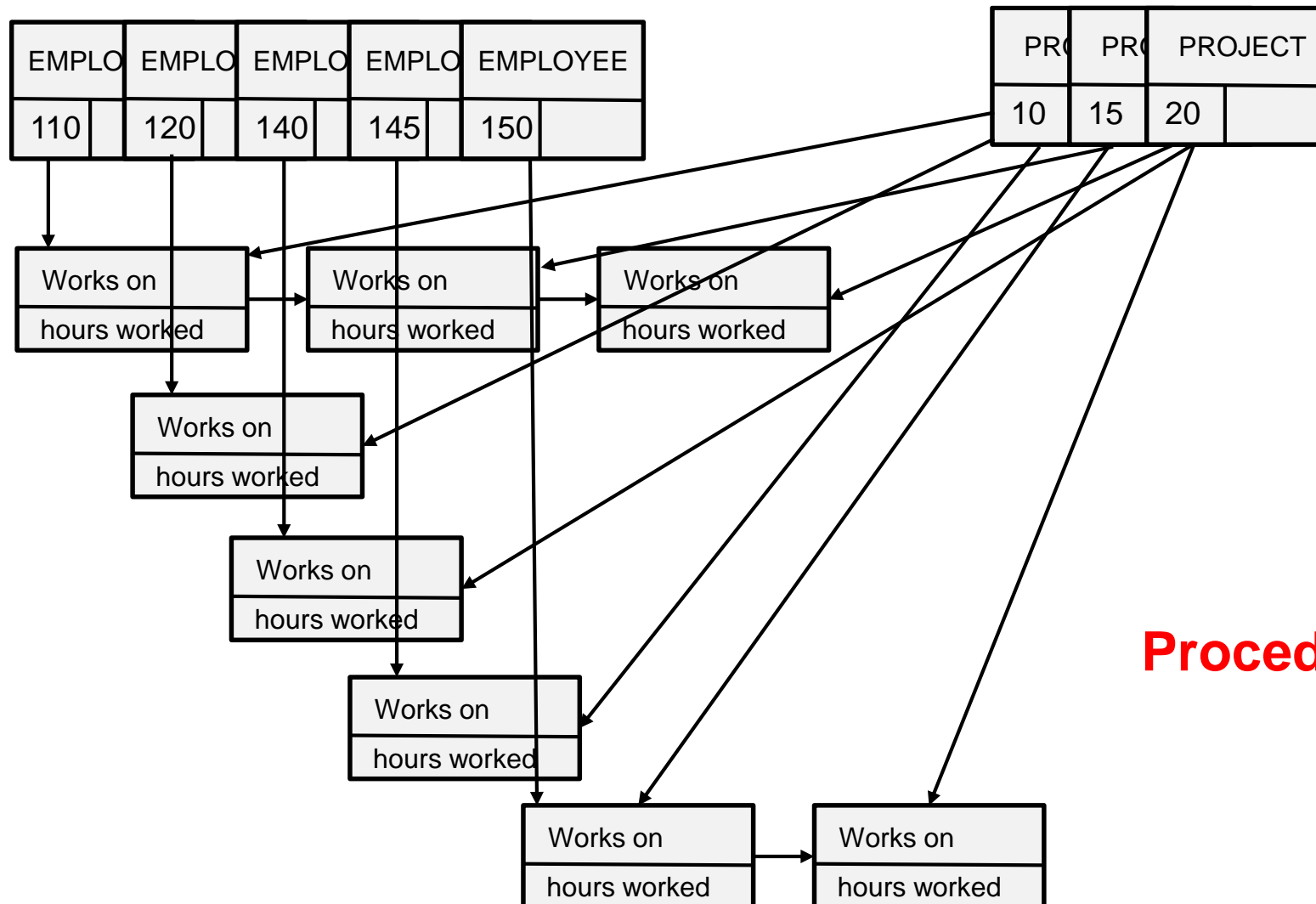


CODASYL Model

- 1:1 relationship types must be enforced in the application program
- N:M relationship types
 - introduce a dummy record type as a member record type in 2 set types having as owners the record types of the original N:M relationship type



CODASYL Model

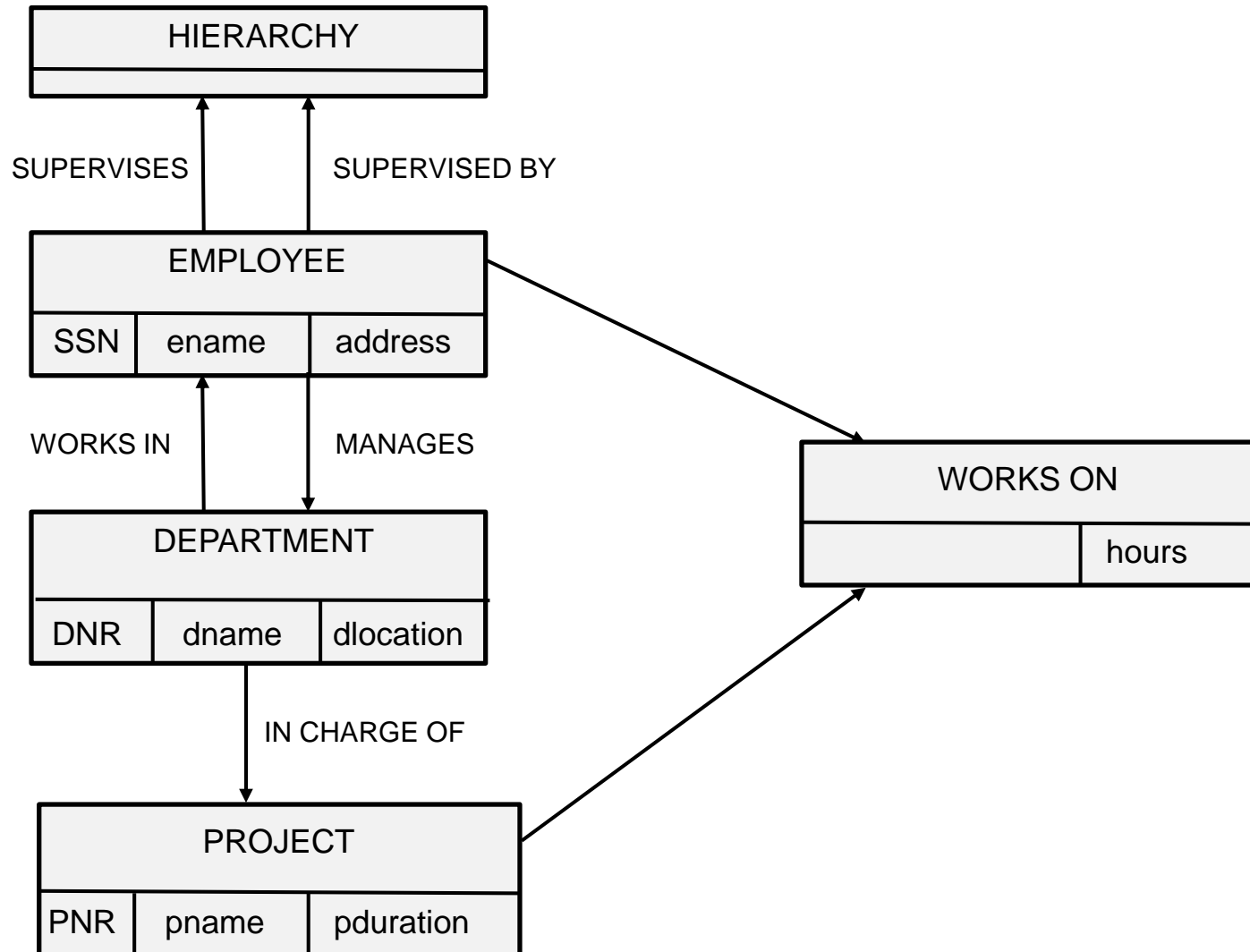


Procedural DML!

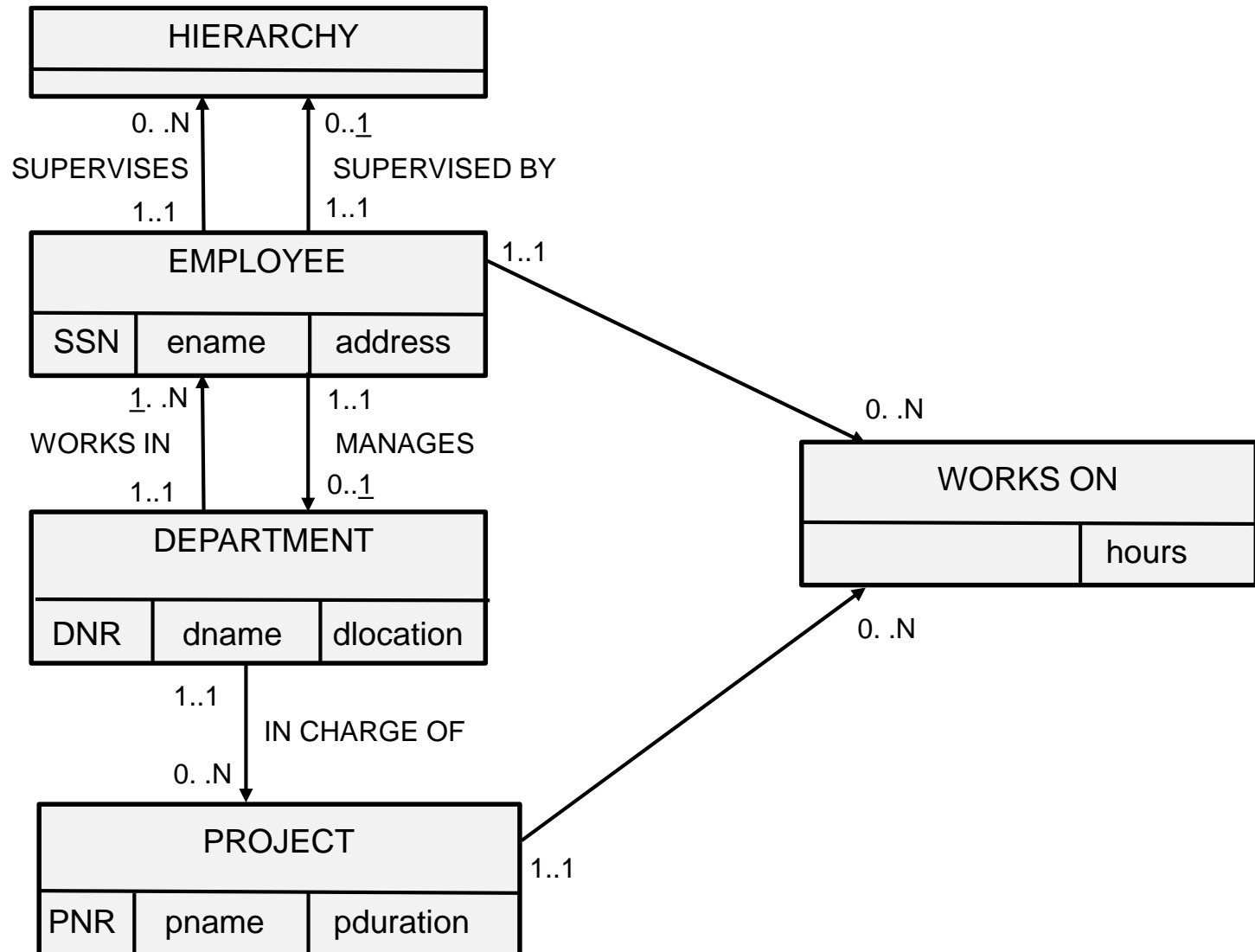
CODASYL Model

- CODASYL allows to logically order the member records of a set (e.g., alphabetically)
- System can act as the owner for the root record type (singular or system owned set type)
- No support for recursive set types
 - dummy record type needs to be introduced
- No set types with more than 2 participating record types

CODASYL Model



CODASYL Model



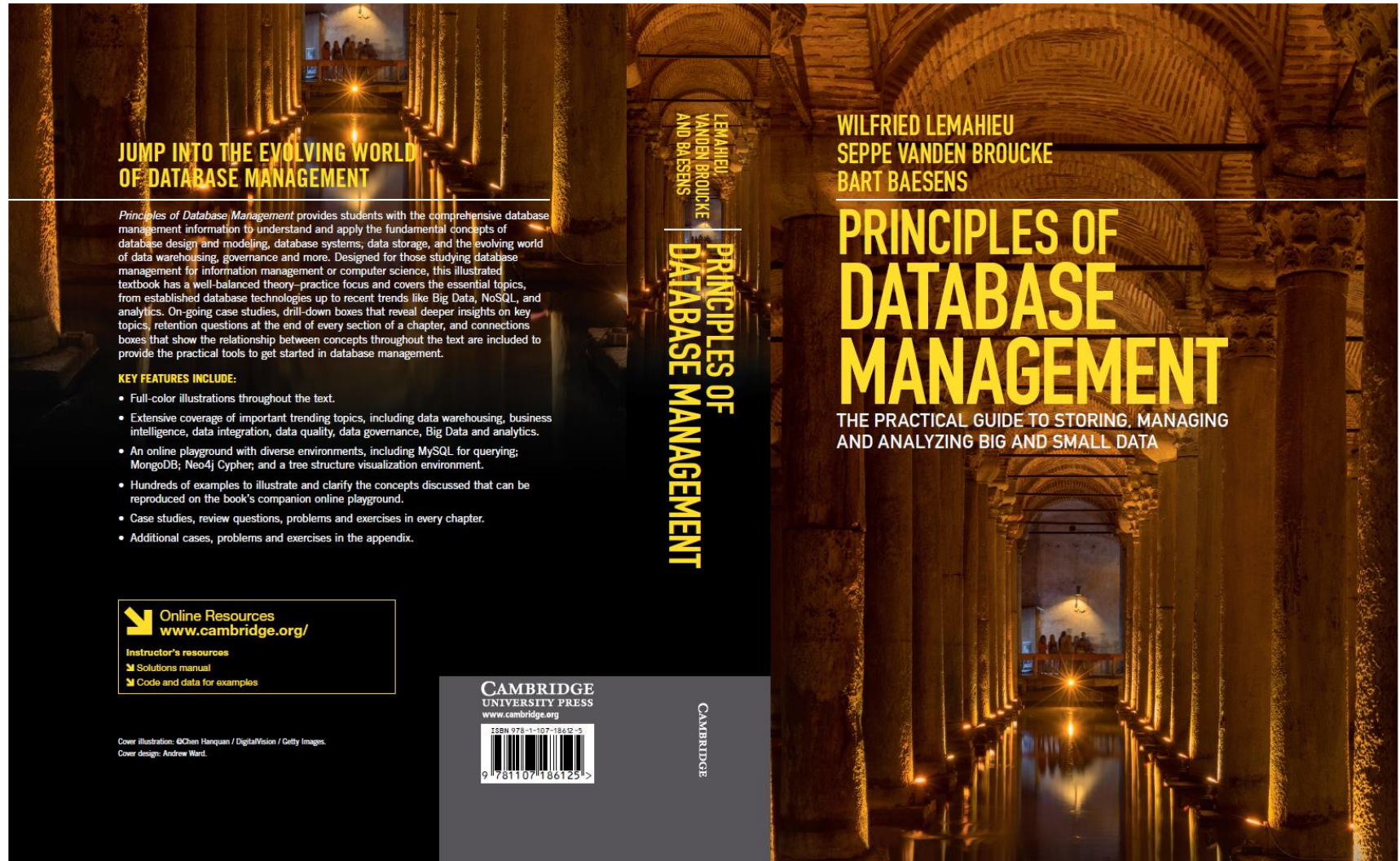
CODASYL

- Model limitations
 - an employee can be managed by multiple employees
 - no guarantee that a department must have exactly 1 manager
 - no guarantee that a department has minimal one employee

Conclusion

- Hierarchical Model
- CODASYL Model

More information?



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