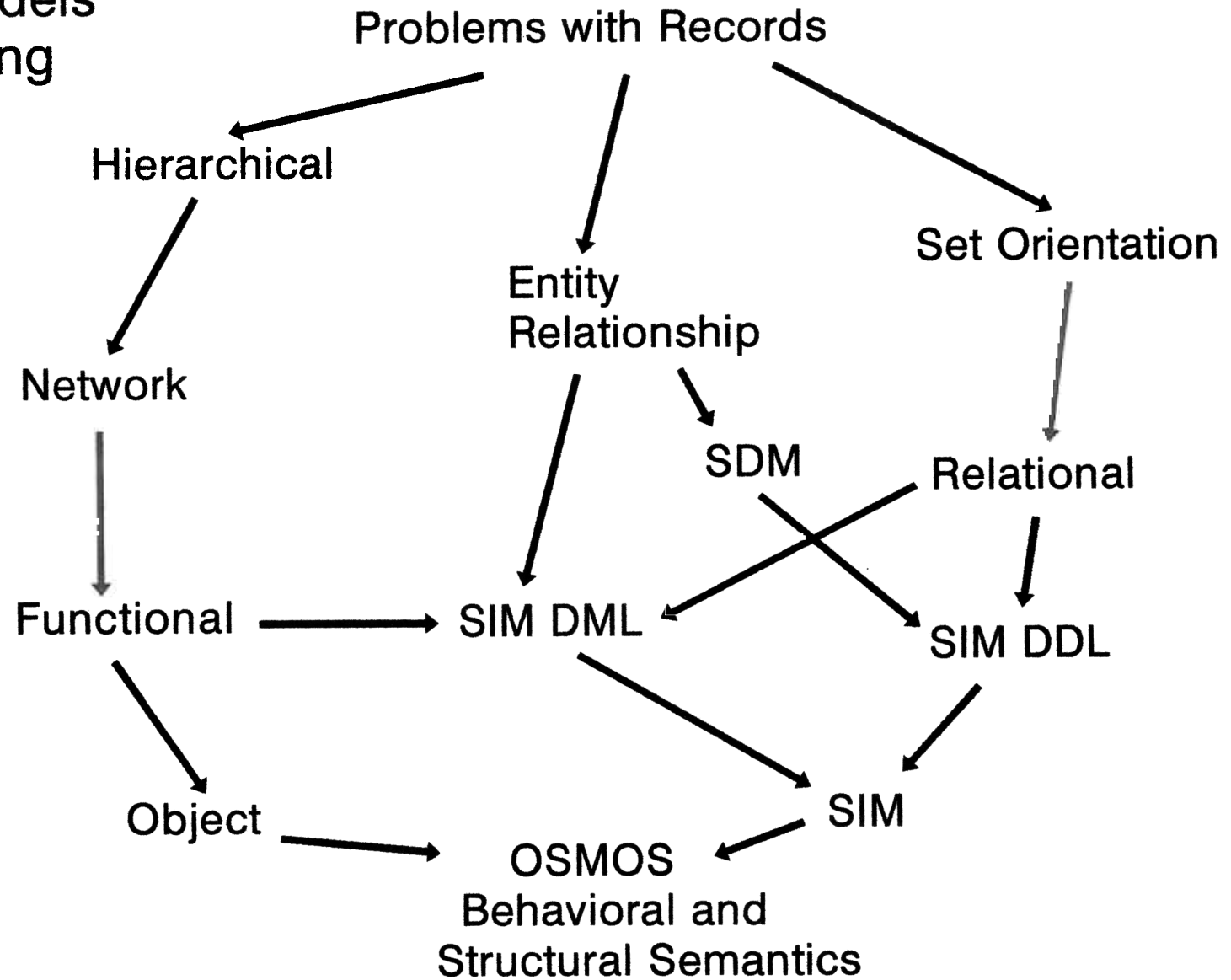


# Data Models Influencing SIM



# SIM Concepts

---

- Entity: a thing
- Class: a collection of like things  
Subclass/Superclass  
Inheritance/Generalization
- Attributes: characteristics of things  
Types  
Extended attributes  
Constraints  
Cardinality
- Generalized Verifys
- Query language

# SIM Concepts

# Classes

---

- A collection of like things
- Subclasses/Superclasses
- Multiple inheritance
- Full generalization

# SIM Concepts

# Attributes

---

- Pascal-like type mechanism
  - Primitive types: Integer, Real, Character, Boolean, Number, Time, Date, String[n], Symbolic
- Kinds
  - DVA: Data-valued Attribute
  - EVA: Entity-valued Attribute -- relationships
    - Inverse may be named, always available
- Access
  - Immediate: Name of Person
  - Inherited: Name of Student
  - Extended: Name of Assigned-Department of Instructor

# SIM Concepts

## Attributes

---

- Cardinality and Constraints

	SV	MV
DVA	Required Unique	Required Unique Max Distinct
EVA	Required Unique	Required Unique Max Distinct

## SIM Concepts

# Generalized Verifies

---

- An assertion that is always held valid  
Updates that violate a verify are rejected
- VERIFY Full-Load ON Student  
ASSERT SUM(Credits of Courses-Enrolled)  $\geq 12$   
ELSE "Student is taking too few credits";
- VERIFY Valid-Salary ON Instructor  
ASSERT Salary + Bonus  $< 100000$   
ELSE "Instructor makes too much money";

# SIM Concepts

## Query Language

---

- Perspective
  - A class of interest, a point of view
  - Binding to perspective class can be broken
- Full expression capabilities
  - Arithmetic (+, -, \*, /, MOD, DIV, ...)
  - Functions (SUM, AVE, COUNT, MIN, MAX, )
  - Quantifiers (SOME, ALL, NO)
  - Qualification (AS, CALLED, INVERSE(...))
  - Local selection (WITH)
  - Transitive closure (TRANSITIVE)
- Outer join by default
  - Inner join requires multiple perspectives

## SIM Concepts

# Retrieval Examples

---

- RETRIEVE Gpa of Student  
WHERE Name of Student = "John Doe"
- RETRIEVE Name of Student  
Title of Courses-Enrolled of Student,  
Credits of Courses-Enrolled of Student,  
Name of Teachers of Courses-Enrolled of Student  
WHERE Soc-Sec-No of Student = 456778899
- RETRIEVE Title of TRANSITIVE(Prerequisite) of Course  
WHERE Title of Course = "Calculus I"
- FROM Course  
RETRIEVE COUNT DISTINCT (TRANSITIVE(Prerequisite))  
WHERE Title = "Quantum Chromodynamics"



# SIM Concepts

# Update

---

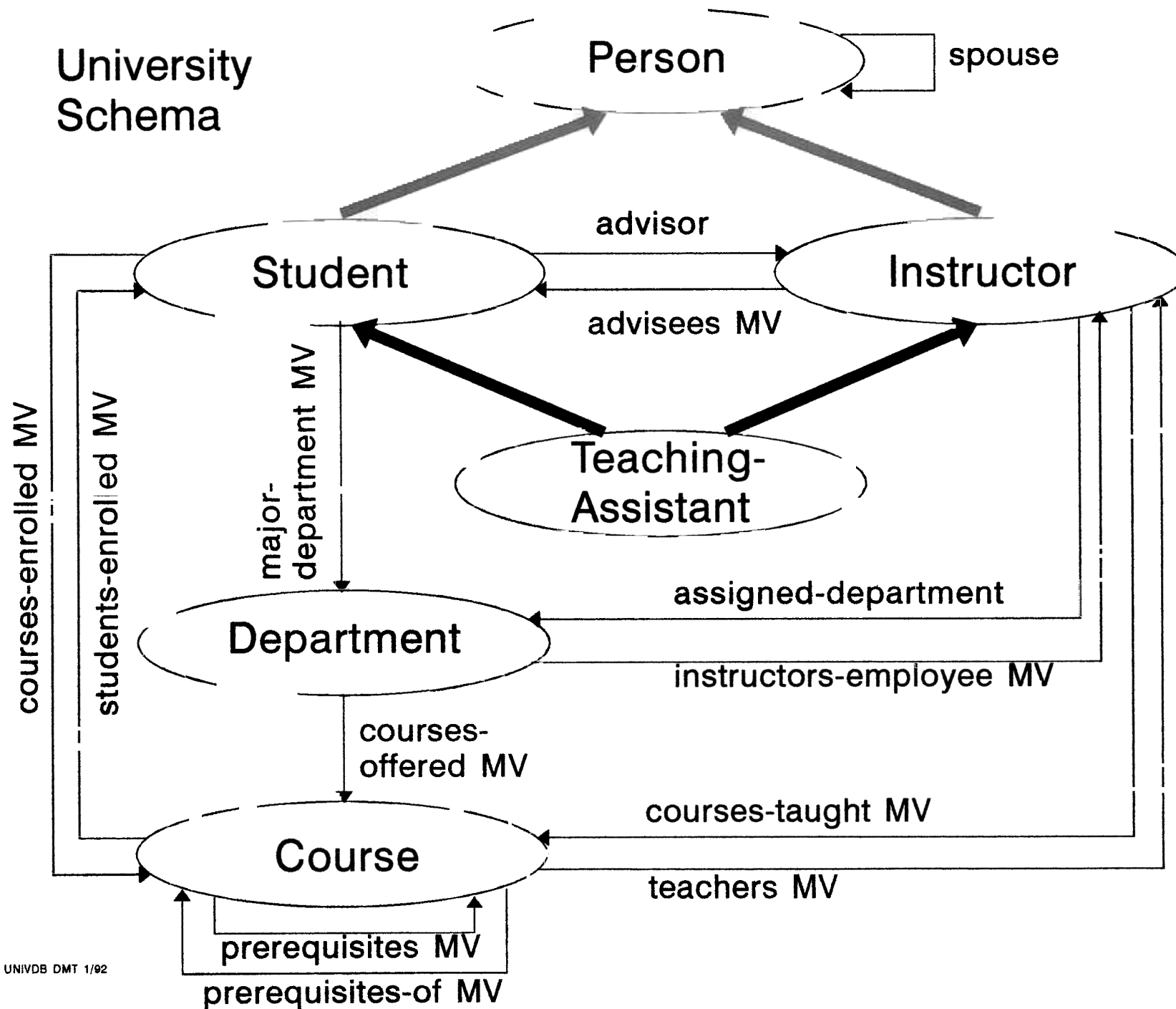
- Full integrity enforced
  - Data type integrity
  - Referential integrity
  - Verifies
- Types of update
  - INSERT Add new entity
  - INSERT FROM Add existing entity to subclass
  - MODIFY Change existing entities
  - DELETE Remove existing entities

# SIM Concepts

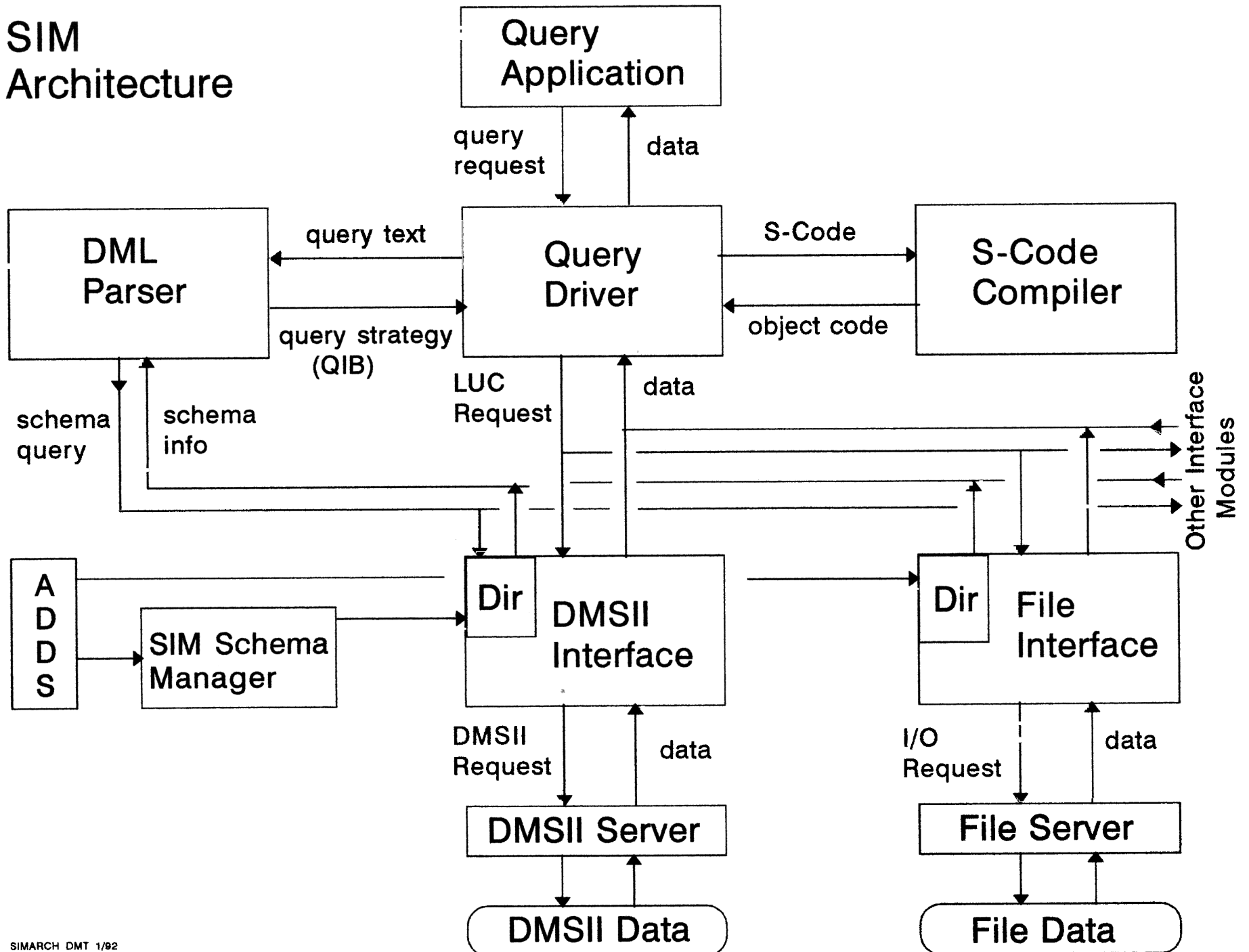
## Update Examples

---

- **INSERT Student**  
(Name := "John Doe", Soc-Sec-No := 456778899,  
Courses-Enrolled := INCLUDE Course WITH (Title = "Algebra I"))
- **INSERT Instructor**  
FROM Person WHERE Name = "John Doe"  
(Employee-Nbr := 1729)
- **MODIFY Instructor** (Salary := 1.1 \* Salary)  
WHERE COUNT(Courses-Taught) of Instructor > 3 AND  
Assigned-Department NEQ SOME(Major-Department of Advisees)
- **DELETE Student**  
WHERE Name = "John Doe"



# SIM Architecture



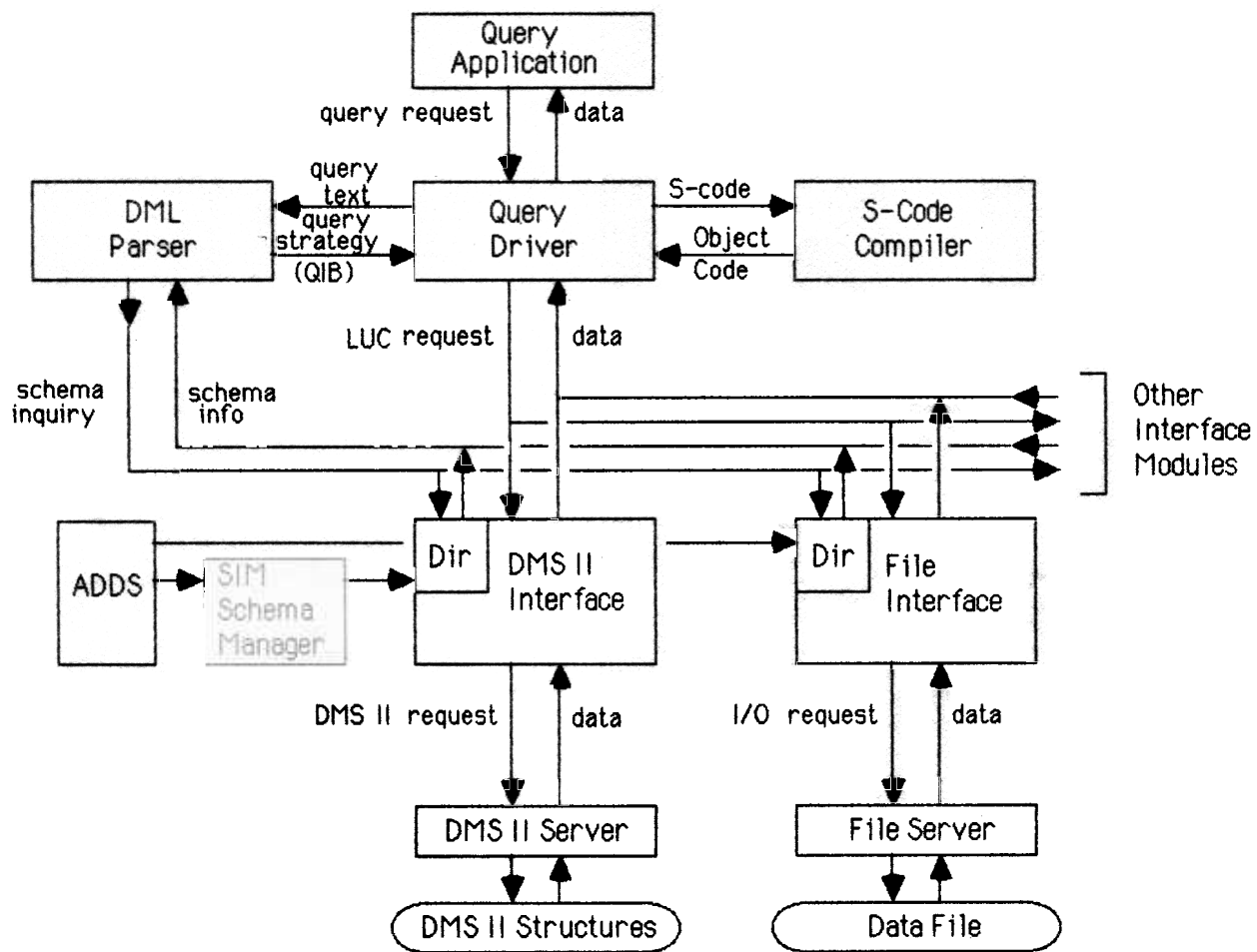


Figure 2

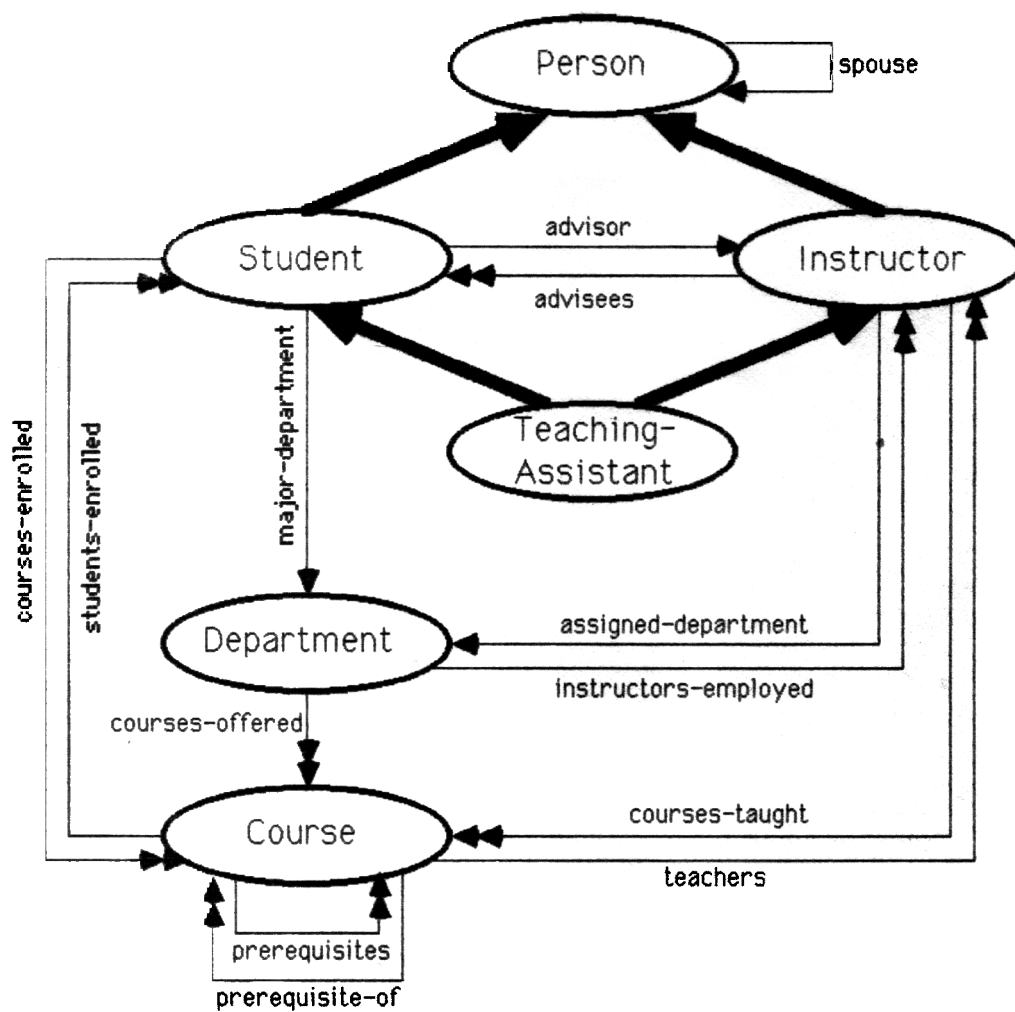


Figure 3