

ENRS: an Object Oriented Approach

By Faris Kateb

What is ENRS?

- * ENRS(Electronic Nursing Record System)
 - * Computer-based documentation associated with nursing care
 - * It will be the cornerstone of a new way of managing nursing information
 - * data collected at the point of care can be used to assist nursing care at all levels of aggregation
- * Nursing terminology
 - * The need of standardized terminology
 - * Facilitate the description, comparison, and communication of nursing-care activities across settings, population groups, and countries

Presentation Purpose

- ✱ How object-oriented analysis and design can be used in developing and implementing a terminology-based electronic nursing record system (ENRS).
- ✱ How to design domain models and implement a model database that allows greater expressiveness and reuse of data.
- ✱ this study can be used to improve a multidisciplinary development team's understanding of the functions and data processing procedures in the design and development stage, as well as of future maintenance procedures.

Introduction

- * the main problem in ENRC
 - * how to transform information from concepts in the nurses' minds to codes in the computer's database
- * Current solution
 - * nursing information systems enter and retrieve structured data using so-called interface terminologies–terminologies
 - * unavailable to share
 - * has not authority levels

What terminologies we have ?

- ✱ International Classification for Nursing Practice (ICNP) by International Council of Nurses (ICN)
- ✱ Difficult to use directly and becomes a barrier to acceptance by nurse users

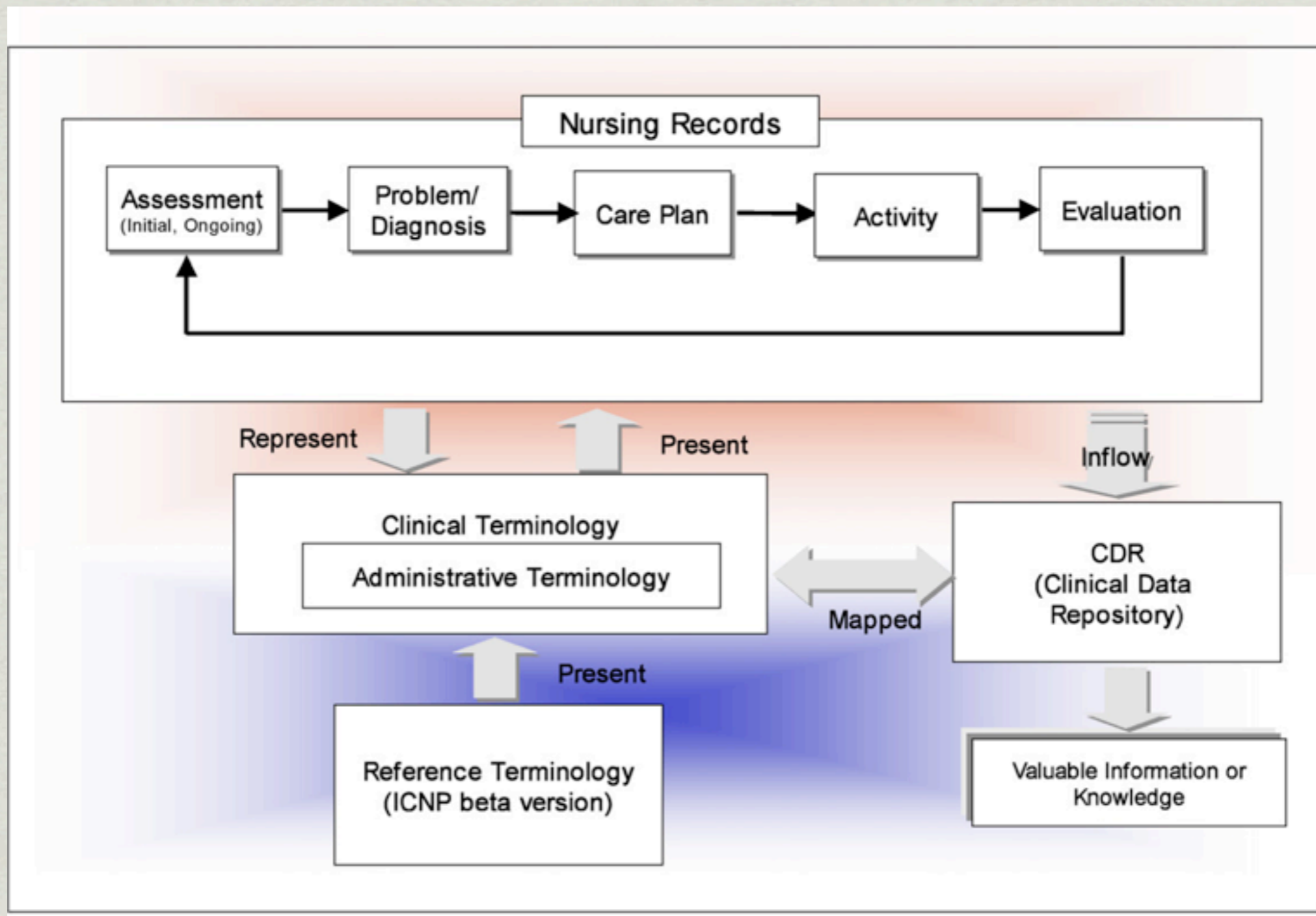
The Study:

The initiation of an ENRS design

- * The study experiment:
 - * By the Department of Nursing at the Seoul National University Hospital
 - * Nursing information model
 - * Six nurse managers
- * They decided to use standard nursing terminology
 - * To make it easy for nursing applications to be adapted
 - * Nursing data such as quality improvement, decision support, and comparison of nursing services.

The Study:

The initiation of an ENRS design



The Study:

The initiation of an ENRS design

- * The figure has:
 - * Data flow between the front-end and back-end of ENRS
 - * “Nursing Records” shows the nursing process.
 - * The components and roles of a terminology server and a clinical data repository

The Study:

The initiation of an ENRS design

Table 1 – Nursing data views for an electronic nursing record system

Data view	Information content	Target nursing unit
Admission nursing assessment	Demographics, admission information, history (health, illness, family, obstetric, menstruation, and immunization), physical assessment, and education	Inpatient units
Graphic record	Vital signs, admission or post-operation day, bowel movements, diet, activity, and input and output	Inpatient units
Flow sheet	Vital signs, admission or post-operation day, diet, position, input and output, medication, ventilator settings, signs and symptoms of respiration, gastrointestinal tract, wounds, consciousness, and skin integument, laboratory, and imaging tests	Intensive care units: MICU, NICU, SICU, and RICU
Nursing notes	Nursing process	Inpatient and outpatient units
Preoperative check list	Patient ID, nursing activities, and education	Surgical, and obstetric and gynecologic units
Nursing discharge plan	Discharge care plan, medication education, and future appointments	Inpatient units
Operating room nursing record	Operating room staff, procedures, operating time, anesthesia, materials used, and medication	Operating room
Nursing order check list	Nursing orders	Inpatient units

MICU, NICU, SICU, and RICU stand for medical intensive care unit, neonatal intensive care unit, surgical intensive care unit, and respiratory intensive care unit, respectively.

Types of Terminology

- * Three types of Terminology
 - * Clinical
 - * Administrative
 - * Reference
- * ICNP terminology was used in the study, which consist
 - * Nursing diagnosis
 - * Nursing activities
 - * Nursing outcomes

The Study: Object-oriented system design

- * Why we need OOP in healthcare system?
 - * Clinical data and the rules for manipulating the data are built within the applications.
 - * Nursing information is shared by other applications e.g.
 - * Clinicians with various professional orientations
 - * Different software modules of the system were created to access and manipulate the same data
 - * Changes in requirements and system growth prefer Object-Oriented more than Algorithmic perspective .
 - * High costs of maintain data consistency because of Complications in the health care systems.

The Study: Object-oriented system design

- * GOAL

- * Clearly separate data from the applications that manipulate them.
 - * e.g. hospital front desk and insurance section

- * HOW

- * Allocating the data to a specific class of data objects that protects it (encapsulating principle)
- * An example of data that have to be encapsulated
 - * Patient's diagnose and symptom that taken by a nurse should be prevented from other system's users such as people at hospital reception.

The Study: Object-oriented system design

- * To perform operations
 - * Messages (commands) used by objects
 - * Objects includes methods (functions)
 - * Object's states are changed (attributes or data values)
- * Limit the access to these objects (private methods) and “authorized” object
 - * It includes methods ensures accessing to objects are accuracy and consistency.
- * the object-oriented technique well suited to the design and development of complex applications

Participants

- * Different stakeholders and different authority
 - * nurses
 - * nurse managers
 - * analysts
 - * Developers
 - * System integrators
 - * project managers

UML and RUP

- * Unified Modeling Language (UML) (not used in the study)
 - * To specify the system components and their behavior
 - * UML is not a standard for the development process, but a standard for the artifacts of development
- * Rational Unified Process (RUP)
 - * improving UML to be wide range of projects and organizations
 - * RUP has four phases:
 - * Inception, elaboration, construction, and transition

RUP four phases

- ✦ **Inception:**

- ✦ Establish a system and identify the beneficiaries

- ✦ **Elaboration:**

- ✦ Determine requirements and establish an architectural baseline

- ✦ **Construction:**

- ✦ Check the built system and see other iterations

- ✦ **Transition:**

- ✦ Evaluate and use the system by end user

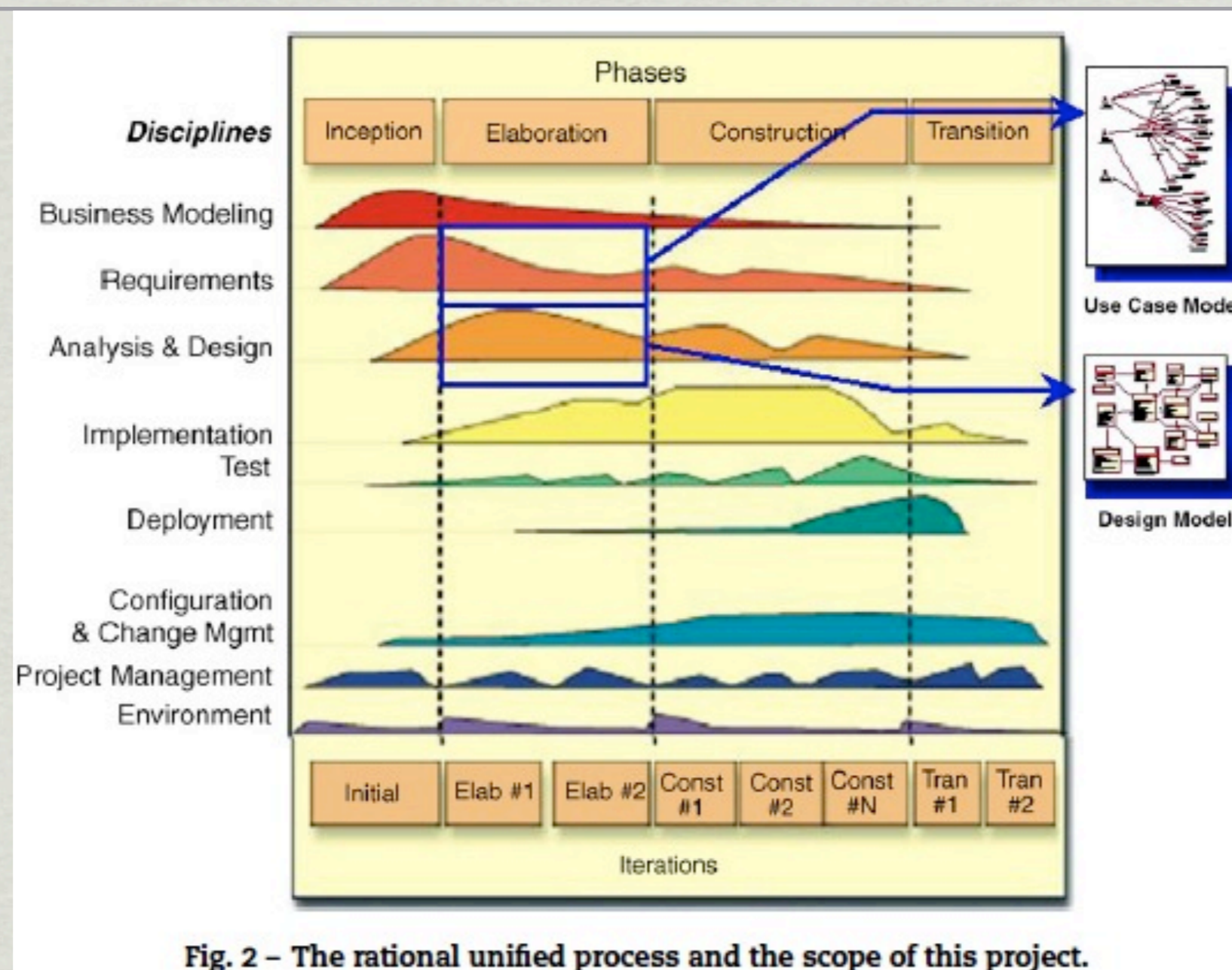


Fig. 2 - The rational unified process and the scope of this project.

- ✱ The study main focus was on requirements and (analysis and design) on the Elaboration phase
- ✱ The study create a case, activity, and class diagram as we will see next slides.

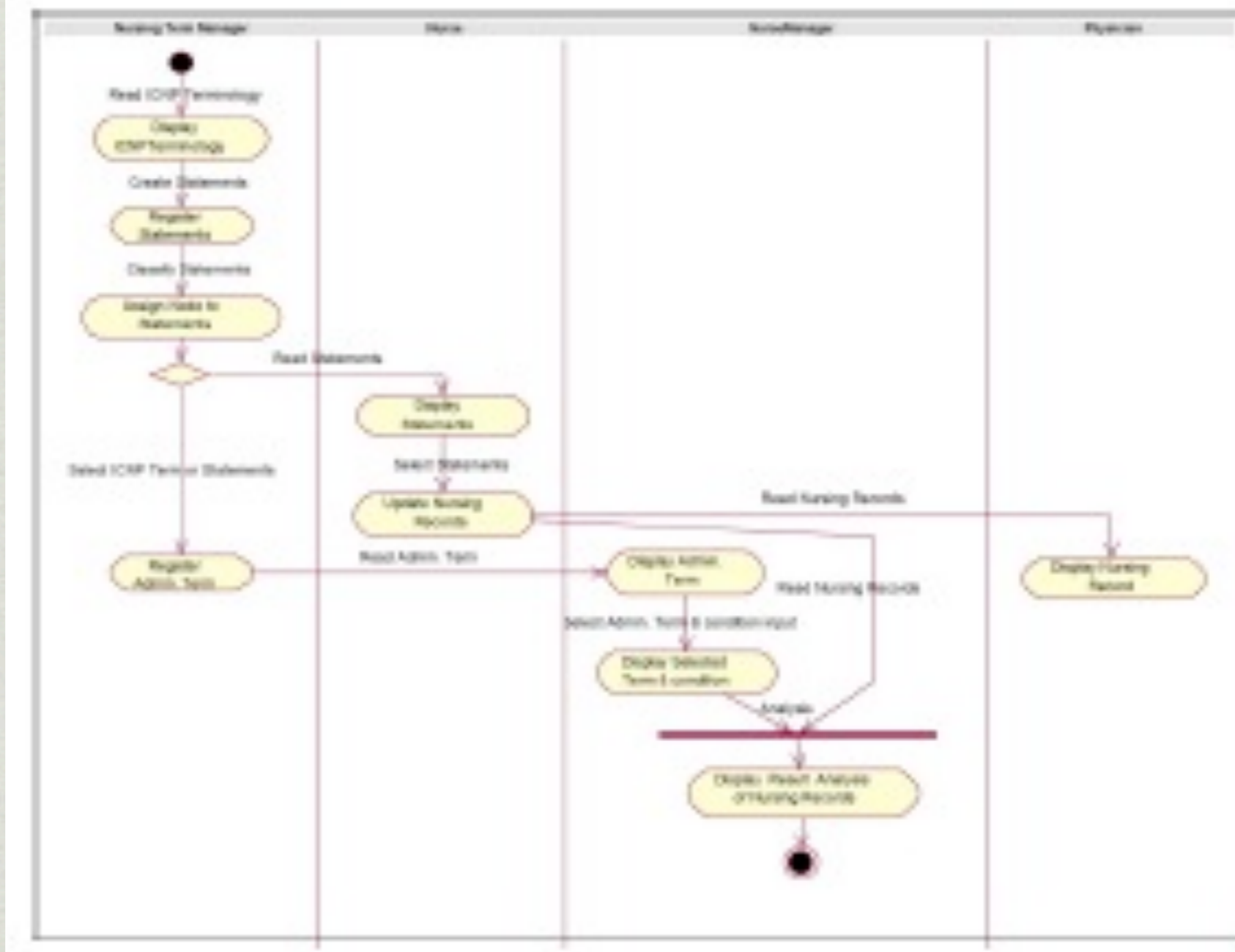
Beside RUP

- ✱ Case models

- ✱ To identify what the system is supposed to do and the system environment.

- ✱ Class diagrams

- ✱ As a design model describing the realization of the use cases



- * Activity diagram

- * show one of the sequence of activities in the scenario of nursing note taking

- * Activities and information exchange

- * Define potential use cases

The Study: Object-oriented system design

- * We identify the relationships between classes
- * We have internal and external class diagram for the system.
- * External:
 - * How to exchange information outside the ENRS
- * Internal view
 - * Deal with elements from the ENRS only

Use Cases

- ✱ shows the behavior of
- ✱ a nurse
- ✱ a nurse manager
- ✱ a physician
- ✱ and the relationship of
- ✱ 8 use cases for a nurse
- ✱ 6 for a nurse manager

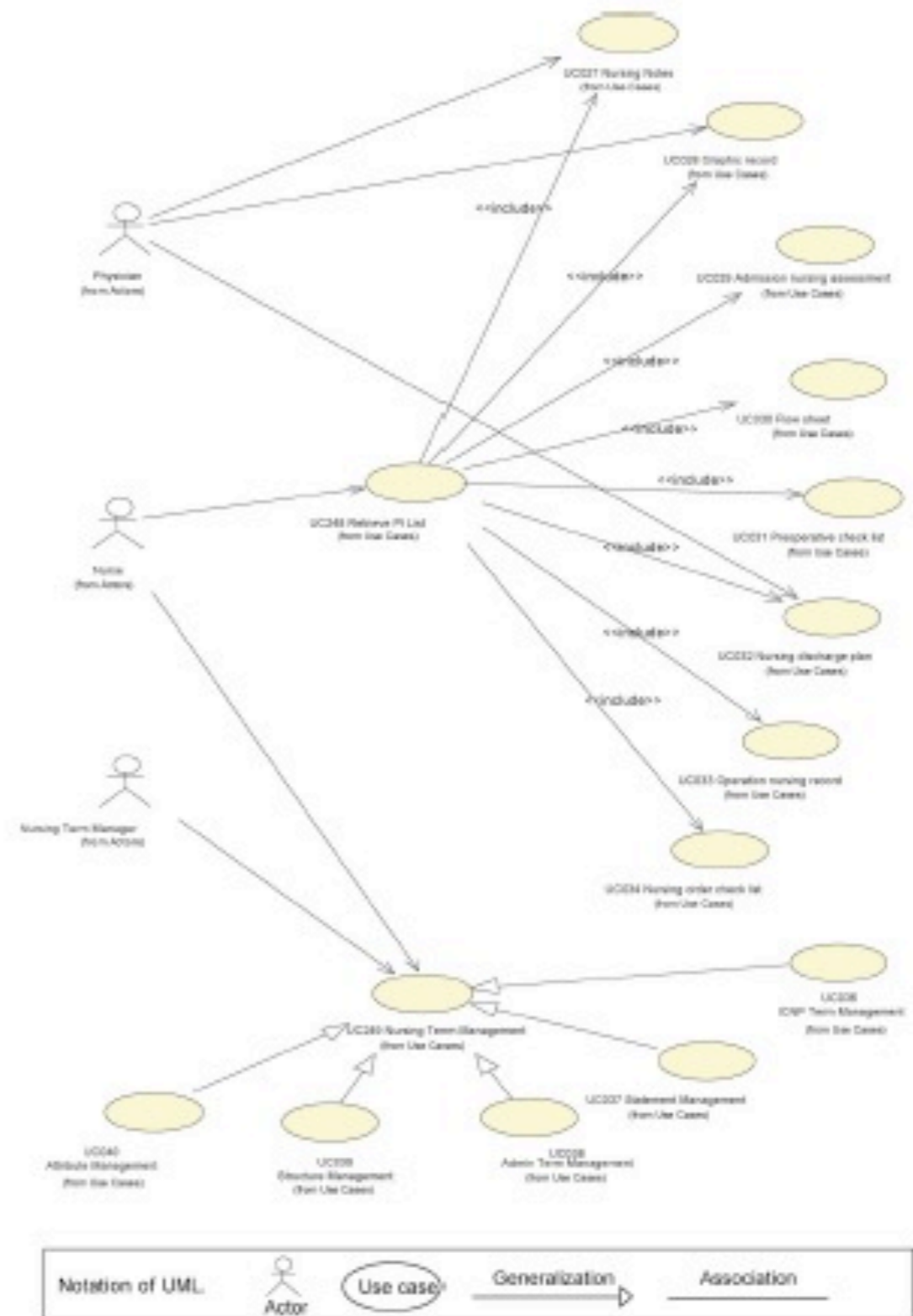


Fig. 3 - Use case diagram of the ENRS.

Use Case Description

- ✱ Describe the scenario's actions
 - ✱ came from stories and identified use case properties
- ✱ Use Case Description includes:
 - ✱ name, a brief description, the event flows, alternative flows, special requirements, and the pre- and postconditions

1. Maintaining Nursing Notes

1.1. Brief Description

This use case allows the nurse to maintain nursing notes for each patient in the ENRS, including adding, modifying, or deleting single episodes of the ?Nursing Notes? use case.

1.2. Flow of Events

1.2.1. Basic Flow

This use case starts when the nurse wishes to add, change, and/or delete one record of the ?Nursing Notes? in the system.

1. The system requests that the nurse specifies the function he or she would like to perform (add a new record, modify a record, or delete a record).
2. Once the nurse provides the requested information, one of the following subflows is executed:
 - If the nurse selected "add a new record", the **Add a New Record** subflow is executed.
 - If the nurse selected "modify a record", the **Modify a Record** subflow is executed.
 - If the nurse selected "delete a record", the **Delete a Record** subflow is executed.

1.2.1.1. Add a New Record

The system requests that the nurse enter the ?Record Time?, which comprises the year, month, date, hour, and minute.

1. Once the nurse provides the requested information, the system generates and assigns a unique ID to the record. The system opens a new input window with the navigation tree of a controlled statement, and is ready for input.
2. The system registers the ID of a controlled statement that the nurse selected from the statement navigation window.
3. The system provides the attribute list of the registered statement.
4. The nurse enters the values of the attribute list.
5. The nurse may repeat steps 3 to 5 for different statements.
6. The system registers the statements in the order of entry as a record unit.
7. The nurse notifies the system that the input is completed.
8. The system waits for the signal from the nurse.

1.2.1.2. Modify a Record

1. The system requests that the nurse select the record.
2. When the nurse selects the record, the system retrieves and displays it on the window for input.
3. The nurse makes the desired changes to the record, including any of the information specified in the **Add a New Record** subflow.
4. Once the nurse updates the necessary information, the system updates the record.

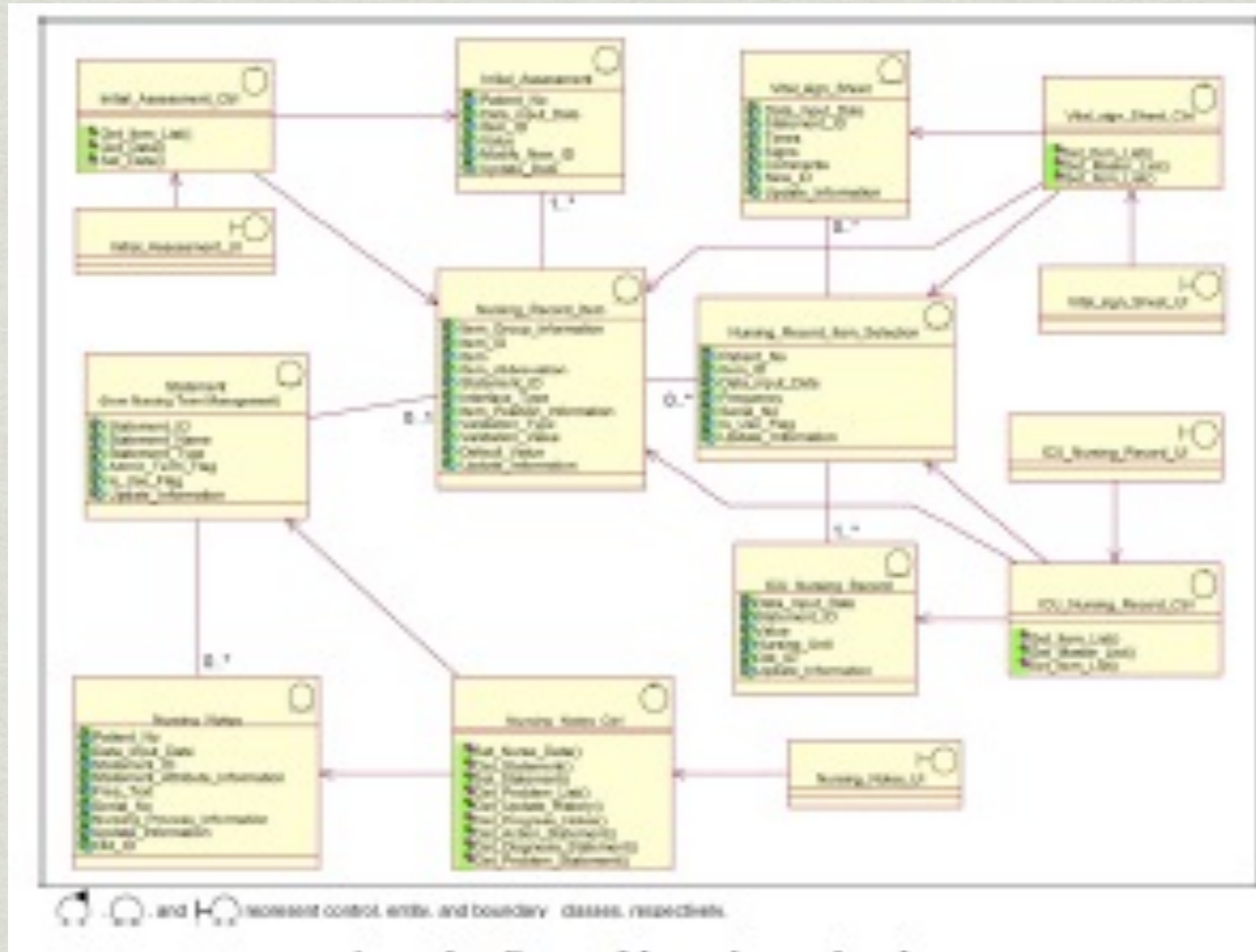
.....

Friday, April 1, 2011

The authorization required to add, modify, or delete a record.

- The system logs for tracing changes to a record.
- The requirement for a digital signature for legal reasons.

Design View Nursing Records



Friday, April 1, 2011

Shows the functional requirements of the system

Design View Nursing Records

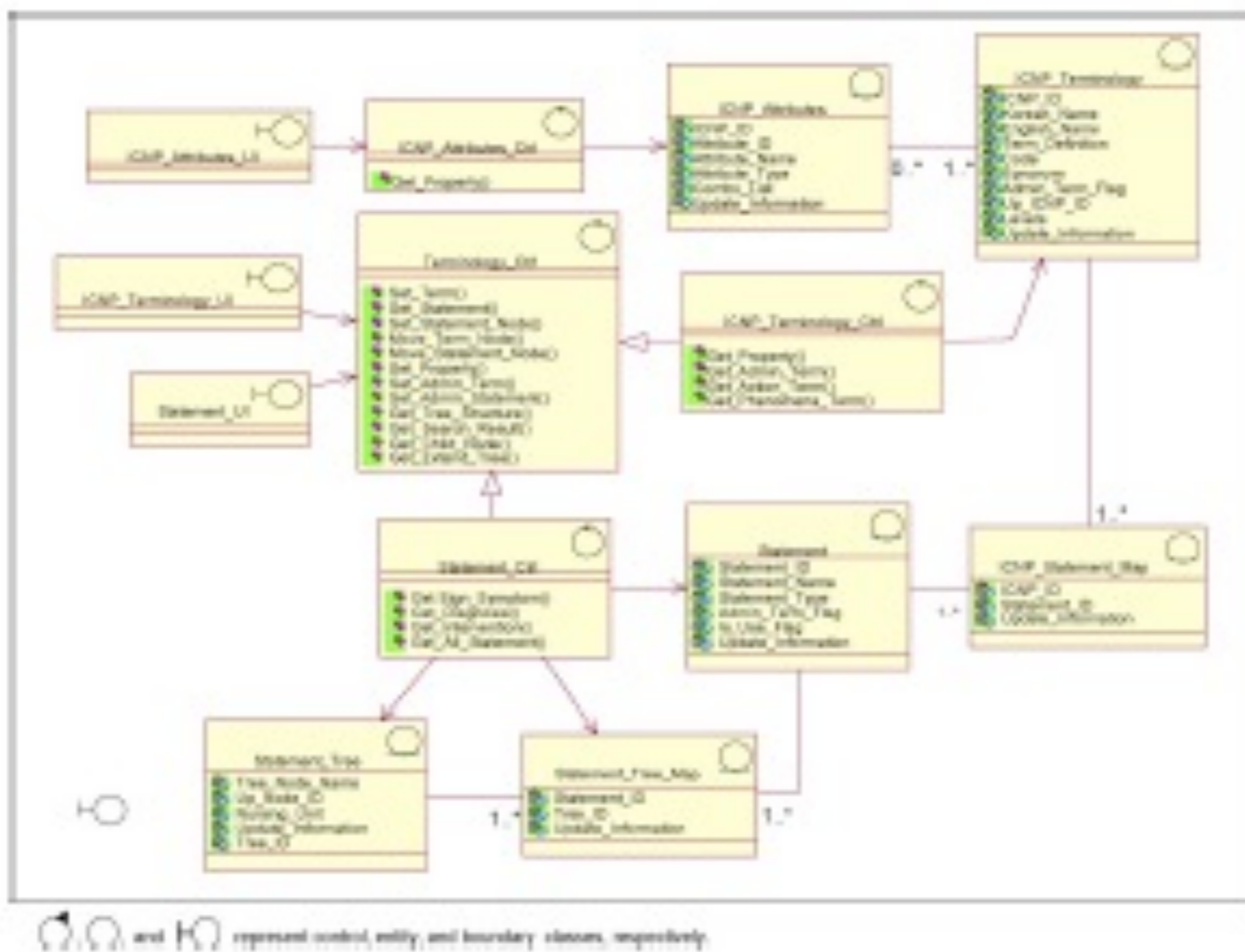
- * it describes
 - * entity, boundary, and control classes
- * which used in
 - * database table schema, user interface, and data processing
- * Classes
 - * Initial_Assessment
 - * Vital_sign_Sheet
 - * Nursing_Notes
 - * ICU_Nursing_Record

Friday, April 1, 2011

Initial_Assessment: 'preoperative check list', 'nursing discharge plan', and 'operating room nursing record'

Design View

Nursing Term Management



Friday, April 1, 2011

The Statement Tree class is introduced to help navigate the statements in each nursing unit.

Design View

Nursing Term Management

- * the above figure includes
 - * Six entity classes
 - * Three boundary classes
 - * Four control classes
 - * and the Relationships between them.

Conclusion

- ✱ By using Object Oriented techniques:
 - ✱ Shows how to overcome the problems in the implementation phase by using of OOAD, UML, and RUP) in the implementation phase.
 - ✱ How it will be easy to exchange the information with third parties.
 - ✱ How to protect information internally and eternally by using encapsulation.
- ✱ The Topic shows:
 - ✱ Importance of create standard terminology in the implementation of an electronic nursing record system.
 - ✱ Nursing data are traditionally recorded in both structured and free-text formats, which make it difficult to implement an ICNP-based ENRS.

Reference

- * “Modeling a terminology-based electronic nursing record system: An object-oriented approach”
 - * international journal of medical informatics 7 6 (2 0 0 7) 735–746
- * By :Hyeoun-Ae Park, InSook Cho, NamSoo Byeun
 - * College of Nursing, Seoul National University, Seoul, South Korea
 - * Department of Nursing, College of Medicine, Inha University, 253 Younghyun-dong Nam-gu, Incheon 402-751, South Korea
 - * EzCareTech, Seoul, South Korea

Question or Comment

Electronic Nursing Record System: An Object-Oriented approach

- * using Object Oriented techniques in ENRS:
 - * Shows how to overcome the problems in the implementation phase by using of OOAD, UML, and RUP) in the implementation phase.
 - * How it will be easy to exchange the information with third parties.
 - * How to protect information internally and eternally by using encapsulation.
- * The Topic shows:
 - * Importance of create standard terminology in the implementation of an electronic nursing record system.
 - * Nursing data are traditionally recorded in both structured and free-text formats, which make it difficult to implement an ICNP-based ENRS.