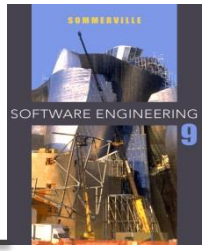
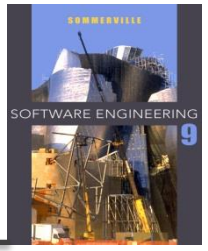



# Chapter 5 – System Modeling

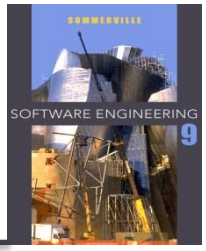
Lecture 1

# Topics covered




1. Context models
2. Interaction models
3. Structural models
4. Behavioral models
5. Model-driven engineering

# Introductory Slides: System modeling

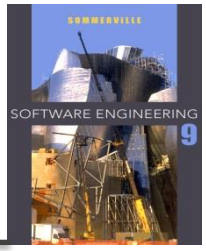



- System modeling is the process of developing abstract models of a system, with each model presenting a different **view** or perspective of that system.

- System modeling has now come to mean representing a system using some kind of **graphical notation,** which is now almost always based on notations in the Unified Modeling Language (UML).

- System modeling helps the analyst
  - to **understand** the functionality of the system and
  - models are used to **communicate** with customers.

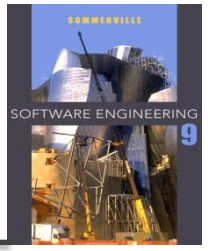
# Existing and Planned System Models




- Models of the **existing system** are used during requirements engineering.
  - They help clarify what the existing system does and can be
  - used as a basis for discussing its strengths and weaknesses.
  - These then lead to requirements for the new system.
- Models of the **new system** are used during requirements engineering to help explain the **proposed requirements** to other system stakeholders.
  - Engineers use these models to discuss design proposals and
  - to document the system for implementation.

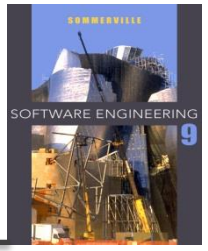
- In a model-driven engineering process, it is possible to generate a complete or partial system implementation from the **system model.**

# System Perspectives



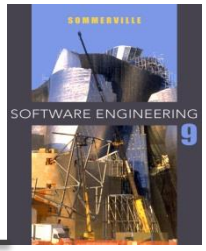

- An **external perspective**, where you model the context or environment of the system.
- An **interaction perspective**, where you model the interactions between a system and its environment, **or** between the components of a system.
- A **structural perspective**, where you model the organization of a system or the structure of the data that is processed by the system.
- A **behavioral perspective**, where you model the dynamic behavior of the system and how it responds to events.

# UML Diagram Types




- The System Perspectives (last slide) are modeled with diagrams
- **Activity diagrams**, which show the activities involved in a process or in data processing .
- **Use case diagrams,** which show the interactions between a system and its environment.
- **Sequence diagrams**, which show interactions between actors and the system and between system components.
- **Class diagrams**, which show the object classes in the system and the associations between these classes.
- **State diagrams**, which show how the system **reacts** to internal and external events.

# 1. Context Models

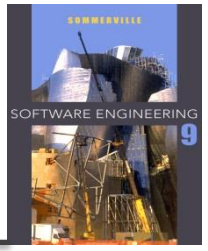



- Context models are used to illustrate the **operational context** of a system -
- They show what lies outside the system boundaries.

- Social and organizational concerns may affect the decision on where to position system boundaries.

- Architectural models show the system and its relationship with other systems.

# System Boundaries

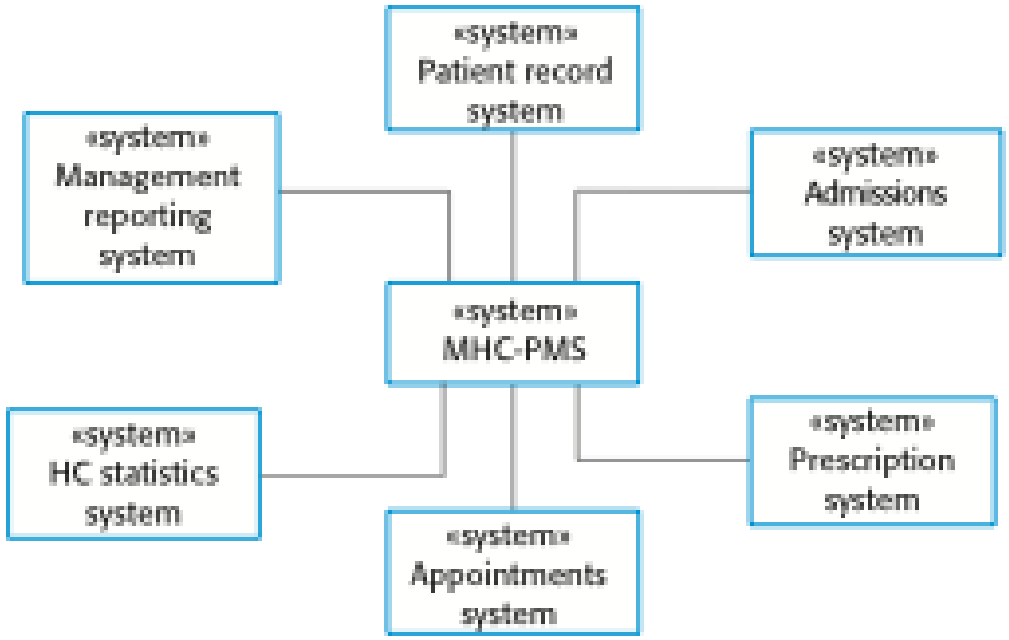



- System boundaries are established to define **what is inside and what is outside the system.**
  - They show other systems that are used or depend on the system being developed.

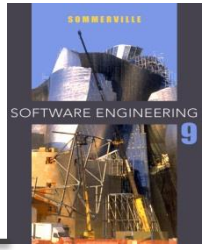
- The position of the system boundary has a profound effect on the system requirements.

- Defining a system boundary is a political judgment
  - There may be pressures to develop system boundaries that increase / decrease the influence or workload of different parts of an organization.

# The Context of the MHC-PMS



# Process Perspective

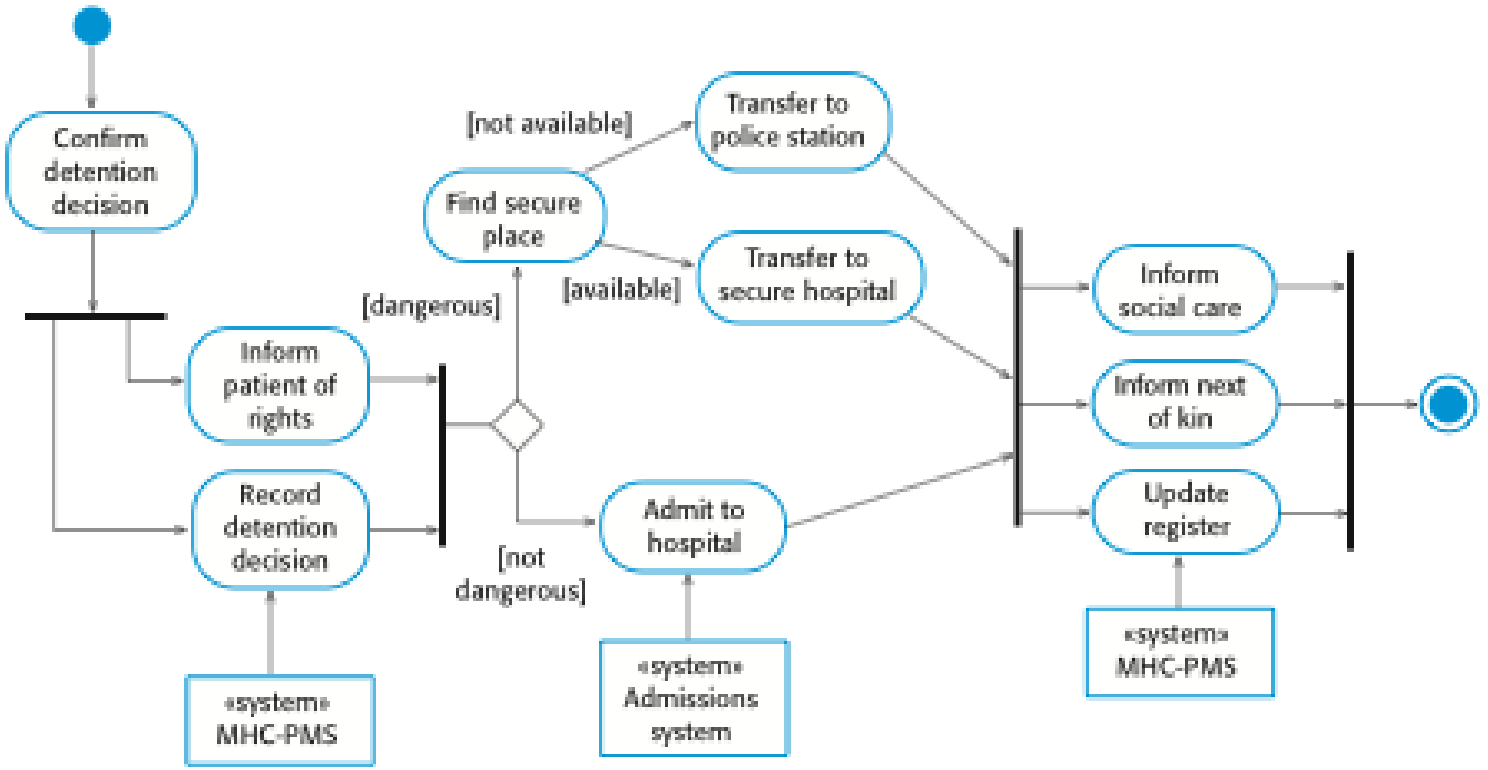



- **Context models** simply **show** the other systems in the environment, not **how** the system being developed is used in that environment.

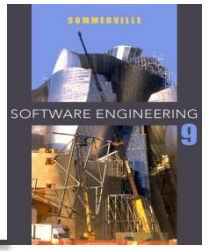
- **Process models** reveal how the system being developed is used in broader business processes.
- How it 'works' Detailed.

- UML activity diagrams may be used to define business process models.

# Process Model of Involuntary Detention



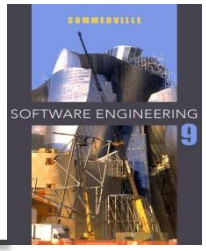
# 2. Interaction Models




- Modeling user interaction is used to identify user requirements.
- We see **structural** connections and **dynamic** (**behavioral**) interactions.
- We do this with graphical models.

- **Use case diagrams and sequence diagrams may be used for interaction modeling.**
- **These are the most popular modeling mechanisms**

# Use Case Modeling (Interaction Model)



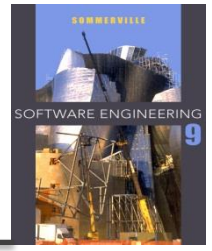

- Use cases were developed originally to support **requirements elicitation** and now incorporated into the UML.

- Each use case represents a **discrete task** that involves **external interaction** with a system.

- **Actors** in a use case may be people, devices, or other systems.

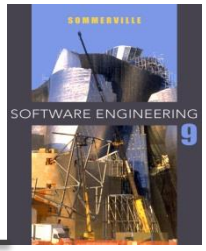
- Represented diagramatically to provide an overview of the use case and in a more detailed textual form.

# Transfer-data Use Case Diagram (graphical model)



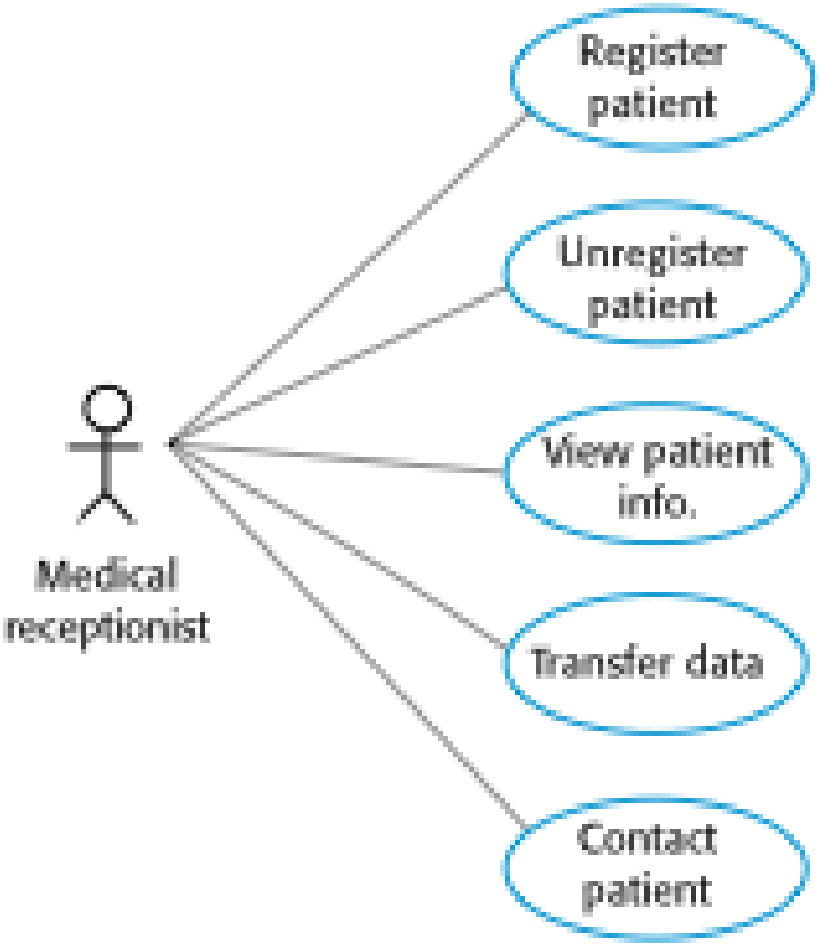

❿ A use case in the MHC-PMS

# Tabular Description of the ‘Transfer data’ use-case

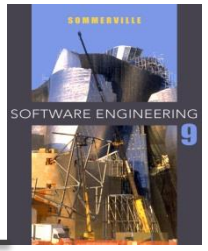



| MHC-PMS: Transfer data | |
|---|---|
| Actors | Medical receptionist, patient records system (PRS) |
| Description | A receptionist may transfer data from the MHC-PMS to a general patient record database that is maintained by a health authority. The information transferred may either be updated personal information (address, phone number, etc.) or a summary of the patient’s diagnosis and treatment. |
| Data | Patient’s personal information, treatment summary |
| Stimulus | User command issued by medical receptionist |
| Response | Confirmation that PRS has been updated |
| Comments | The receptionist must have appropriate security permissions to access the patient information and the PRS. |

# Use Cases in the MHC-PMS involving the role 'Medical Receptionist' (only showing one actor here)



# Sequence Diagrams (Interaction Model)



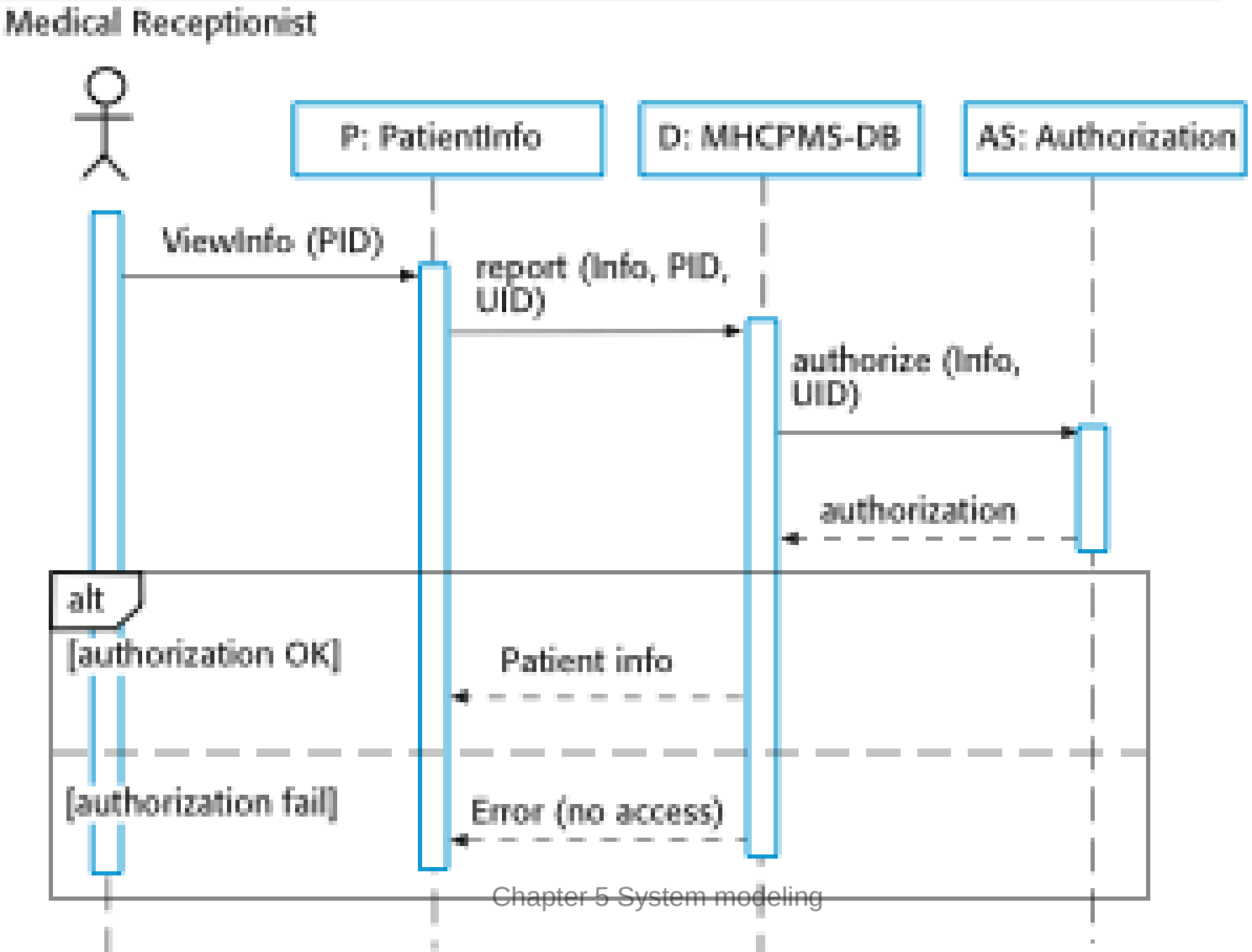

- **Sequence diagrams are part of the UML and are used to model the interactions between the actors and the objects within a system.**

- A sequence diagram shows the sequence of interactions that take place during a particular use case or use case instance.

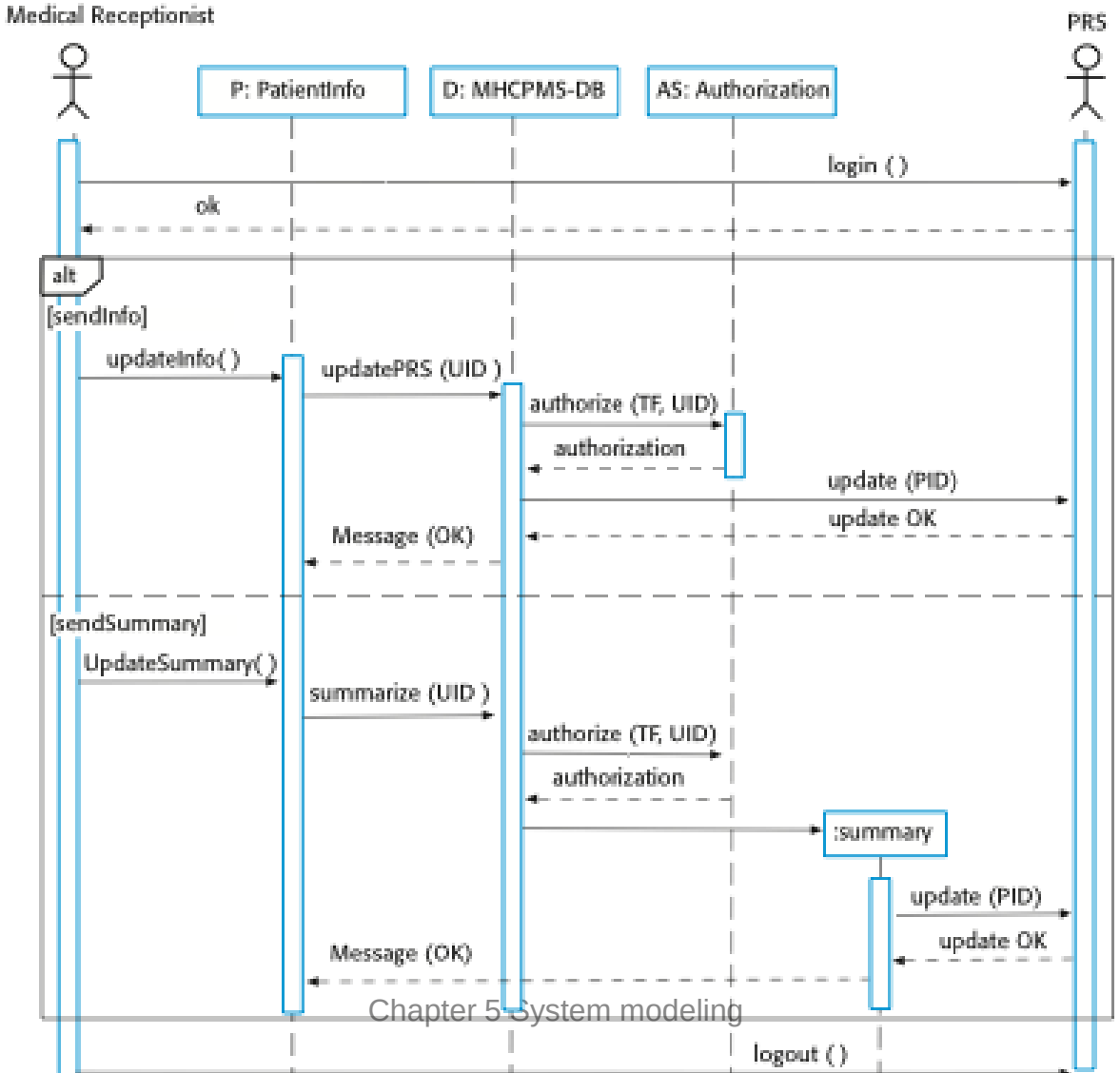
- The objects and actors involved are listed along the top of the diagram, with a dotted line drawn vertically from these.

- Interactions between objects are indicated by annotated arrows.

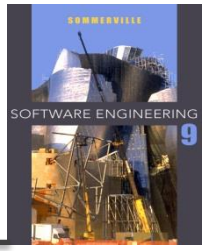
# Sequence diagram for View Patient Information



# Sequence diagram for Transfer Data



# Key points




- A model is an abstract view of a system that ignores system details. Complementary system models can be developed to show the system's context, interactions, structure and behavior.

- Context models show how a system that is being modeled is positioned in an environment with other systems and processes.

- Use case diagrams and sequence diagrams are used to describe the interactions between users and systems in the system being designed. Use cases describe interactions between a system and external actors; sequence diagrams add more information to these by showing interactions between system objects.