CSC00004

Software engineering

KHOA CÔNG NGHỆ THÔNG TIN
TRƯỜNG ĐẠI HỌC KHOA HỌC TỰ NHIÊN

Content

- Fundamentals
  - The Software Engineering Discipline
  - The Software Life Cycle
  - Development Phases
  - Software Engineering Methodologies
  - Documentation
  - Project Management
- Other Aspects in SE
  - Software Design: Modularity
  - Tools of the Trade
  - Software Ownership and Liability
- SE Department – FIT – HCMUS

FUNDAMENTALS

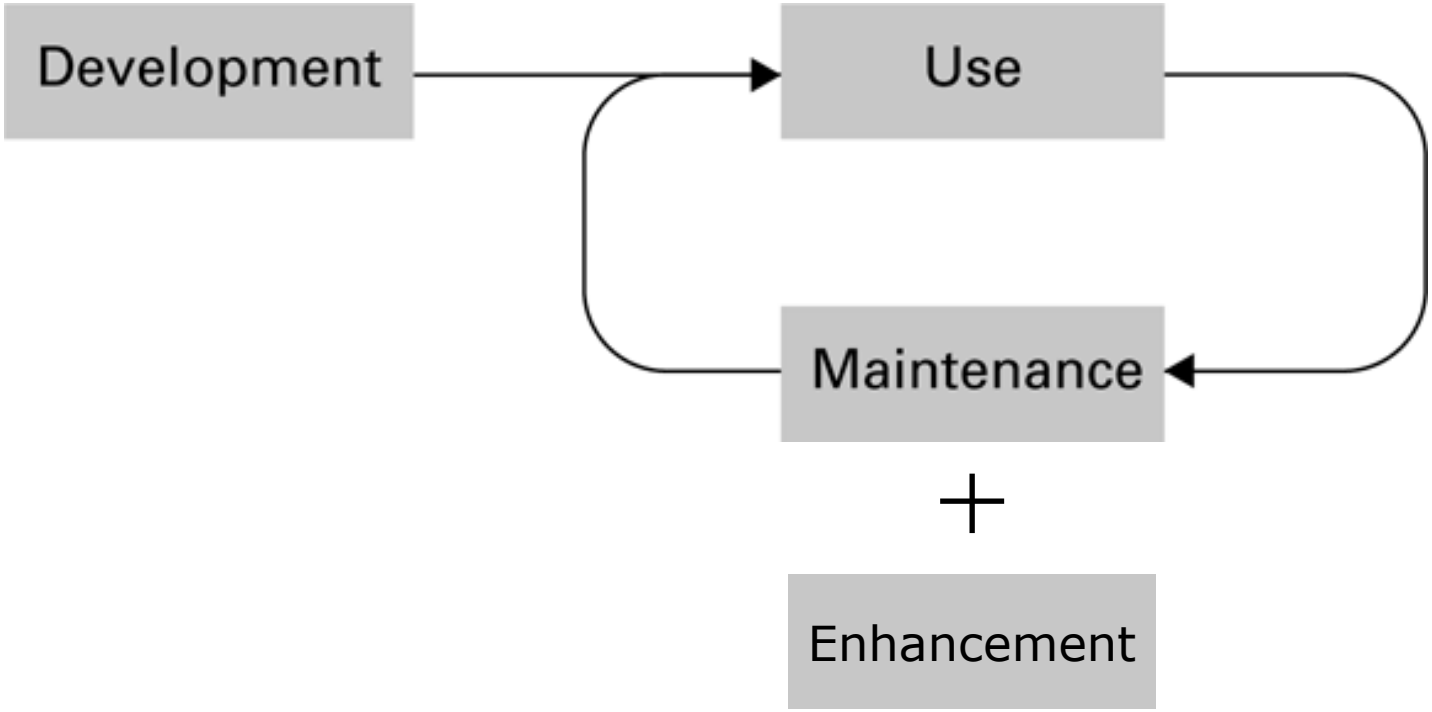
The Software Engineering Discipline

- Distinct from other engineering fields
  - Prefabricated components
  - Metrics
- Practitioners versus Theoreticians
- Professional Organizations: ACM, IEEE…
  - Codes of professional ethics

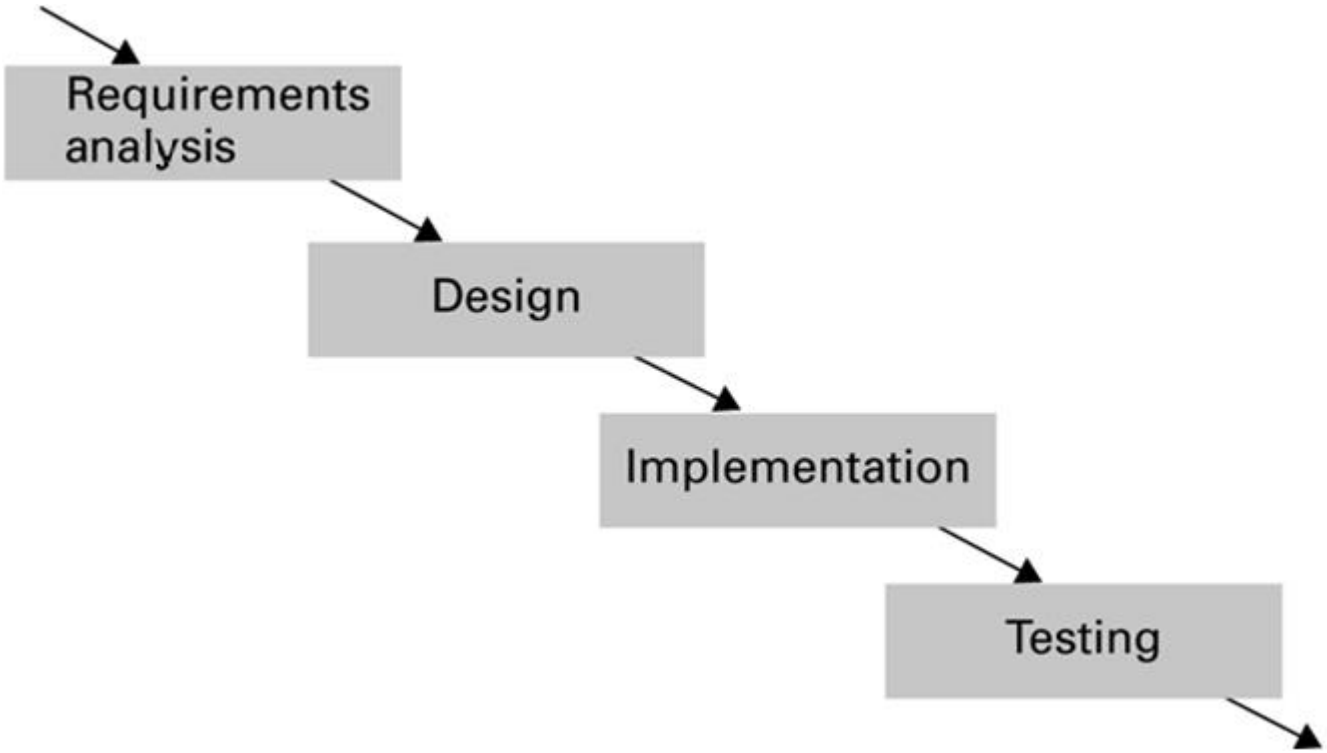
Computer Aided Software Engineering (CASE) tools

- Project planning
- Project management
- Documentation
- Prototyping and simulation
- Interface design
- Programming
- Configuration management (git)
- Collaboration (Slack, Trello)

The software life cycle



The development phase of the software life cycle



Analysis Stage

- Requirements
  - Application oriented
- Specifications
  - Technically oriented
- Software requirements document

Design Stage

- Methodologies and tools
- Human interface (psychology and ergonomics)

Implementation Stage

- Create system from design
  - Write programs
  - Create data files
  - Develop databases
- Role of “software analyst” versus “programmer”

Testing Stage

- Validation testing
  - Confirm that system meets specifications
- Defect testing
  - Find bugs

- Level of test
  - Unit testing
  - Integration testing
  - System testing

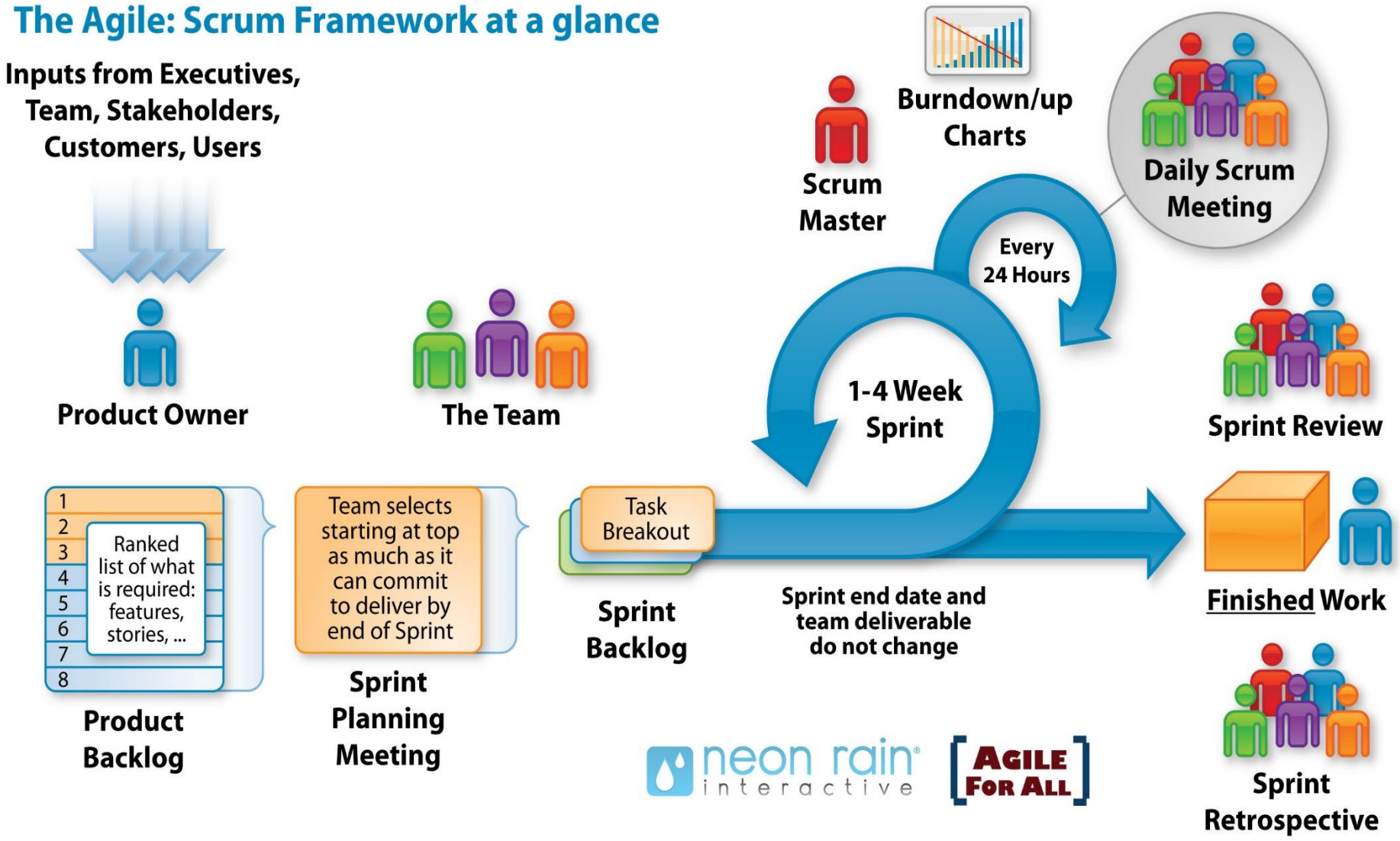
Software Testing Strategies

- Glass-box testing (white-box testing)
  - Pareto principle
  - Basis path testing
- Black-box testing
  - Boundary value analysis
  - Redundancy testing
  - Beta testing

Software Engineering Methodologies

- Waterfall Model
- Incremental Model
  - Prototyping (Evolutionary vs. Throwaway)
- Open-source Development
- New Methodologies
  - Agile
  - Extreme Programming

Scrum


The Agile: Scrum Framework at a glance
Inputs from Executives, Team, Stakeholders, Customers, Users
Product Owner
The Team
Scrum Master
Burndown/up Charts
Daily Scrum Meeting
Every 24 Hours
1-4 Week Sprint
Sprint Review
1
2
3
4
5
6
7
8
Ranked list of what is required: features, stories, ...
Product Backlog
Team selects starting at top as much as it can commit to deliver by end of Sprint
Sprint Planning Meeting
Task Breakout
Sprint Backlog
Sprint end date and team deliverable do not change
Finished Work
Sprint Retrospective
neon rain interactive
AGILE FOR ALL

Documentation

- User Documentation
  - Printed book for all customers
  - On-line help modules
- System Documentation
  - Source code
  - Requirement, analysis, design, test, maintenance documents
- Technical Documentation
  - For installing, customizing, updating, etc.
- Support documentation
  - For management, team working, collaboration

Project Management

- A dynamic process that utilizes the appropriate resources of the organization in a controlled and structured manner, to achieve some clearly defined objectives identified as needs

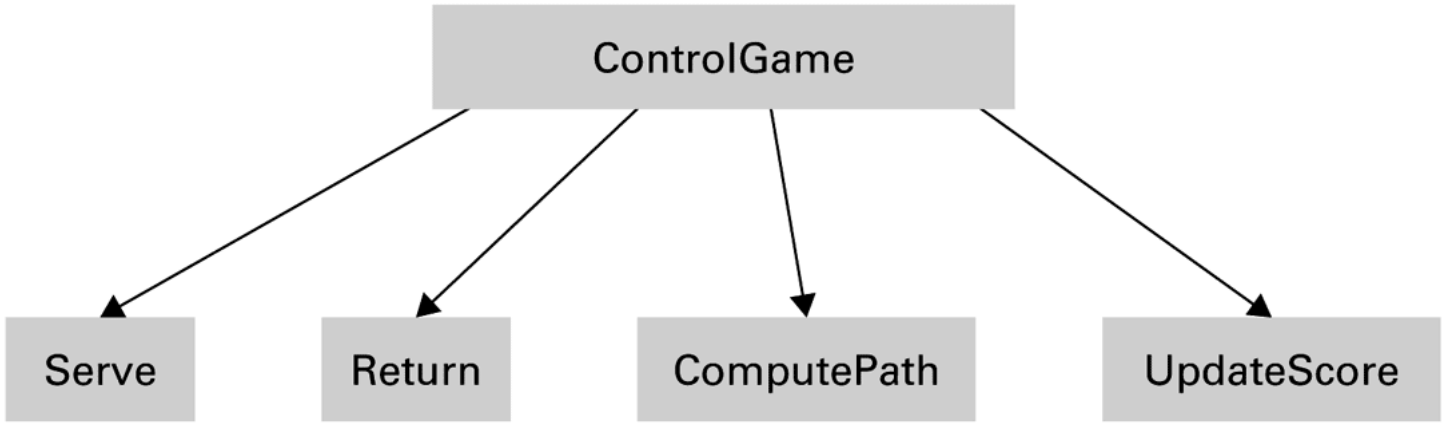
- Consist of
  - Project Planning
  - Project Monitoring and Control
  - Management of Scope, Time, Cost, Risk, Quality, Human Resource, Communication, Procurement

OTHER ASPECTS OF SE

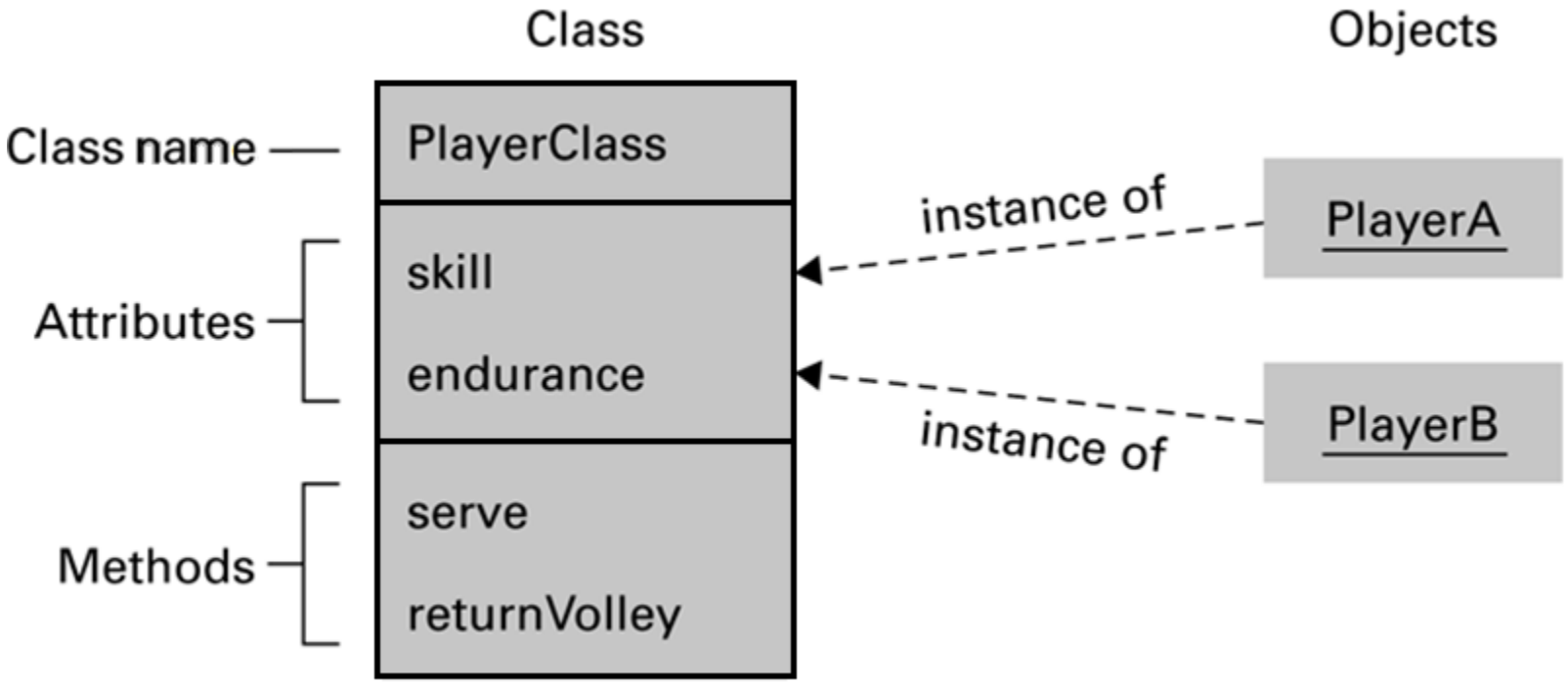
Software Design – Modularity

- Functions – Imperative paradigm
  - Structure charts
- Class – Object-oriented paradigm
  - Collaboration diagrams
- Components – Component architecture
- Services – Service-oriented architecture (SOA)

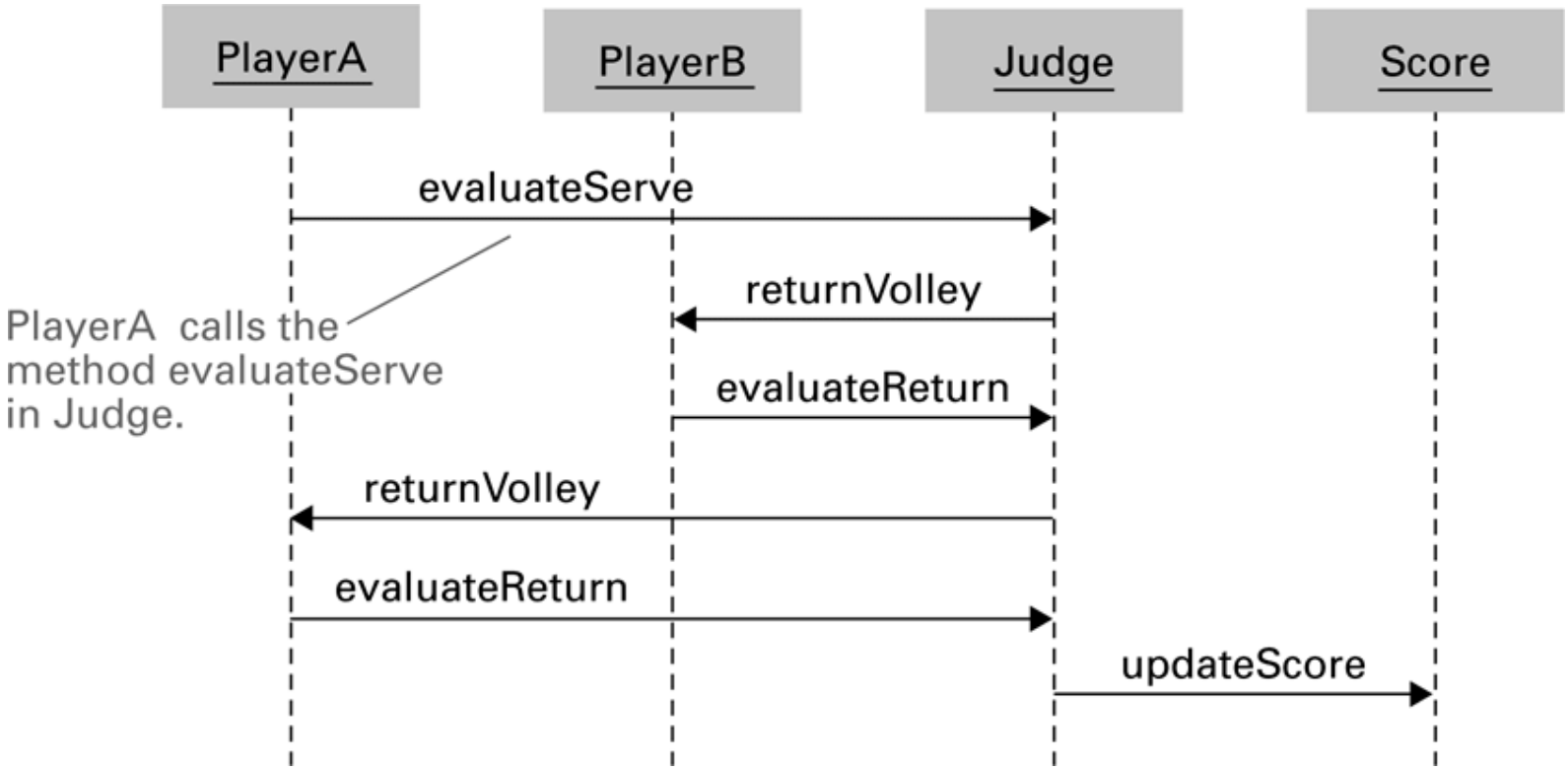
A simple structure chart



The structure of PlayerClass and its instances



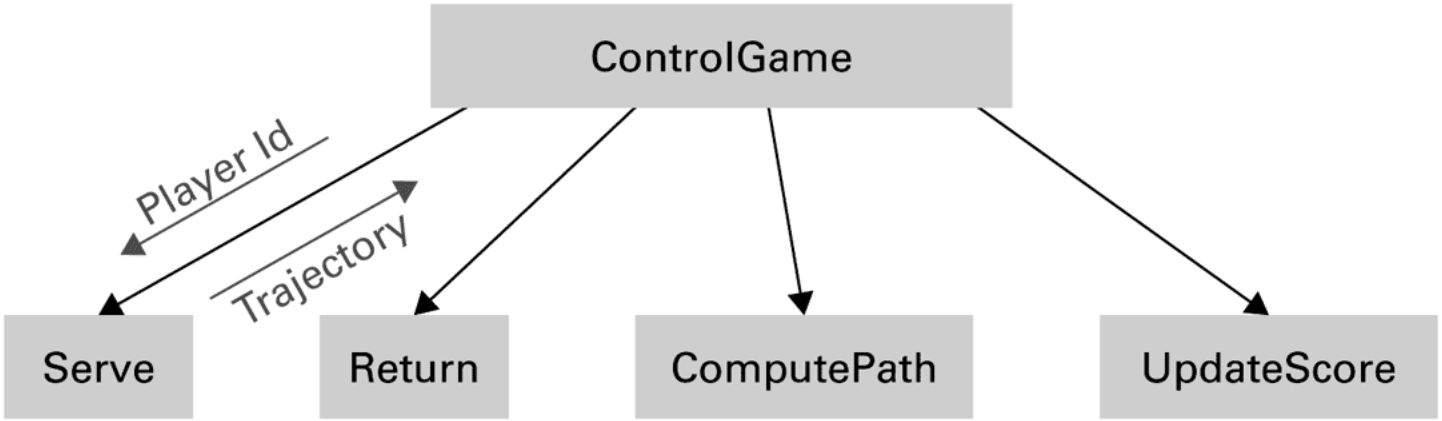
The interaction between objects resulting from PlayerA's serve



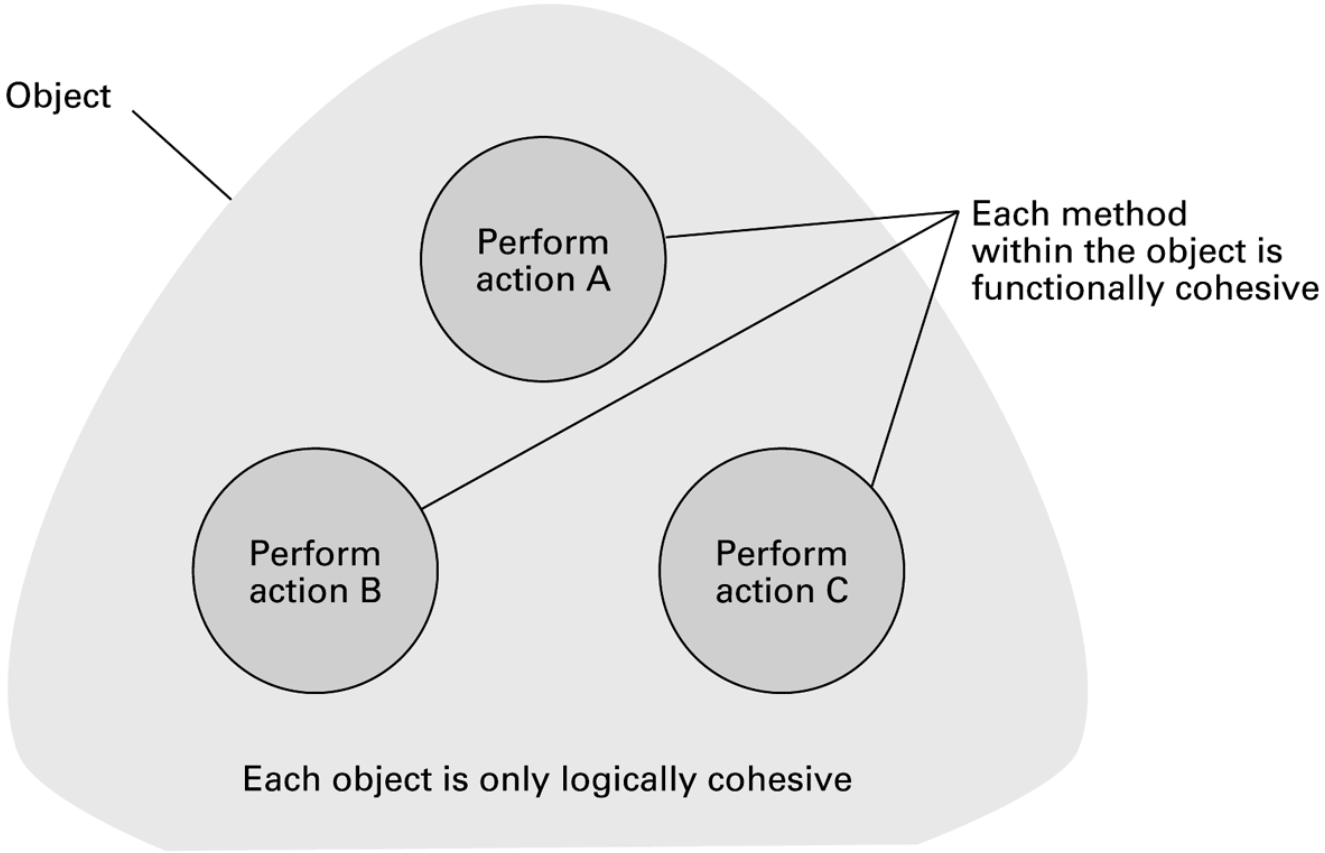
Coupling vs. Cohesion

- Coupling
  - Control coupling
  - Data coupling
- Cohesion
  - Logical cohesion
  - Functional cohesion

A structure chart including data coupling



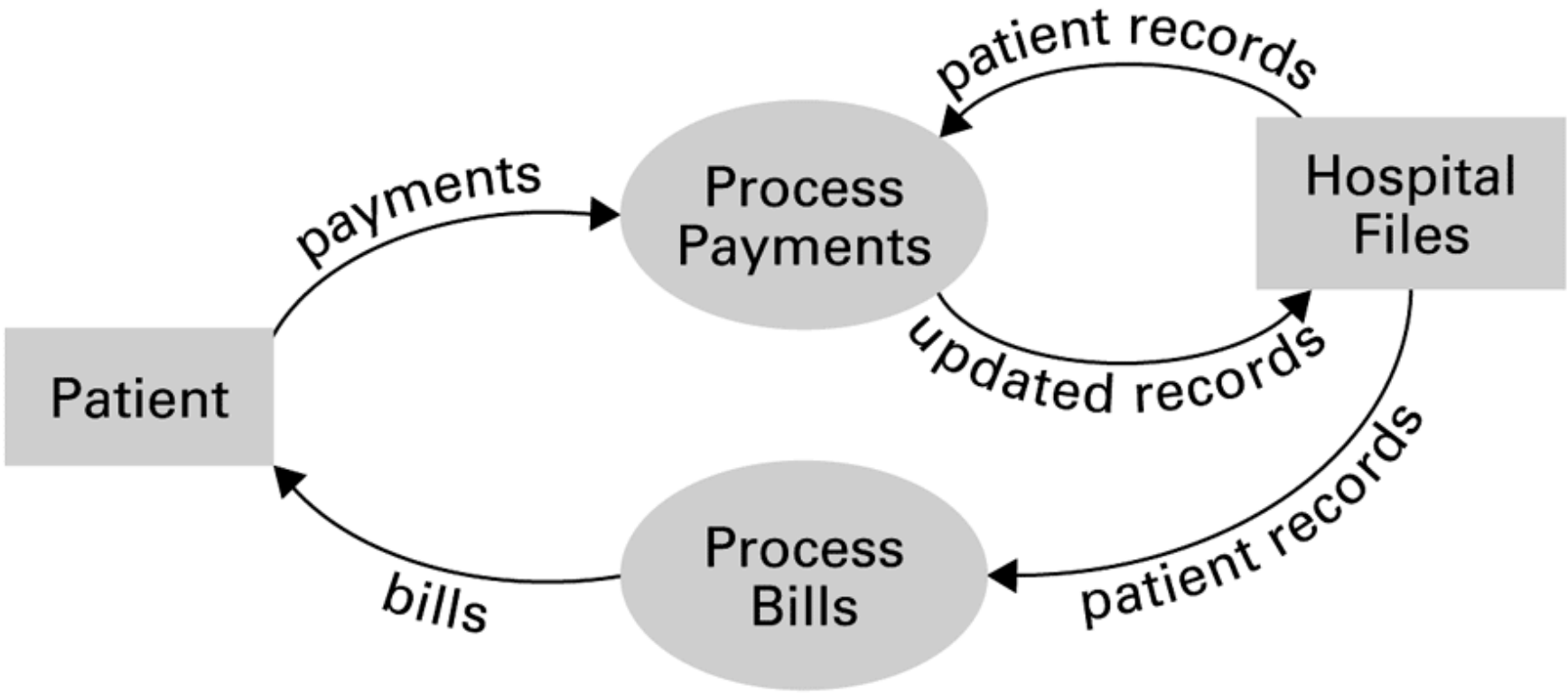
Logical and functional cohesion within an object



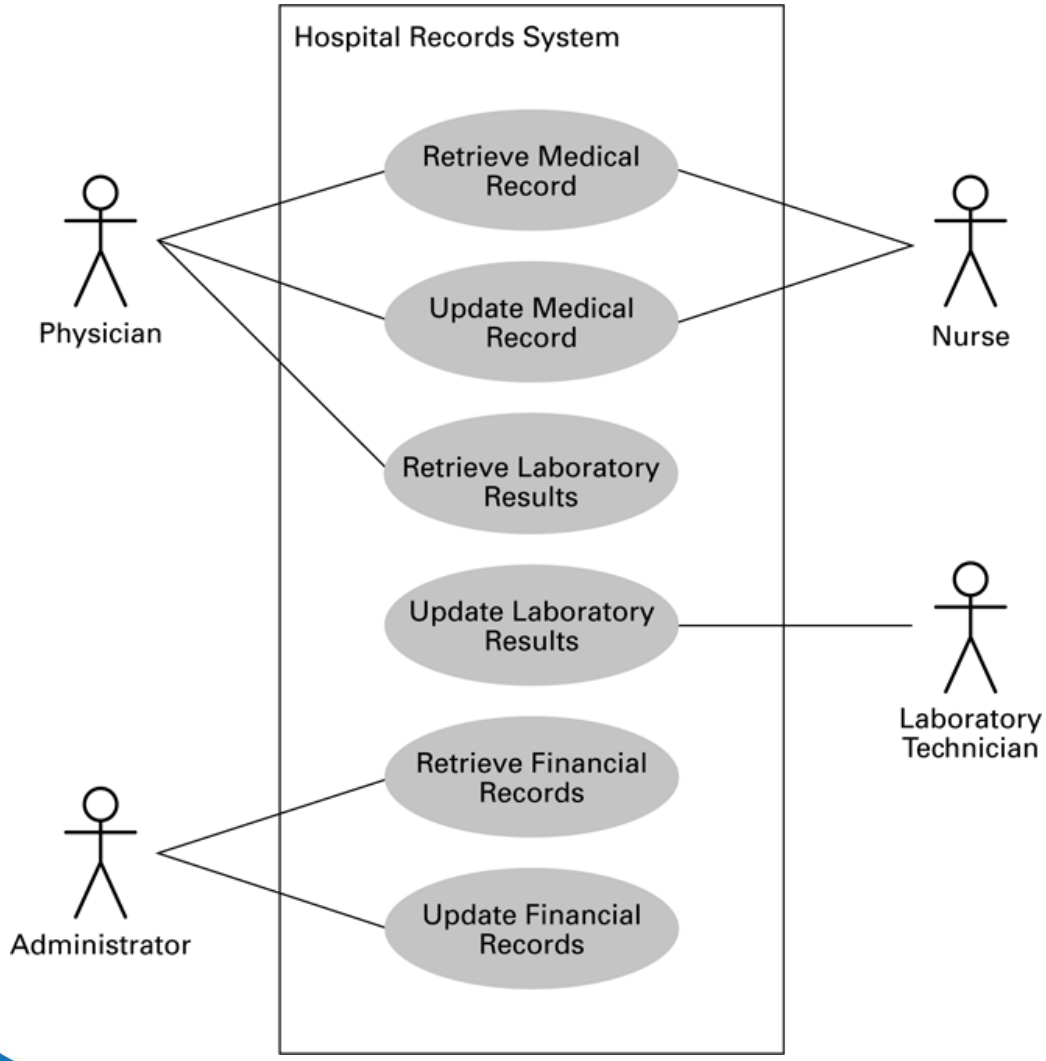
Unified Modeling Language

- Use Case Diagram
  - Use cases
  - Actors
- Class Diagram
  - Class
  - Relationship: generalization, association, dependency

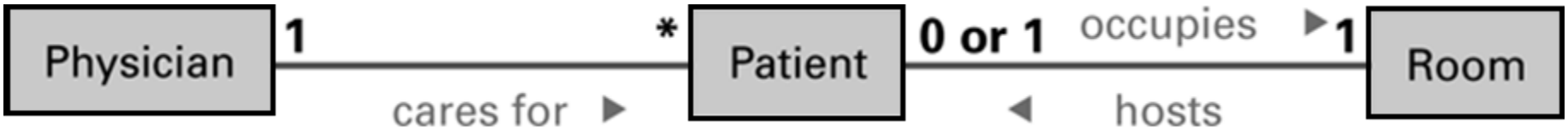
A simple dataflow diagram



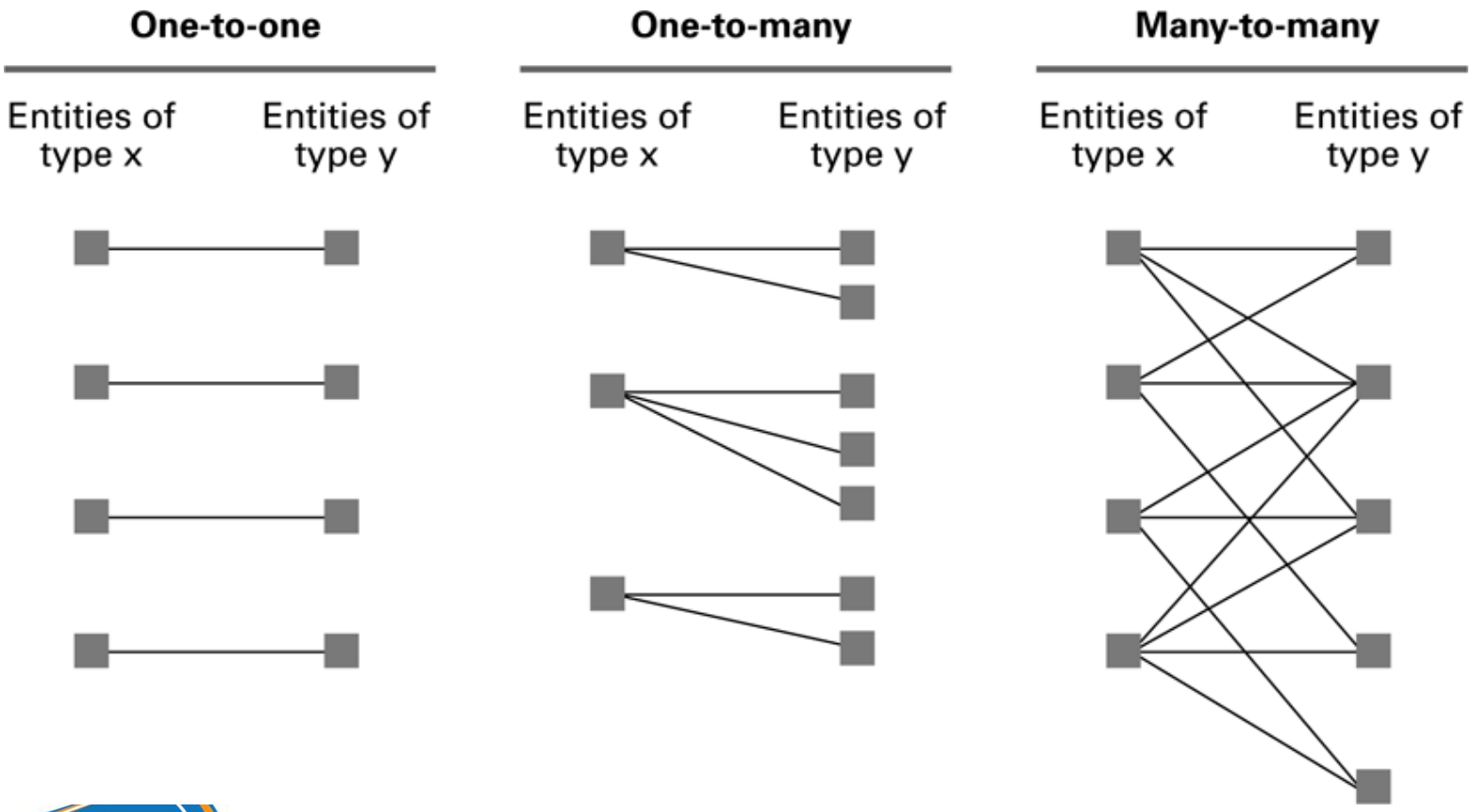
A simple use case diagram



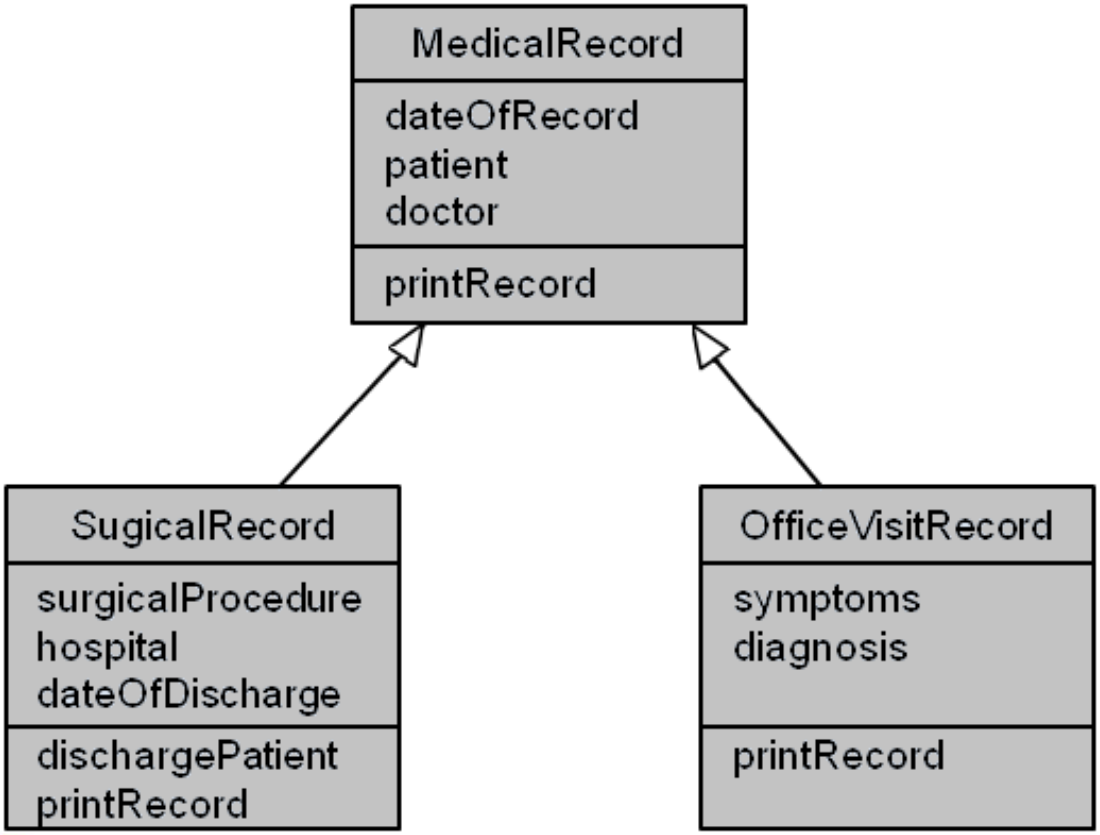
A simple class diagram



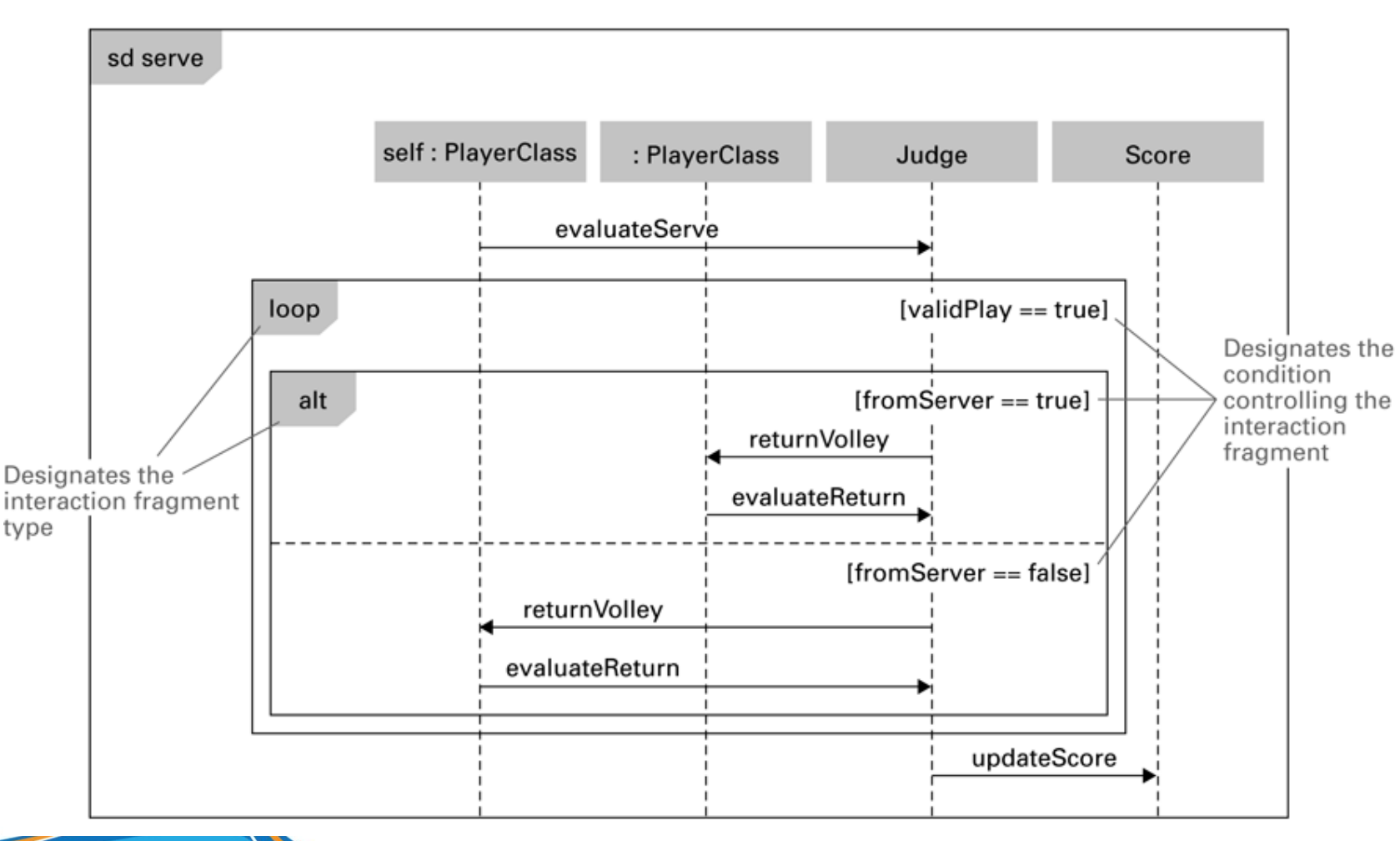
Relationships between entities of types X and Y



A class diagram depicting generalizations



A sequence diagram depicting a generic volley



Structured Walkthroughs

- “Theatrical” experiment
- Class-responsibility-collaboration cards

Design Patterns

- Well designed “templates” for solving recurring problems
- Examples:
  - Adapter pattern: Used to adapter a module’s interface to current needs
  - Decorator pattern: Used to control the complexity involved when many different combinations of the same activities are required
- Inspired by the work of Christopher Alexander in architecture

Software Ownership

- Copyright
  - Allow a product to be released while retaining ownership of intellectual property
  - Asserted in all works:
    - Specifications
    - Source code
    - Final product

Software Ownership (continued)

- Software License
  - A legal agreement that grants the user certain permissions without transferring ownership
  - Open source license
- Patents
  - Must demonstrate that it is new, usable, and not obvious to others with similar backgrounds
  - Process is expensive and time-consuming

DEPARTMENT OF SOFTWARE ENGINEERING

Introduction

- Room: I82
- Phone: (028) 38 324 467 (ext: 802)

- Head of department
  - Dr. Nguyen Van Vu
- Vice head of department
  - Dr. Nguyen Thi Minh Tuyen

Human resources

- 31 staffs are working in VN
  - Associate Professor – 1
  - Doctor – 5
  - M.Sc. – 24
  - B.Sc. – 1 (graduate student)

Software engineering

- A discipline related to all aspects of professional software development

- Goal : develop a software system with
  - High quality
  - Low cost
  - On time
  - Customer satisfaction

Importance of SE

- Software is an indispensable part of modern life
- The industries depend on software

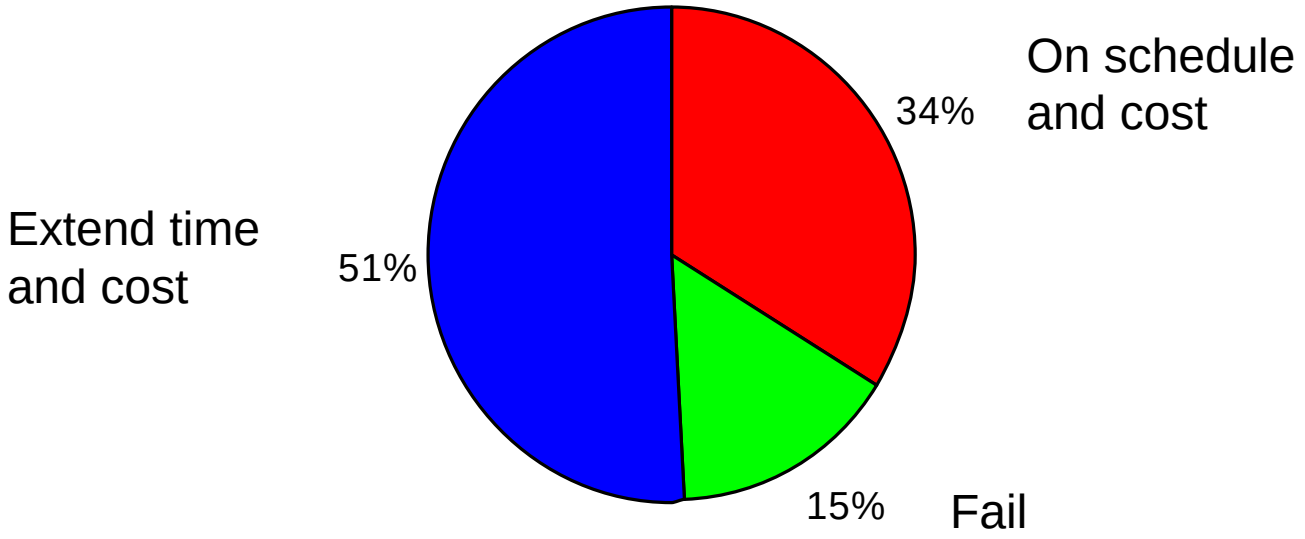
- SE helps to develop software
  - Lower costs
  - Shorter time
  - Better response

Importance of SE (cont.)

- Examples
  - Programing languages are easier to use
    - From Assembly to Fortran, C, Cobol, C++, Java
  - From waterfall process to agile process
  - Programming tools are more diverse and modern

Challenges in SE

- Report of Standish Group Chaos 2003
  - The rate of successful software projects is low



Challenges in SE (cont.)

- Software is different from hardware
  - Cannot touch
  - Flexible, easy to edit
  - Depend on human
  - Diverse
    - Environment
    - OS, devices
    - Functions, development approaches

Educational objectives

- Ability to analyze requirements, design, test and deploy software systems
- Ability to learn to use and self-study software development tools
- Ability to self-study and research new technologies, methods and processes in software industry

Required courses of SE major

- Students accumulate at least 5 courses

Nhập môn công nghệ phần mềm

Quản lý dự án phần mềm

Lập trình Windows

Phát triển ứng dụng Web

Phát triển game

Phân tích và quản lý yêu cầu phần mềm

Phân tích và thiết kế phần mềm

Kiểm chứng phần mềm

Phát triển phần mềm cho thiết bị di động

Optional courses

- Students accumulate at least 5 courses, which contain at least 2 courses (8 credits) of SE department

Các chủ đề nâng cao trong CNPM

Thuật toán tổ hợp và ứng dụng

Nhập môn tư duy thuật toán

Quy hoạch tuyến tính

Khởi nghiệp (2 tín chỉ)

Thiết kế giao diện

Mô hình hóa phần mềm

Kiến trúc phần mềm

Thanh tra mã nguồn

Kiến tập nghề nghiệp (3 tín chỉ)

Optional courses (cont.)

Mẫu thiết kế HĐT và ứng dụng

Đặc tả hình thức

Lập trình hướng đối tượng nâng cao

Công nghệ **XML** và ứng dụng

Lập trình ứng dụng **Java**

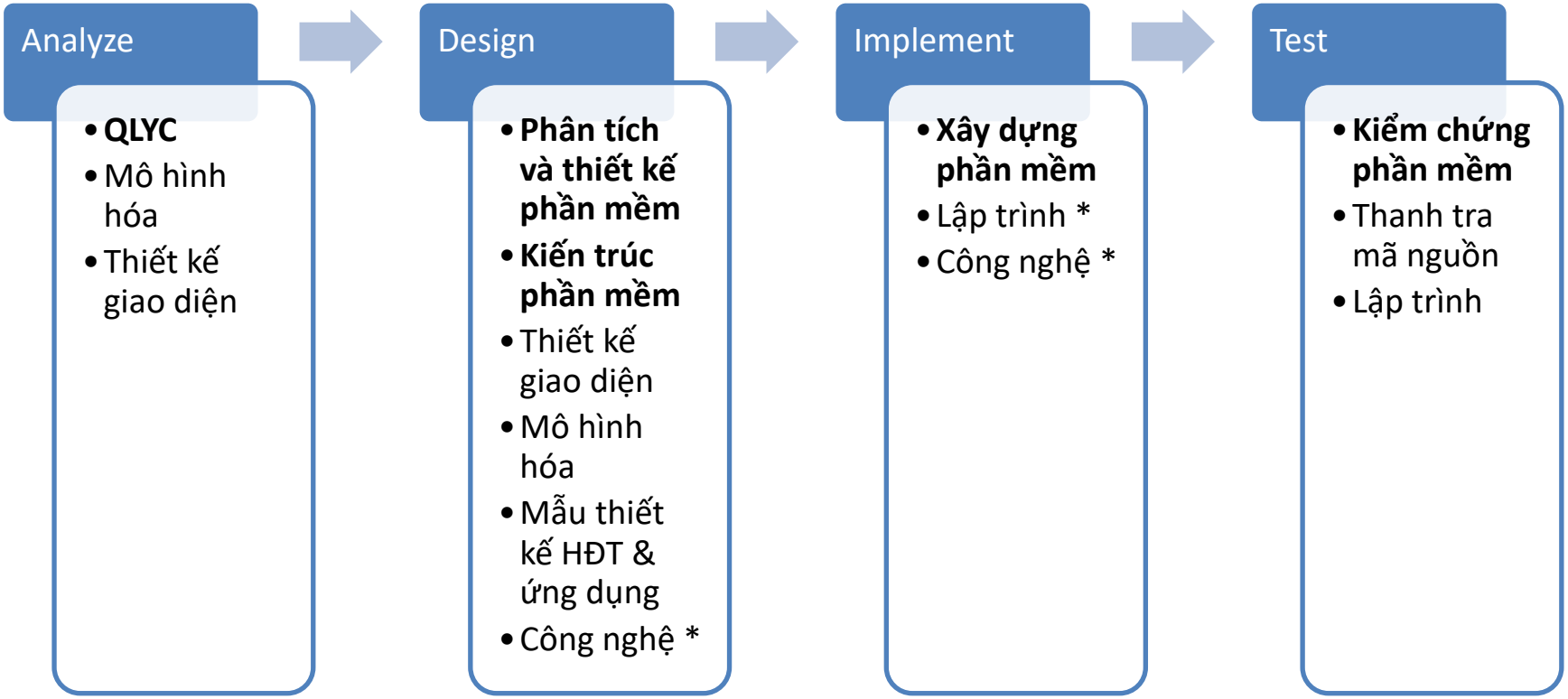
Công nghệ **Java** cho hệ thống **phân tán**

Phát triển phần mềm **nguồn mở**

Phát triển phần mềm cho **hệ thống nhúng**

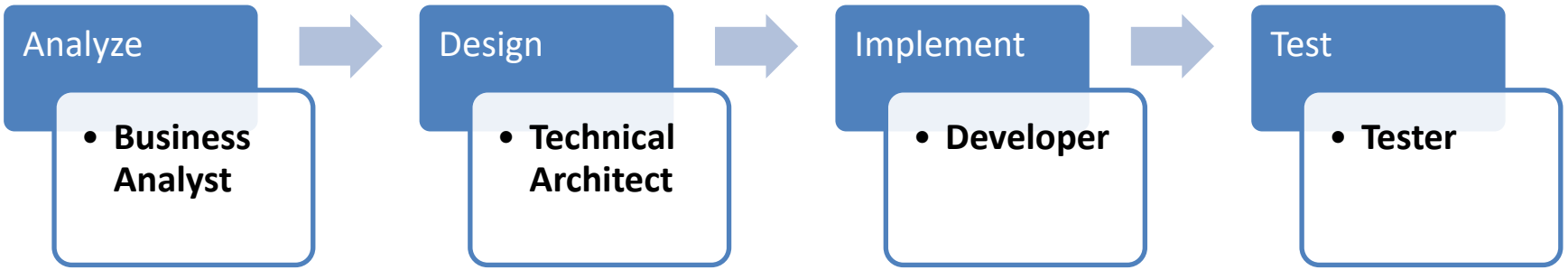
Thực tập thực tế

Correlation of courses and SE



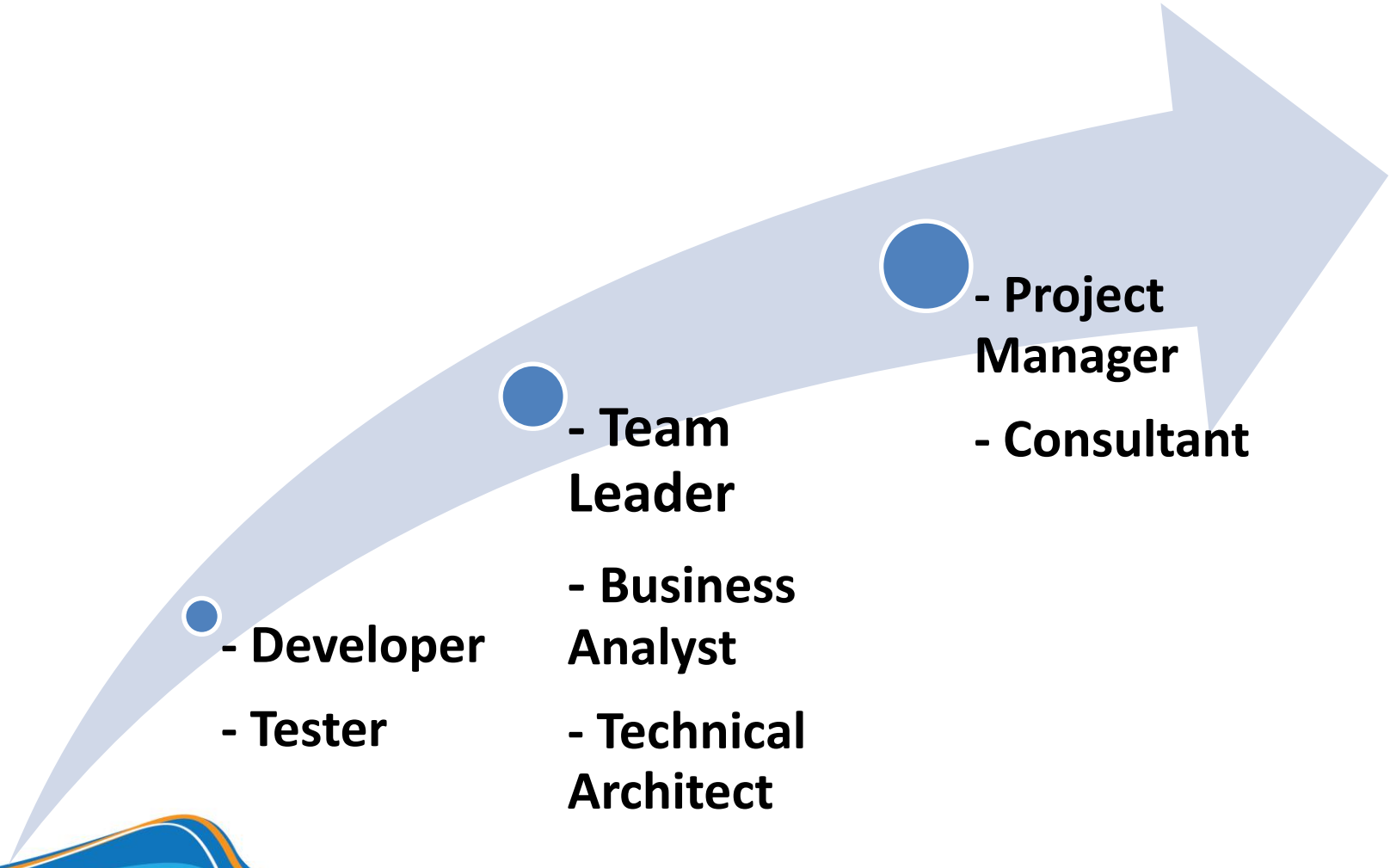
- **Nhập môn CNPM**
- **Quản lý dự án phần mềm**
- Các chủ đề nâng cao trong CNPM

Career orientation



- Team Leader
- Project Manager
- Consultant

Career orientation (cont.)



Research directions

- Software estimation
- Test automation
- Mining software repositories
- Software cloud-based services
- Software engineering education
- Software verification and validation
- Human computer interaction

Research directions (cont.)

- Software design, software architecture and software design patterns
- Engineering of desktop, web and mobile enterprise software
- Cloud computing application development
- Applying AI/ML/NLP to address software engineering problems

Research groups

- Associate Prof. Trần Minh Triết
- Dr. Đinh Bá Tiến
- Dr. Nguyễn Văn Vũ
- Dr. Nguyễn Thị Minh Tuyền
- Dr. Ngô Huy Biên