西安电子科技大学
XIDIAN UNIVERSITY

计算机科学与技术学院
SCHOOL OF COMPUTER SCIENCE AND TECHNOLOGY
国家示范性软件学院
NATIONAL PILOT SCHOOL OF SOFTWARE ENGINEERING

软件体系结构

—课程总结

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本节内容

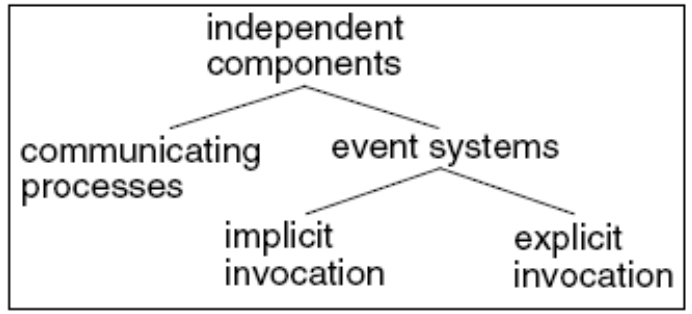
1. 知识点串讲
2. 体系结构设计案例讲解
3. 架构师思维

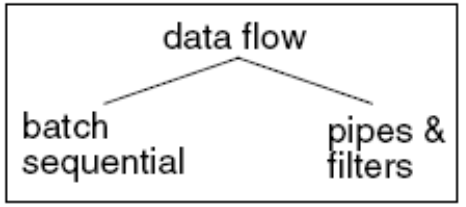
体系结构定义

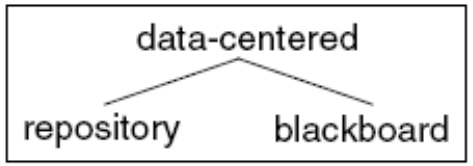
- 软件体系结构定义
  - 不存在一个统一的定义
  - 各个流派对软件体系结构的定义
  - 重点关注
    - Garlan and Shaw的定义：
      体系结构 = 组件 + 连接件 + 约束
      Software Architecture =
      Components + Connectors + Constrains

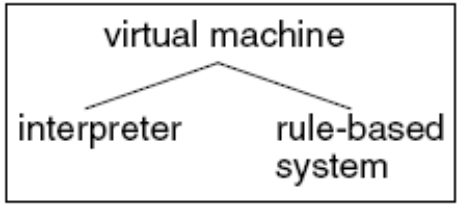
体系结构风格

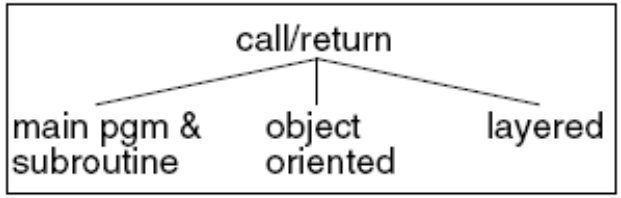
- 软件体系结构风格定义
- 软件体系结构风格的描述
- 常见的软件体系结构风格
  - 数据流
    - 顺序的批处理
    - 管道过滤器
    - 控制环路
  - 调用/返回
    - 主程序/子程序
    - 面向对象
    - 层次结构
    - 客户端/服务器





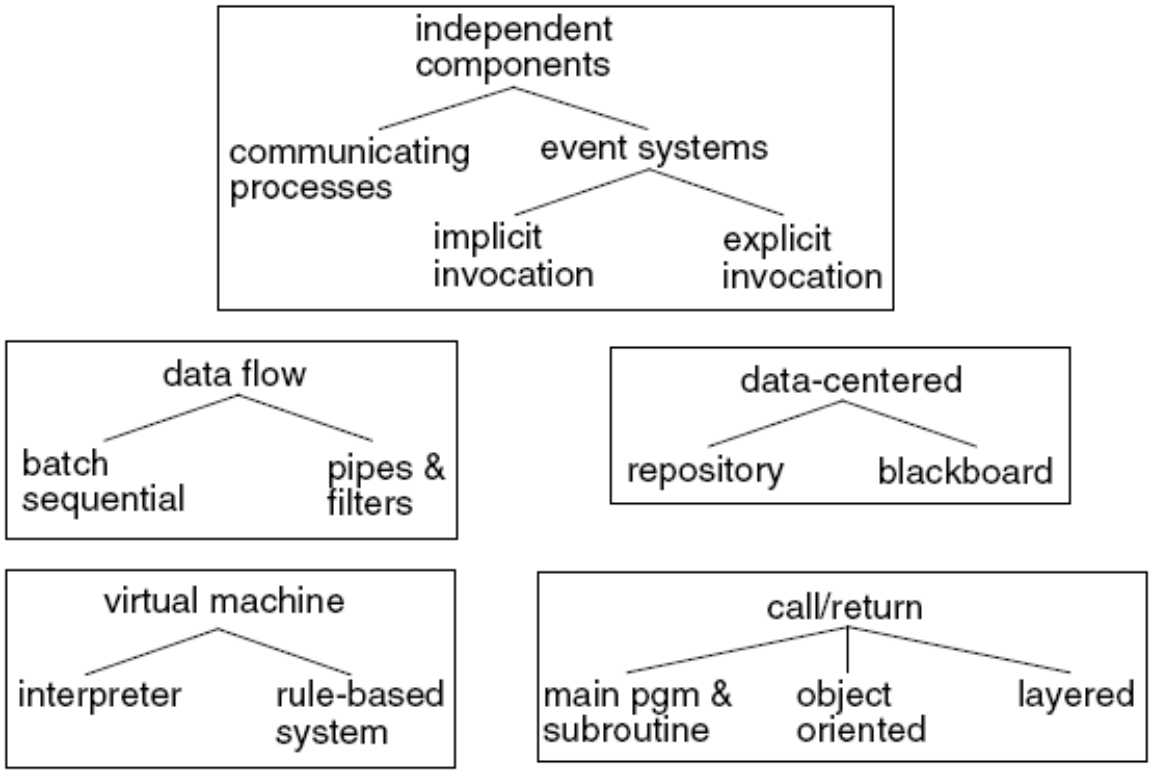




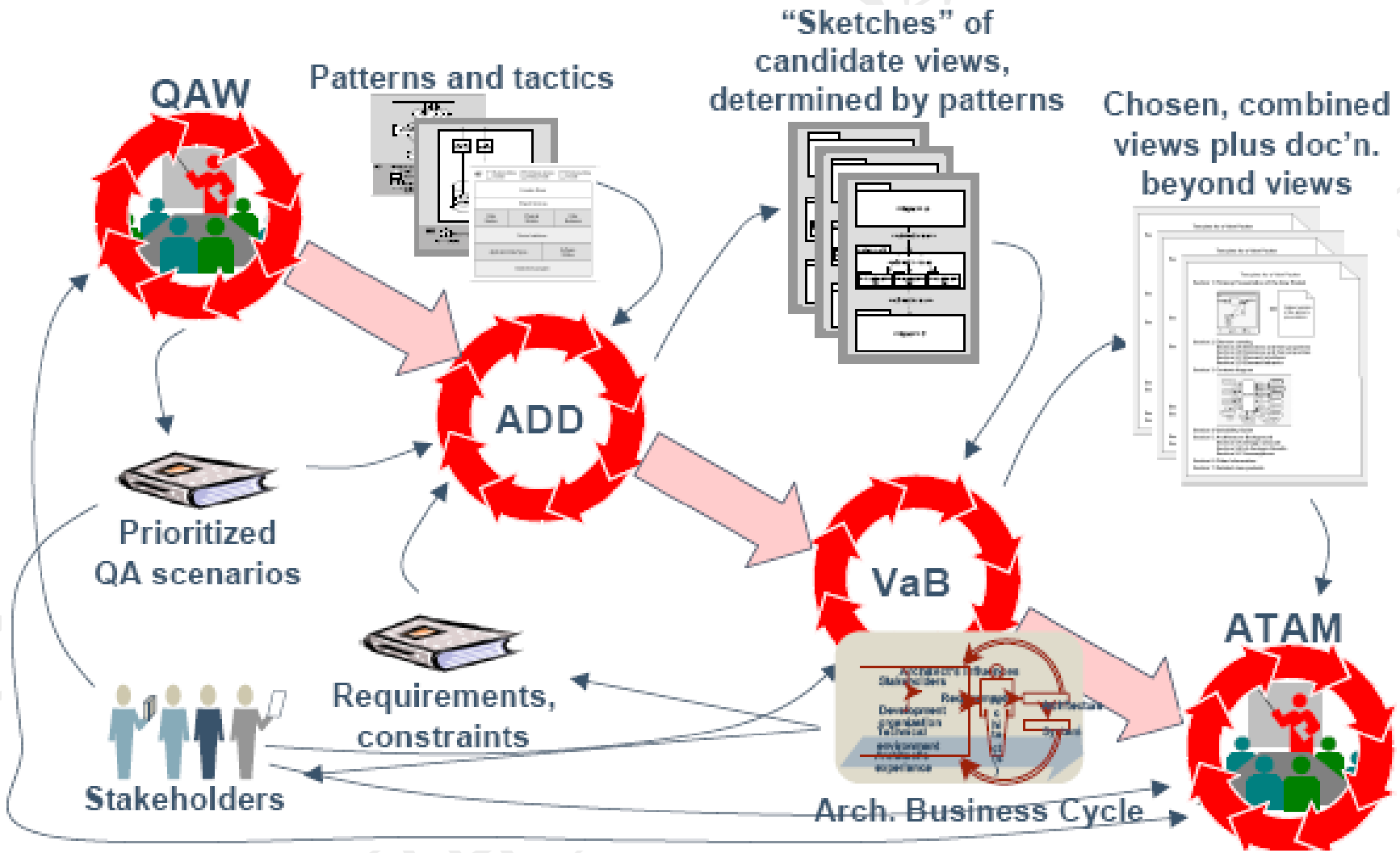


体系结构风格

- 以数据为中心（数据共享）
  - 数据存储（编译器的演化）
  - 黑板
- 虚拟机
  - 解释器
  - 基于规则的系统
  - 其它
- 独立组件
  - 通信进程
  - 事件（隐式调用）
  - 其它
- 其它风格
  - C2
  - HMB
  - DSSA



基于软件体系结构的开发过程



软件质量属性

- 软件质量属性定义
- 软件质量属性与功能、非功能性需求的关系
- 软件质量属性情景
  - 定义
  - 如何描述
- 常见的质量属性
  - 可用性（Availability）
  - 可修改性（Modifiability）
  - 性能（Performance）
  - 安全性（Security）
  - 可测试性（Testability）
  - 易用性（Usability）
- 其它质量属性

体系结构设计

- 架构模式的应用
- 常见质量属性的设计
  - 可用性（Availability）
  - 可修改性（Modifiability）
  - 性能（Performance）
  - 安全性（Security）
  - 可测试性（Testability）
  - 易用性（Usability）

体系结构评估

- 常见的体系结构评估方法
  - 重点掌握ATAM
  - ATAM的过程
- 质量属性评估效用树（Utility Tree）
- 风险/非风险、敏感点和权衡点的理解与应用

案例讲解

- A company wants to develop a software system used in its intranet（局域网）. The function of this systems is same as Weibo and Twitter. Each department（部门） can publish information about the department using this system, and Employees in the company can follow（关注） one or more departments to receive information published by these departments. When one department publishes a piece of new information, the system will send the information to all the followers（关注者） of this department. After one employee unfollows one department, he/she will not receive information published by this department in future
- Following are some detailed requirements of this system.

案例讲解

- One employee can follow one or more departments, and can unfollow one department at any time.
- The total unavailable time of the systems should be less than 10 hours in a year. The average recovery time of each system fault should be less than one hour.
- The system copies the interface（界面） of Weibo, so it's easy to use.
- Every minor update of this system should be accomplished by 2 developer within 1 days.
- A hardware firewall is used to separate the system from the Internet.
- One employee can send private messages to another employee using this system.
- The loading time from an employee's login to displaying his/her homepage should be less than 0.1s.
- The system provides special interfaces to do automated（自动的） testing.

案例讲解

- Please analyze the requirements and complete following 4 questions:
  a) Identify and name the related quality attributes according to the requirements.
  b) For each quality attribute, give the corresponding quality attribute scenario.
  c) For each quality attribute, list at least 2 solutions for archiving the corresponding quality attribute.
  d) According to the requirements, which software architecture style is better for this system? Describe the reason and list the advantages and disadvantages of architecture style you choose for the system.

第一步：去伪存真

- One employee can follow one or more departments, and can unfollow one department at any time.
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第二步：归类

- The total unavailable time of the systems should be less than 10 hours in a year. The average recovery time of each system fault should be less than one hour.（可用性）
- The system copies the interface（界面） of Weibo, so it's easy to use.（易用性）
- Every minor update of this system should be accomplished by 2 developer within 1 days.（可修改性）
- A hardware firewall is used to separate the system from the Internet.（安全性）
- The loading time from an employee's login to displaying his/her homepage should be less than 0.1s. （性能）
- The system provides special interfaces to do automated（自动的） testing.（可测试性）

第三步：六要素法描述质量属性场景

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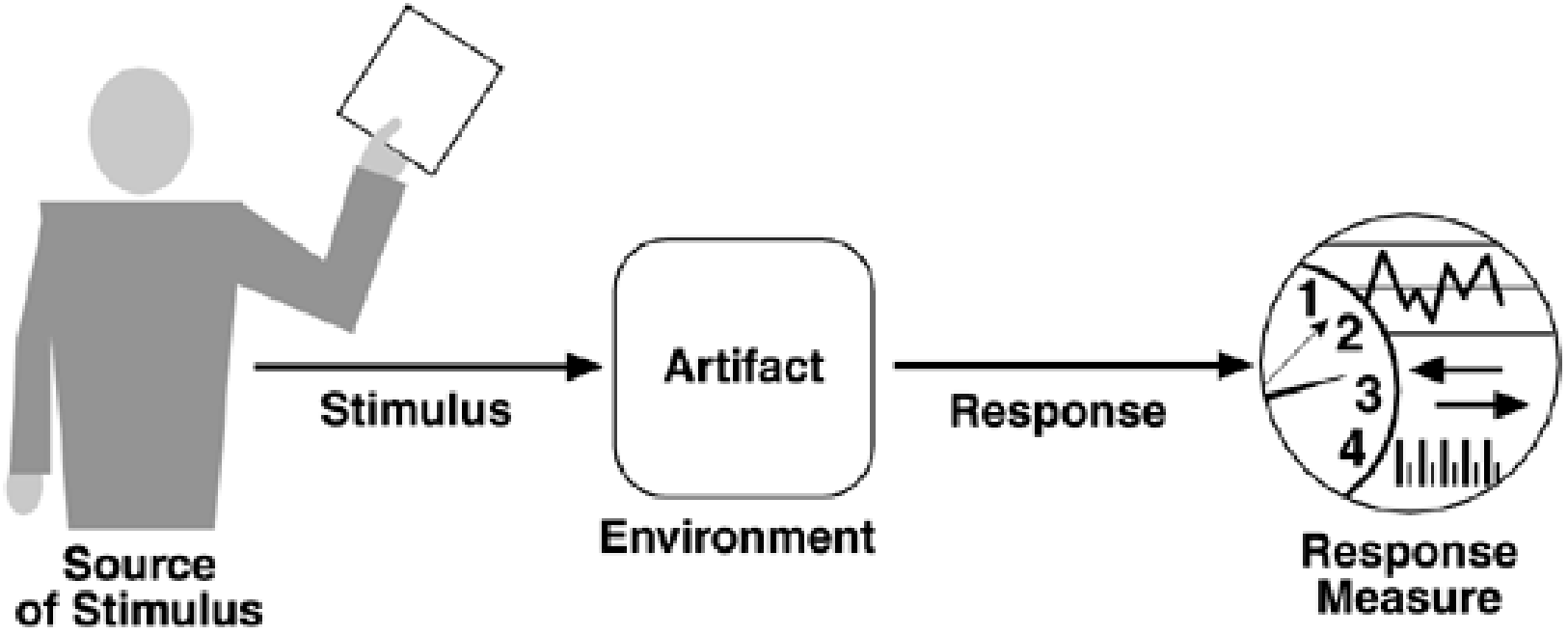
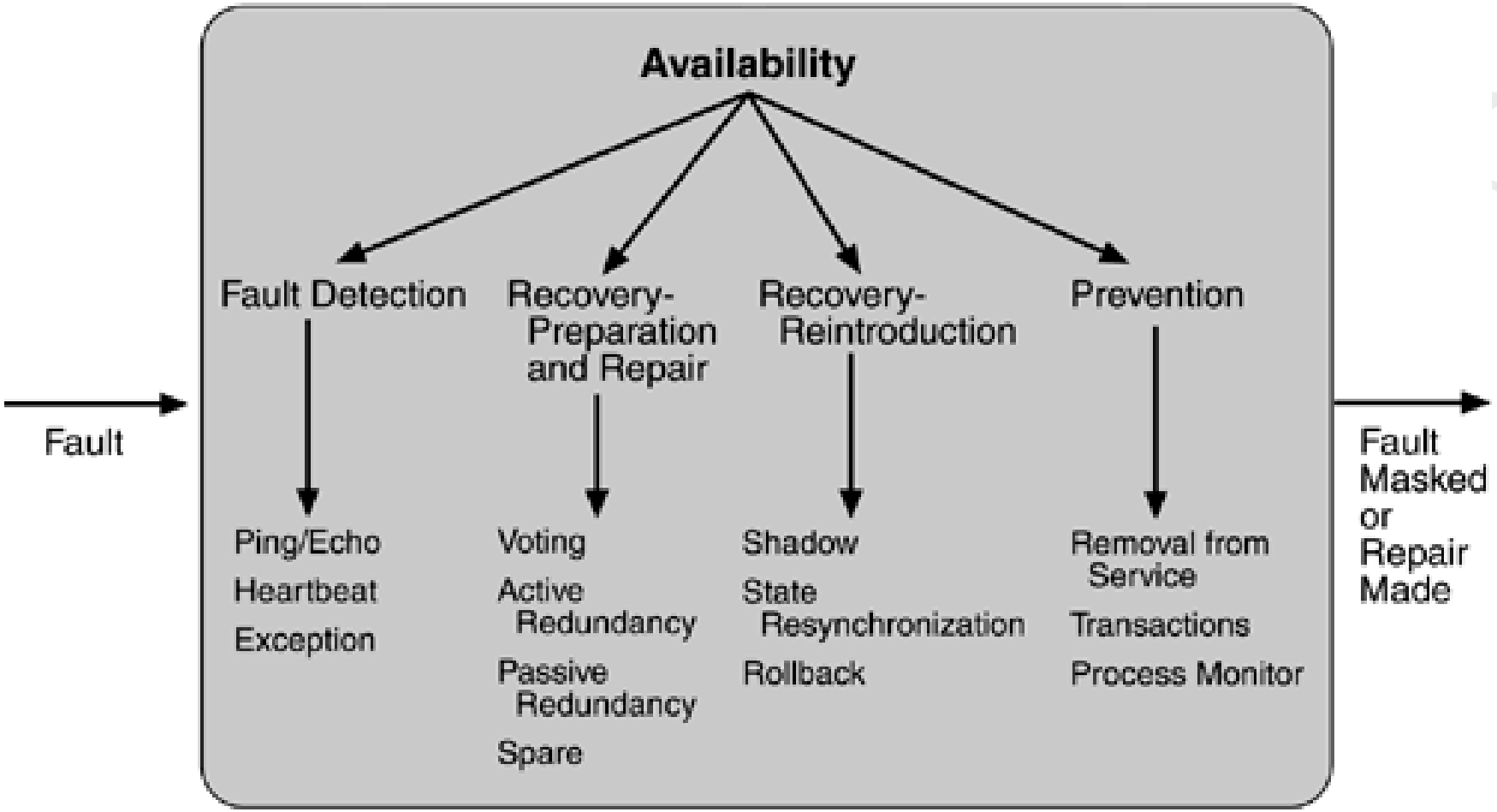
- Every minor update of this system should be accomplished by 2 developer within 1 days.（可修改性）



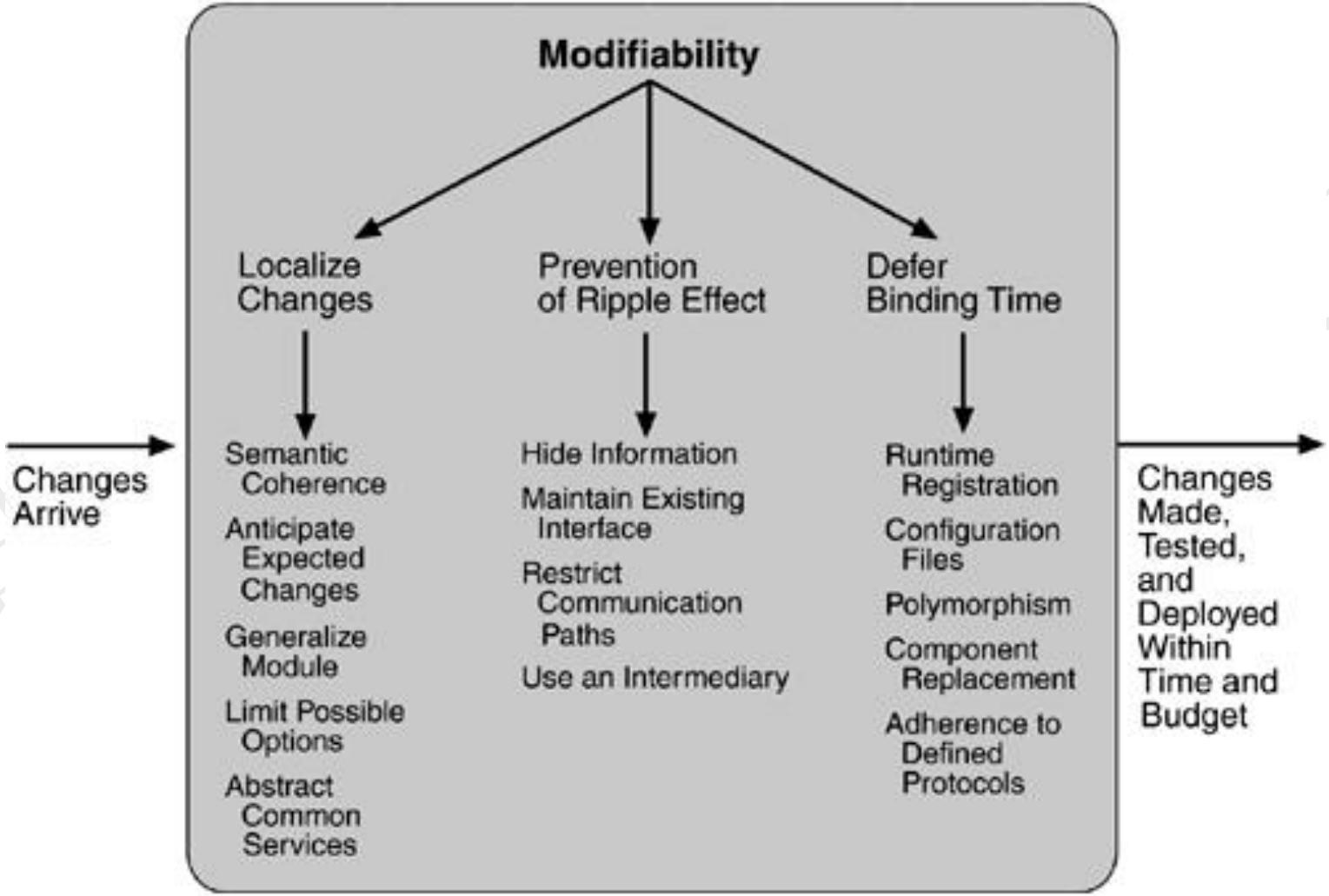
第四步：针对质量属性要求给出设计策略

- The total unavailable time of the systems should be less than 10 hours in a year. The average recovery time of each system fault should be less than one hour.（可用性）
- The system copies the interface（界面） of Weibo, so it's easy to use.（易用性）
- Every minor update of this system should be accomplished by 2 developer within 1 days.（可修改性）
- A hardware firewall is used to separate the system from the Internet.（安全性）
- The loading time from an employee's login to displaying his/her homepage should be less than 0.1s. （性能）
- The system provides special interfaces to do automated（自动的） testing.（可测试性）

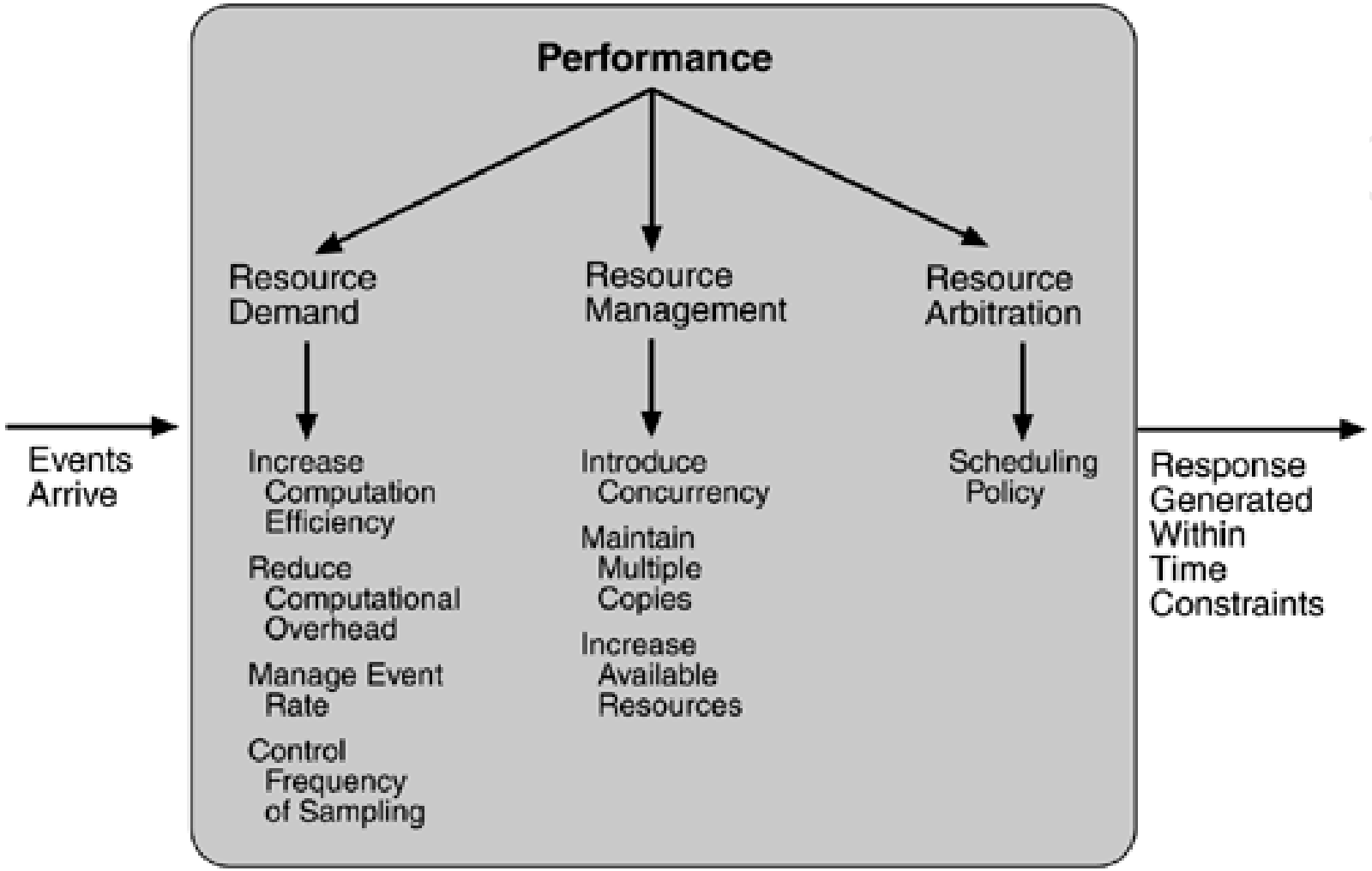
可用性策略总结


Availability
Fault
Fault Detection
Recovery-Preparation and Repair
Recovery-Reintroduction
Prevention
Ping/Echo
Heartbeat
Exception
Voting
Active Redundancy
Passive Redundancy
Spare
Shadow
State Resynchronization
Rollback
Removal from Service
Transactions
Process Monitor
Fault Masked or Repair Made

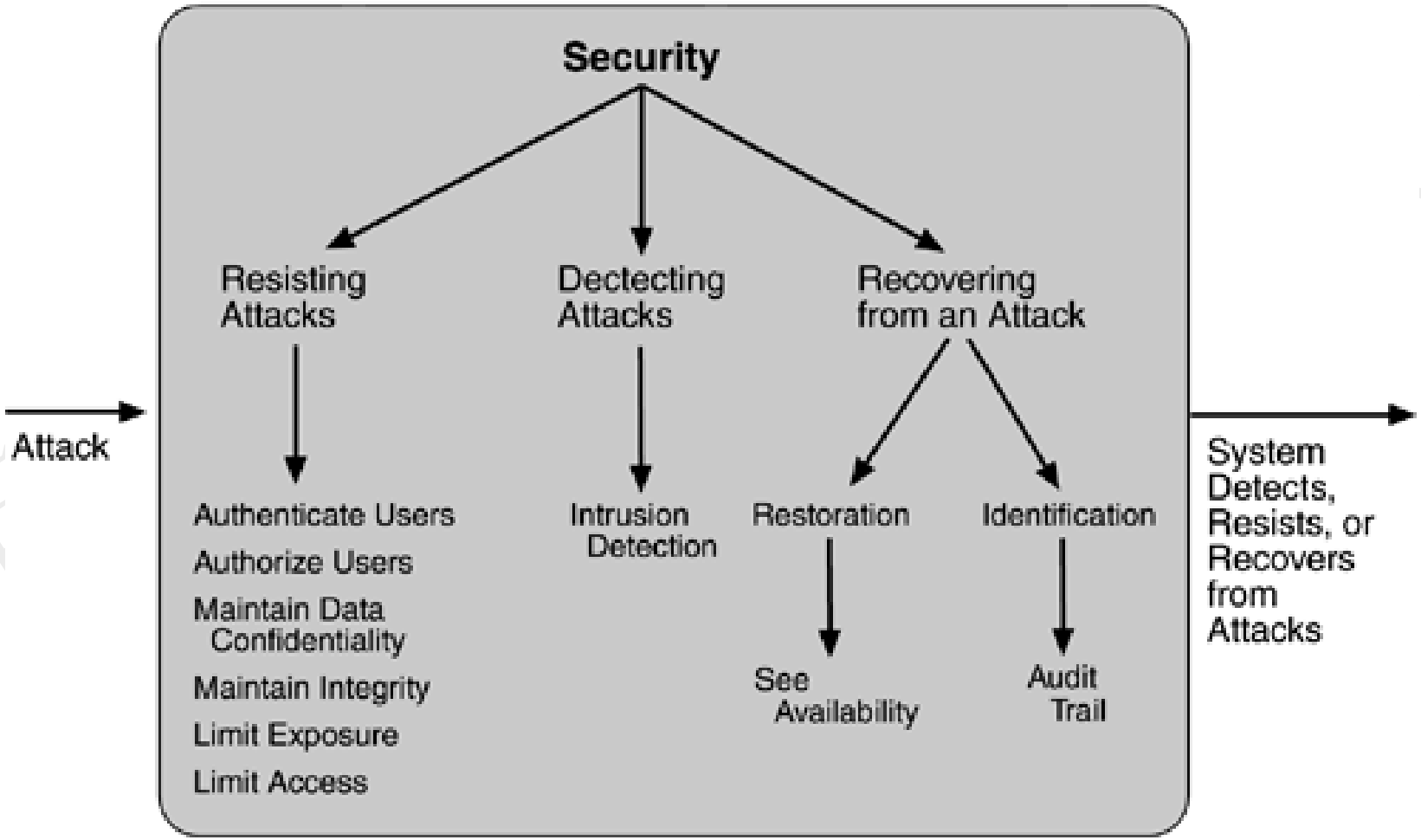
可修改性策略总结


Modifiability
Localize Changes
Prevention of Ripple Effect
Defer Binding Time
Changes Arrive
Semantic Coherence
Anticipate Expected Changes
Generalize Module
Limit Possible Options
Abstract Common Services
Hide Information
Maintain Existing Interface
Restrict Communication Paths
Use an Intermediary
Runtime Registration
Configuration Files
Polymorphism
Component Replacement
Adherence to Defined Protocols
Changes Made, Tested, and Deployed Within Time and Budget

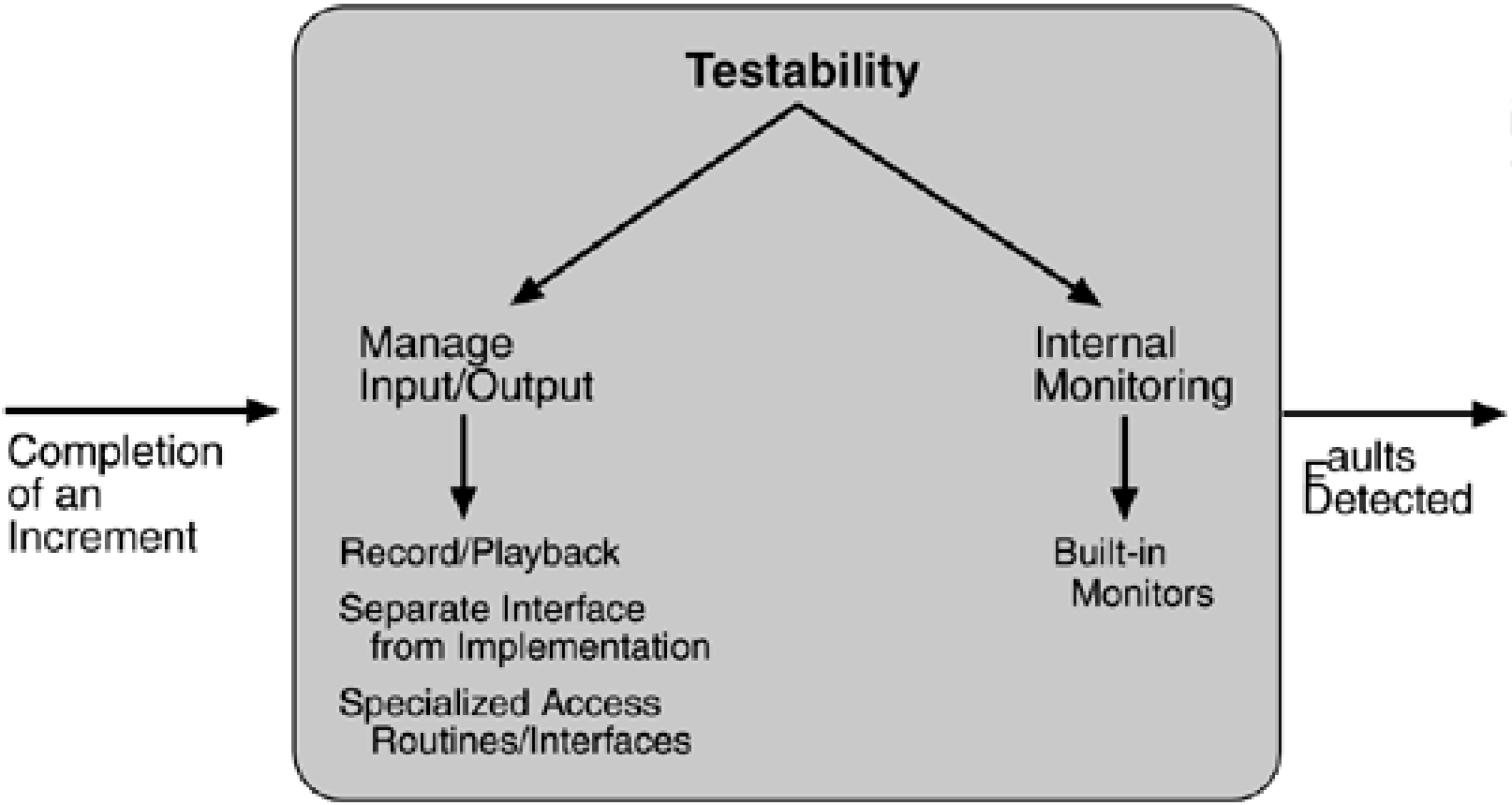
性能策略总结


Performance
Resource Demand
Resource Management
Resource Arbitration
Events Arrive
Increase Computation Efficiency
Reduce Computational Overhead
Manage Event Rate
Control Frequency of Sampling
Introduce Concurrency
Maintain Multiple Copies
Increase Available Resources
Scheduling Policy
Response Generated Within Time Constraints

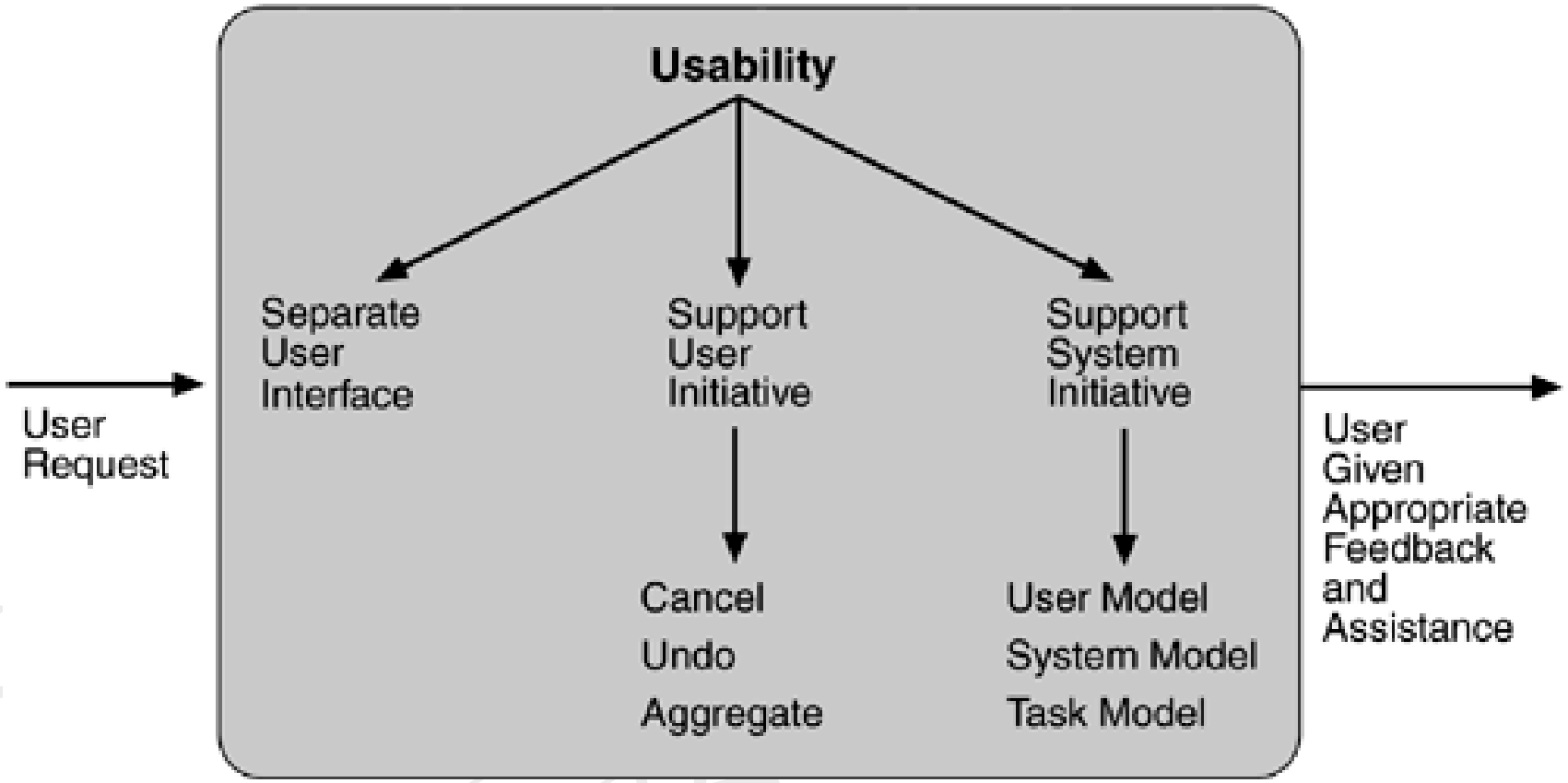
安全性策略总结


Security
Resisting Attacks
Dectecting Attacks
Recovering from an Attack
Attack
Authenticate Users
Authorize Users
Maintain Data Confidentiality
Maintain Integrity
Limit Exposure
Limit Access
Intrusion Detection
Restoration
Identification
See Availability
Audit Trail
System Detects, Resists, or Recovers from Attacks

可测试性策略总结


Testability
Manage Input/Output
Internal Monitoring
Completion of an Increment
Record/Playback
Separate Interface from Implementation
Specialized Access Routines/Interfaces
Built-in Monitors
aults Detected

易用性策略总结


Usability
Separate User Interface
Support User Initiative
Support System Initiative
User Request
Cancel
Undo
Aggregate
User Model
System Model
Task Model
User Given Appropriate Feedback and Assistance

第四步：抓住主要矛盾，给出建议风格

- A company wants to develop a software system used in its intranet （局域网）. The function of this systems is same as Weibo and Twitter. Each department（部门） can publish information about the department using this system, and Employees in the company can follow（关注） one or more departments to receive information published by these departments. When one department publishes a piece of new information, the system will send the information to all the followers （关注者） of this department. After one employee unfollows one department, he/she will not receive information published by this department in future

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- Implicit Invocation！
- Why？

架构师思维

- 图式思维能力
  - 擅长用图而非文字表达自己的设计理念
  - 一图胜千言
- 经验驱动的设计能力
  - 针对每个新问题，在自己的知识库中寻找类似的成功/失败案例，借鉴设计经验/避免设计问题
  - 千万不要自己重头开始一个全新的“设计”
- 定量描述问题的能力
  - 软件架构与软件的质量属性高度相关
  - 要学会采用量化、精确的方式表达对质量属性的要求

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谢谢大家！

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