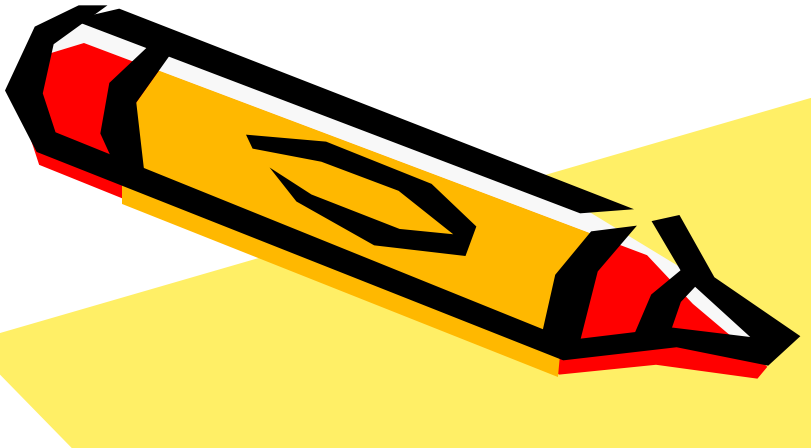

Web应用架构

Qiuyan Huo 霍秋艳
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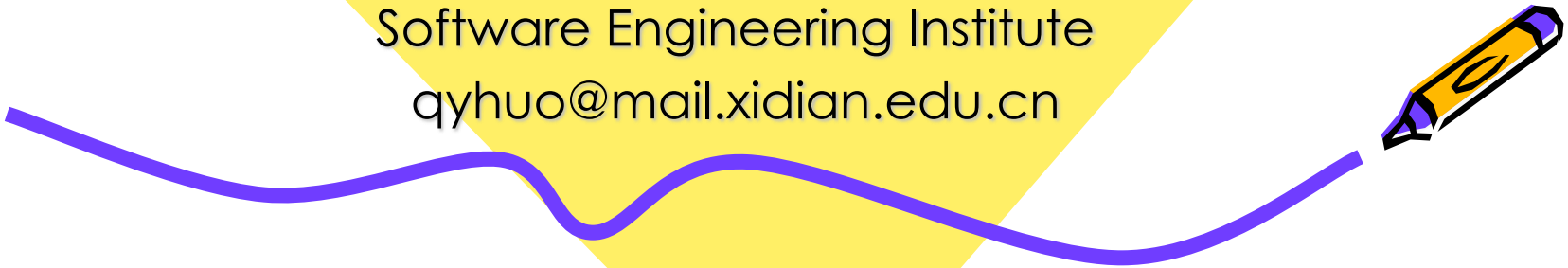
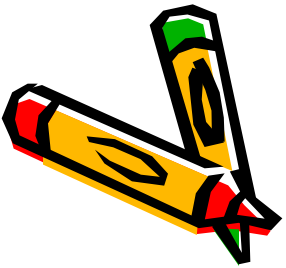
qyhuo@mail.xidian.edu.cn



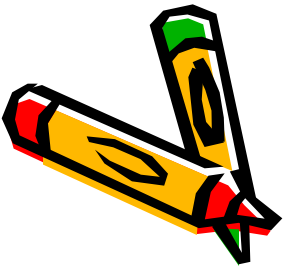
Introduction

- We build a …
  - Bird house
    - Basic tools: hammer, nails, saw, wood -> go!
  - Garden house
    - Draw a plan, Construct
  - One-family house
    - make a sketch(*草图*), discuss, change plan, draw outside view, compute static's construct
  - Hotel****
    - Make sketches, models, plans, detail function units (kitchen, lifts, stairs), plan interior decoration of entrance hall, …
  - Church
    - Design of acoustics(*声学*), check spiritual(*精神上的*) aspects of design, impact of church spire(*尖顶*) on city skyline

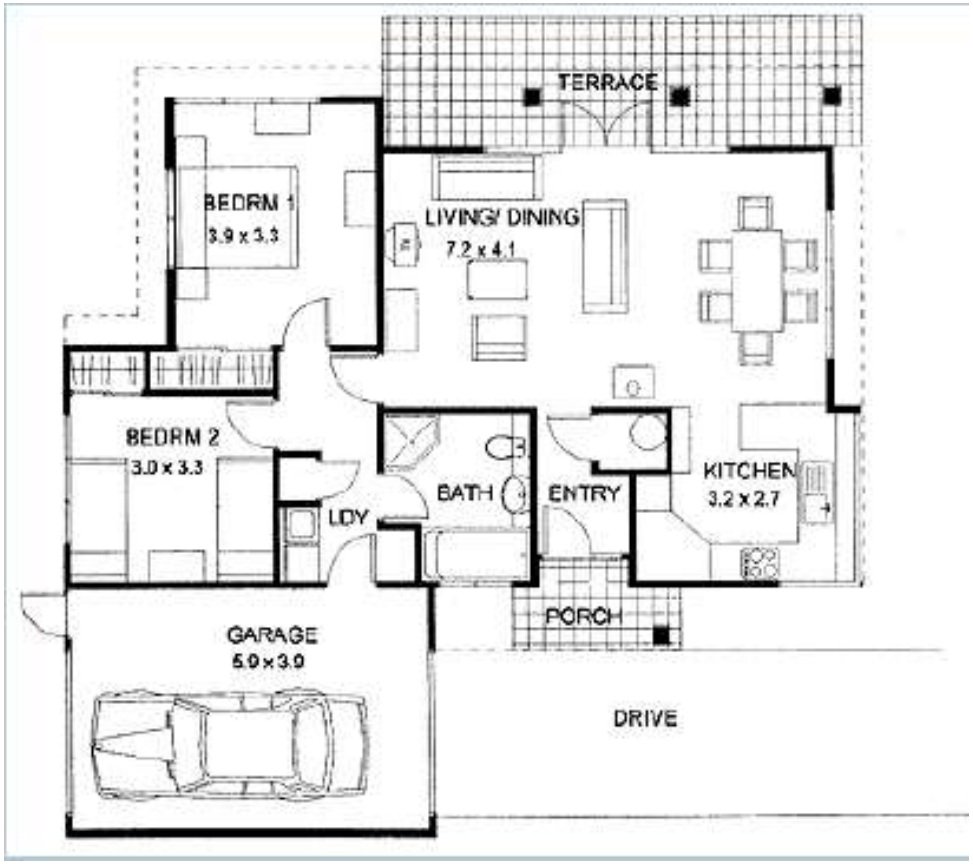


Objectives of Architectures

- Well-structured(*结构良好的*)
- Encapsulation / hiding(*封装/隐藏*)
- Performance (e.g., efficient traffic flow)
- Extensibility(*可扩充性*)
- Mobility(*灵活性*)

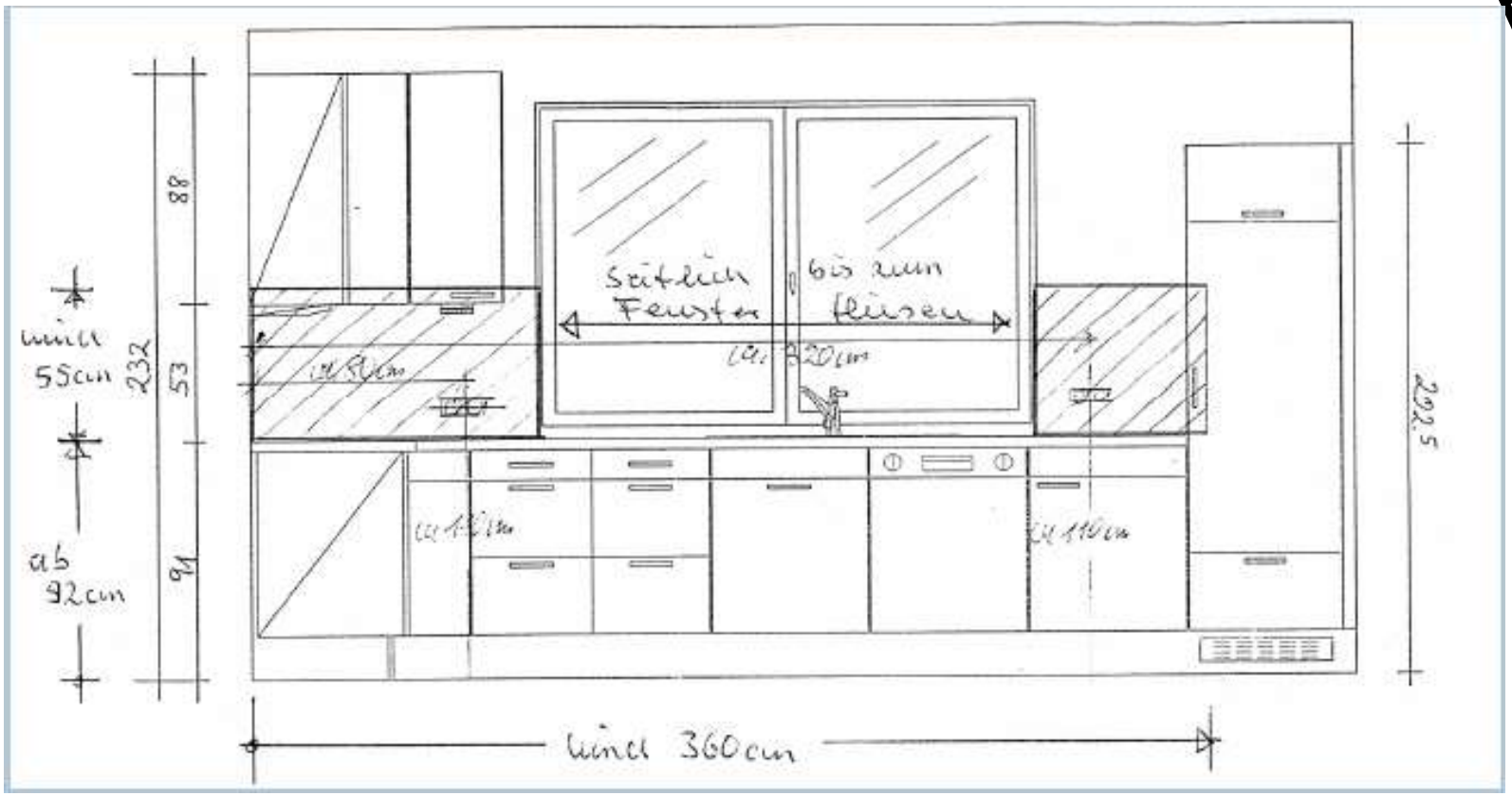


Architecture: floor plan

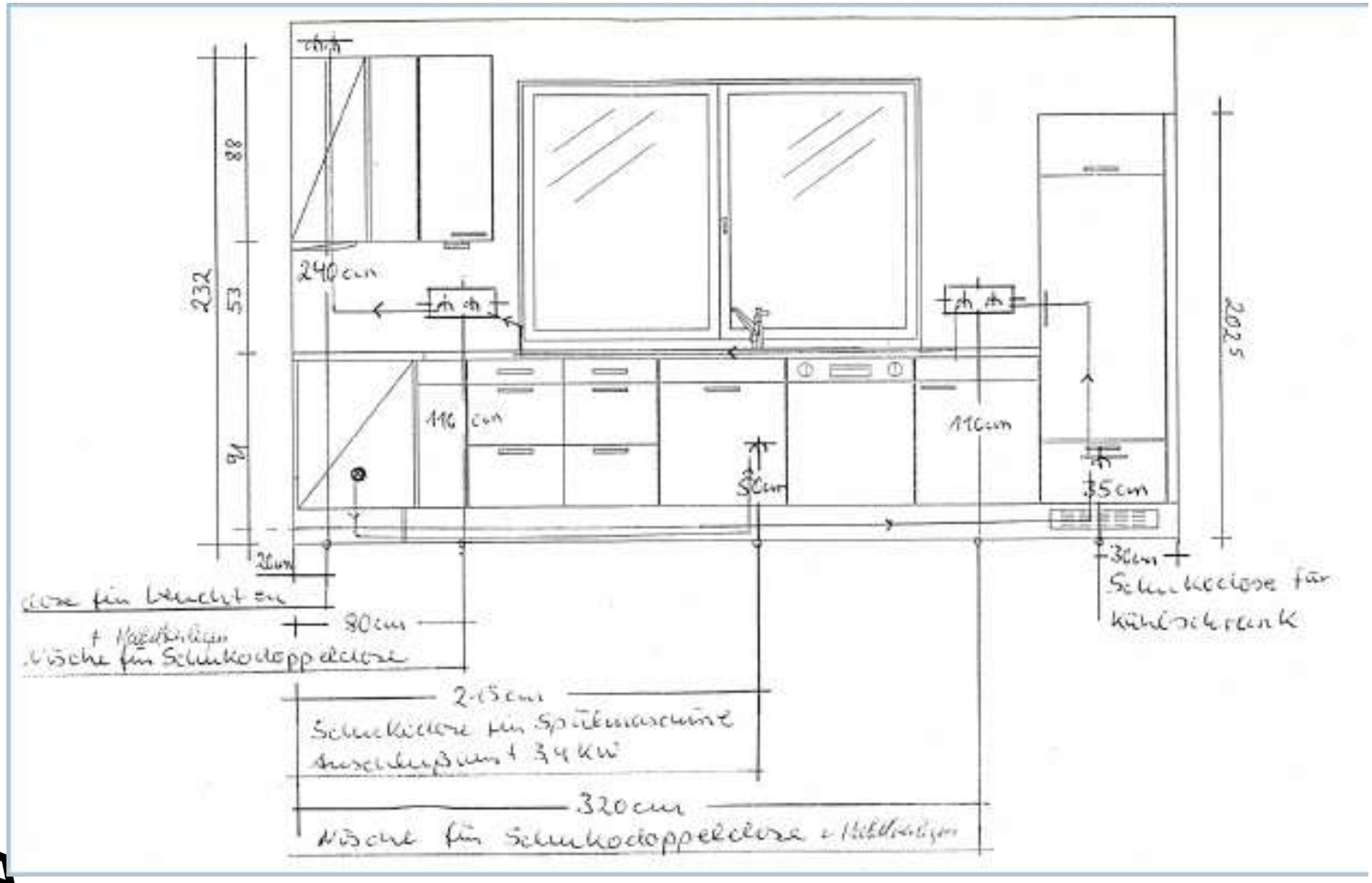


Architecture: sheer(垂直的) plan

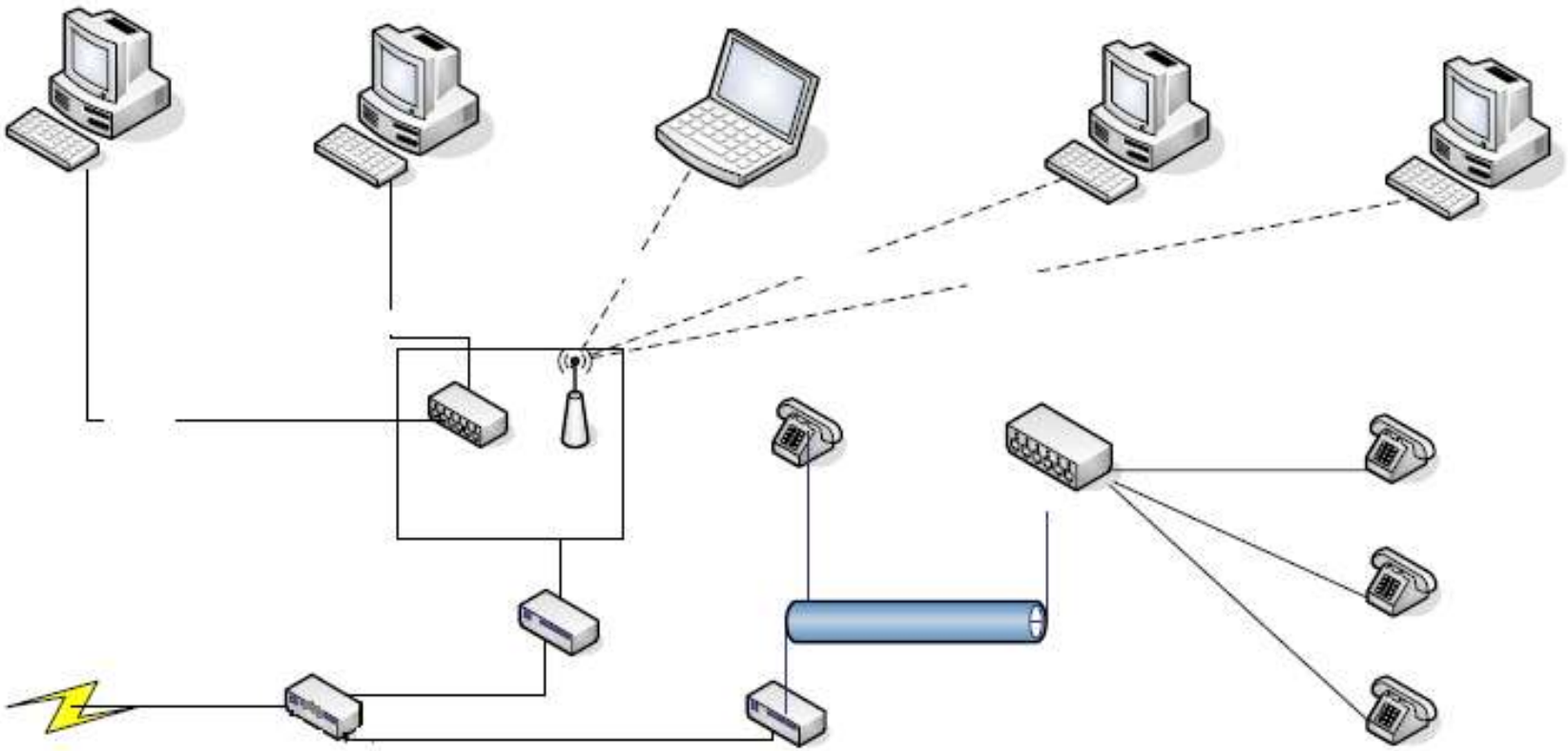
Architecture: tiler(铺瓦工) plan



Architecture: electricity plan

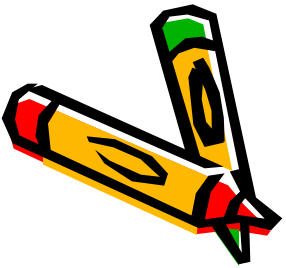


Architecture: network plan

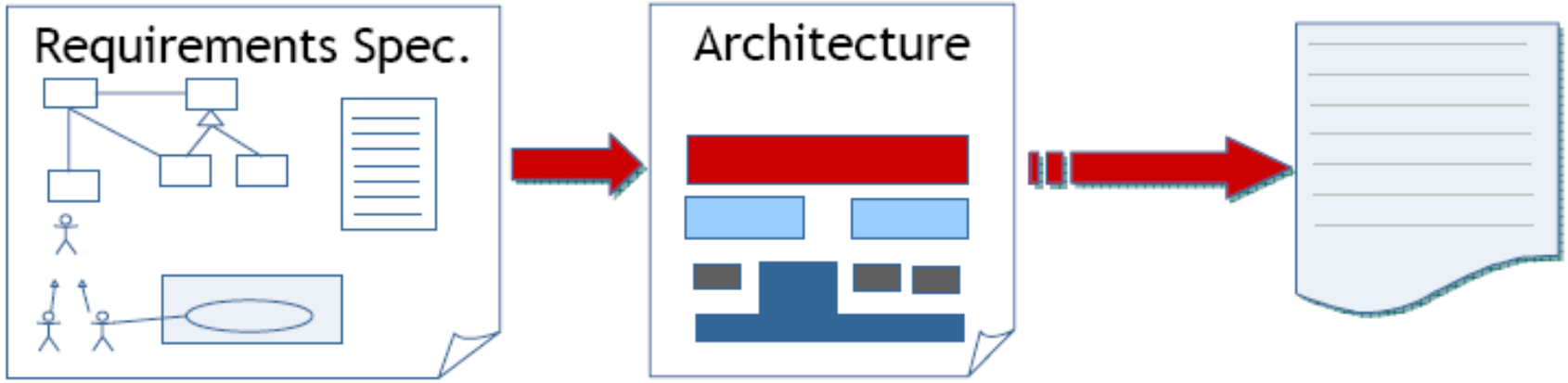


Architecture of buildings

- objectives for a realization
- One architect – several architectural draftsmen – many construction worker
- Different abstraction levels of architectures
  - District in town
  - Complex of buildings
  - Single building
  - Floor
  - Room
- Different views on architectures
  - **Physical** views (floor plan, sheer plan, 3-D view)
  - **Logical** views (network plan, waste water plan, static)
  - Different levels of detail



Software Architecture



- Programming-in-the-large
  - Overall structure of the system *(系统整体架构、体系结构)*
  - Usually called *software architecture* *(软件架构)*

软件架构的特性

- 来源于需求规格说明
  - 功能和非功能需求
- 几个架构师，很多程序员
- 可运行软件的抽象
- 定义模块或组件以及它们之间的交互
- 抽象层次的问题
  - 对于盖房设计图而言，没有清晰地区分不同组件类型 (building –floor –room)
  - 软件架构中任何事物全部都是软件—不同的抽象

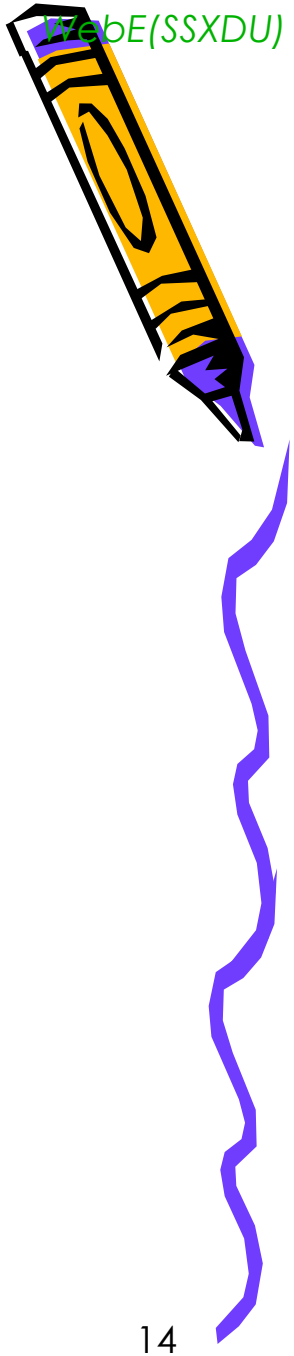
软件架构的特性

- 系统的特定视图
- 系统的多种架构视图可能并存
- 架构视图的适合度取决于特定视角(e.g., distribution, communication, security)
- 和建筑物架构比较
  - 软件架构更多描述逻辑组件
  - 只有部署图为物理视图
  - 软件架构更动态性——复杂的行为和不断地演化

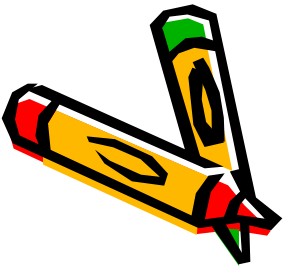
Web应用架构

- Web应用架构及其特性
- 模型驱动架构
- **层次**架构
  - 2/3/N层架构
- **集成**架构
  - 门户/EAI/SOA
- **面向数据**的架构
  - 数据为中心/Web文档管理/流媒体数据

总结与展望

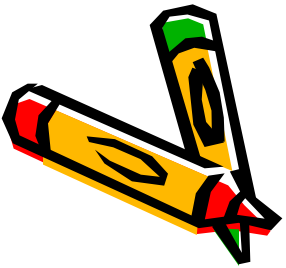


WEB应用架构及其特性



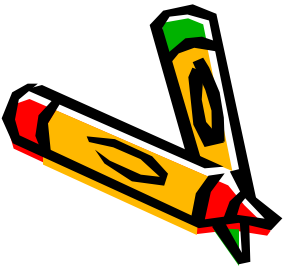
设计模式(Patterns)

- 在特定设计环境中反复出现的设计问题并给出相应的解决方案
  - 描述特定问题中组件及其职责、相互联系和相互作用
- 使用已有的设计知识来支持开发高质量的软件系统

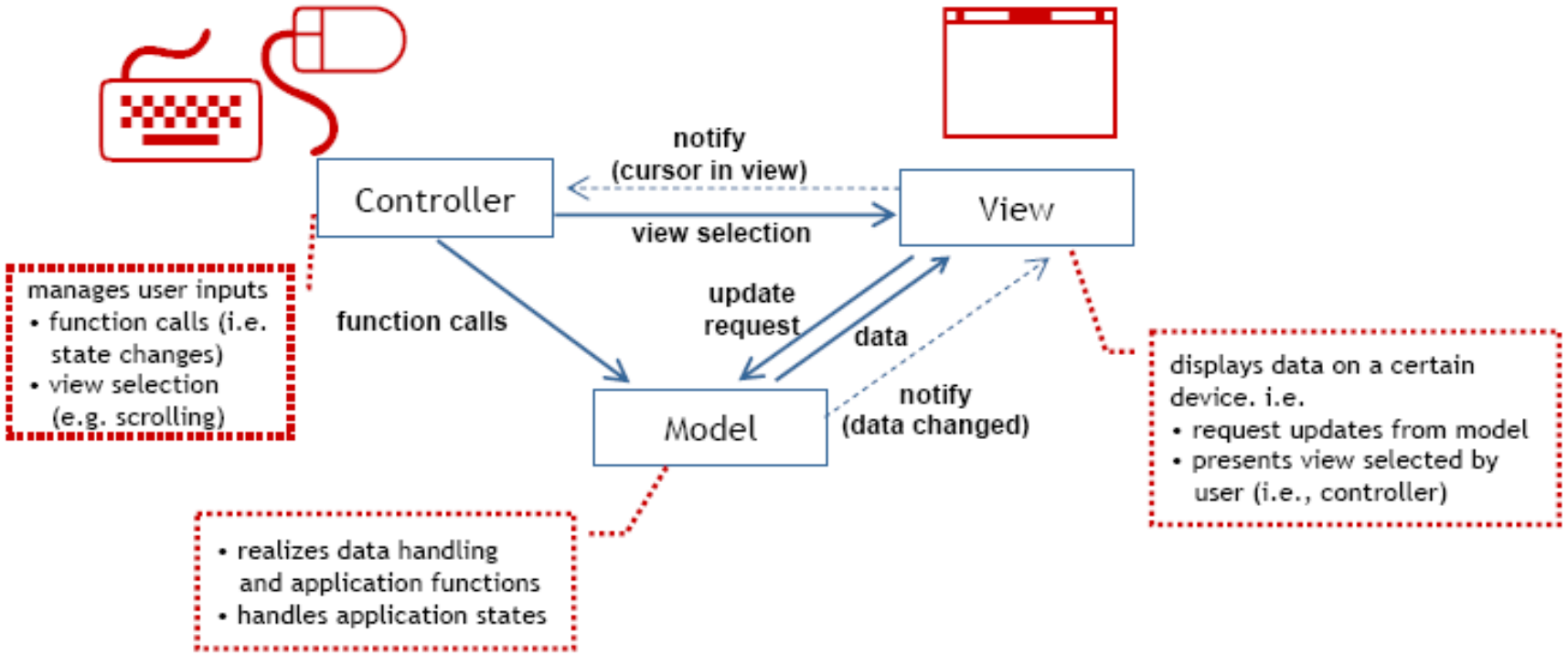


设计模式(Patterns)

- 三个不同的抽象层次
  - 架构模式（Architectural Pattern）
    - 系统的基本结构方案
    - 包括子系统架构及其职责、关系和相互作用(E.g., MVC)
  - 设计模式（Design Pattern）
    - 特定环境下，解决通用设计问题的组件结构、关系和相互作用(E.g., Publisher-Subscriber)
  - 编程模式（Idiom）
    - 在程序设计语言中某些功能的特定实现方式(e.g., Counted-Pointer in C++)



Model – View – Controller (MVC)



eBusiness应用模式

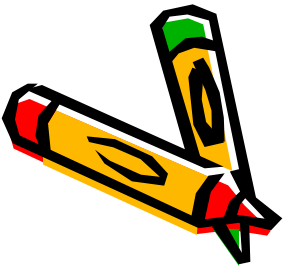
- 应用服务器（Application Server）模式
- 服务器端会话（Server-side Session）模式
- 垂直分片（Vertical Slice）模式
- 服务器集群故障转移（Fail-over Through Server Clustering）模式和任务分配（Job Draining）模式
- 心跳（Heartbeat）模式
- Web监视器（Web Inspector）模式
- 业务上下文感知目标检索（Business Context-Aware Object Retrieval）模式
- 预制业务对象（Prefabricated Business Objects）模式

框架(Framework)

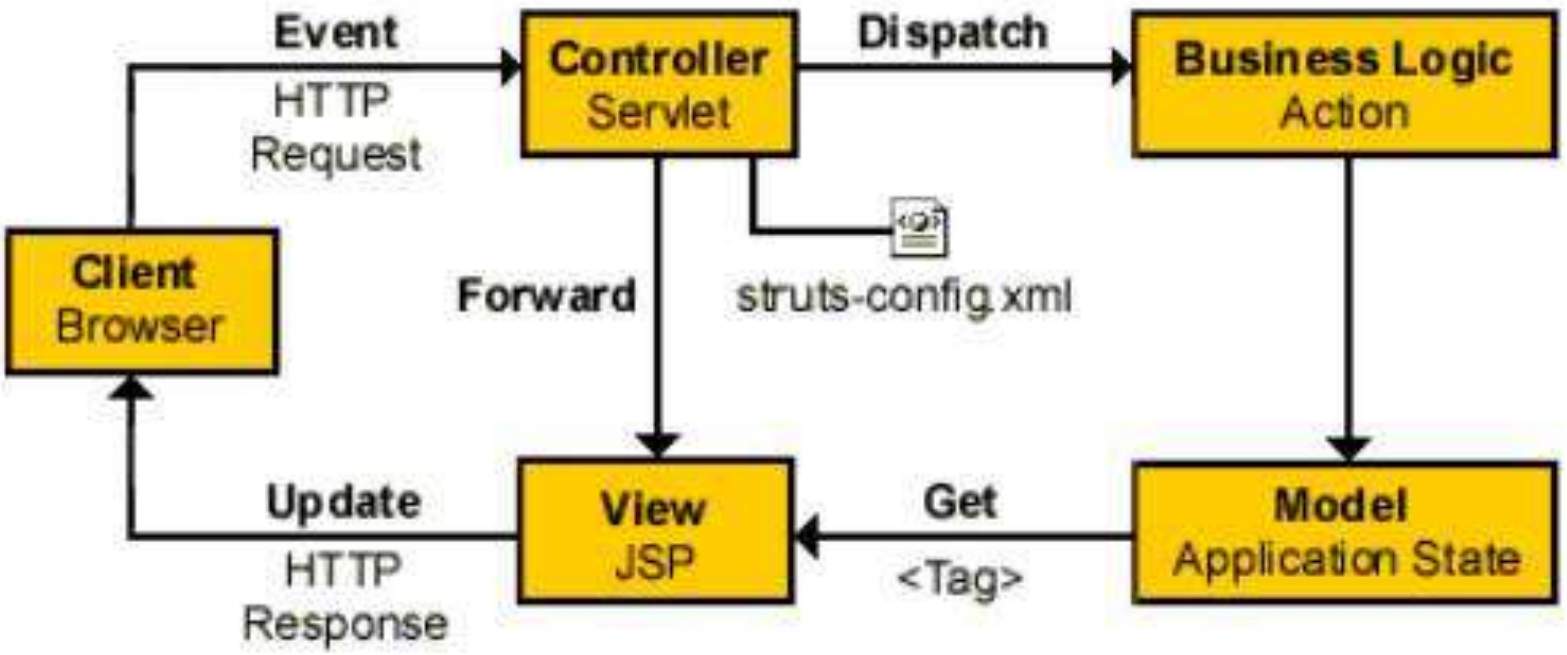
- 另一种重用架构知识的方式
- 框架是一组组件的综合，这些组件相互协作，为一类相关应用提供了可重用的框架结构
  - 通用功能已经被实现的可复用软件系统
  - 可以进行实例化
  - 作为特定领域应用的基本架构和基本功能的蓝图
- 框架中包含的知识可以被应用全部采纳
- E.g., Struts、Webwork、Spring、Tapestry和JSF, Rails, Backbone, ……

框架(Framework)

- Benefits:
  - 简单重用框架的架构和功能
- drawbacks:
  - 使用需要专业知识
  - 不同框架之间并没有集成标准
  - 开发出的应用对开发商过于依赖等

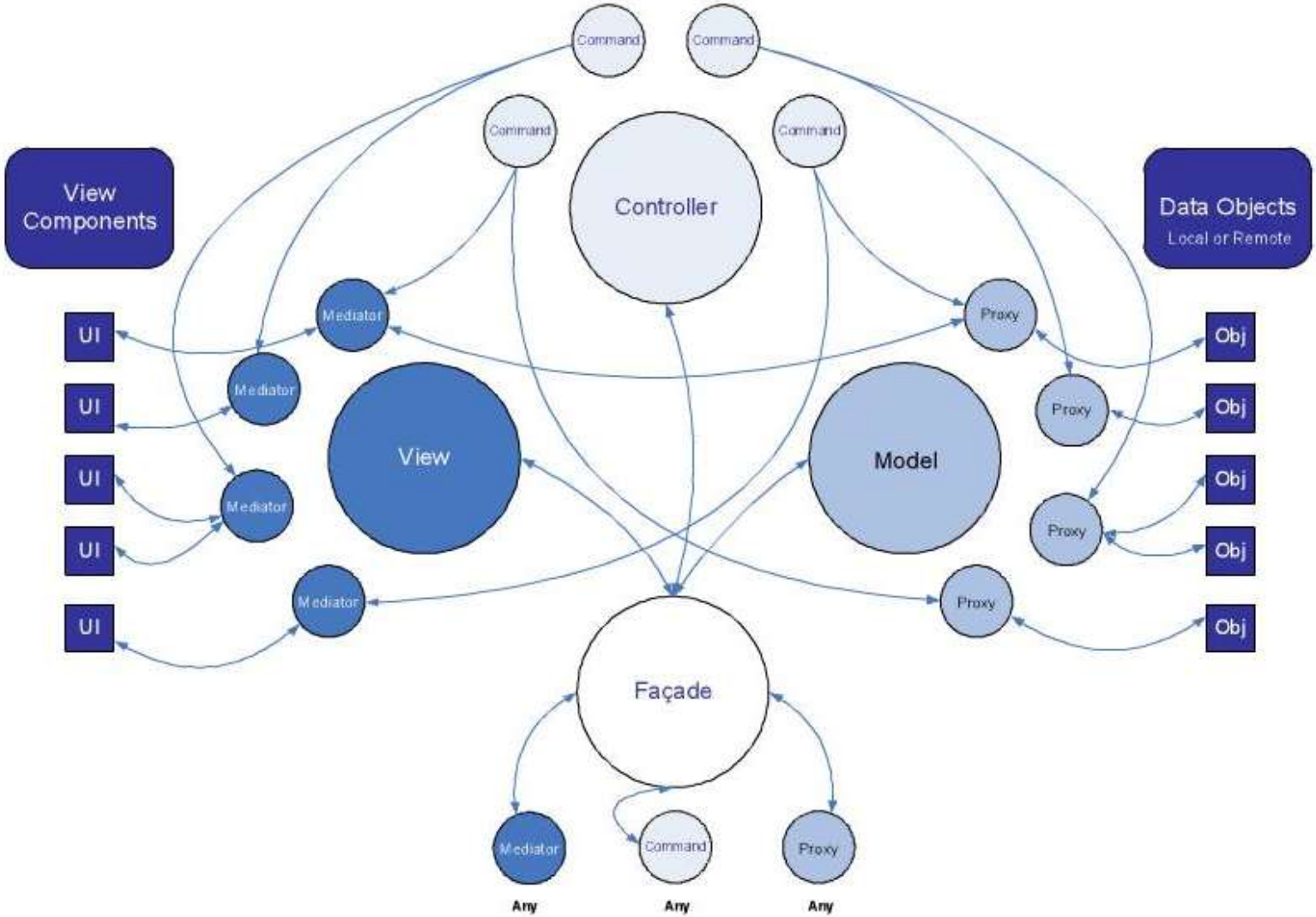


Struts



Struts在MVC方面是最好的

PureMVC

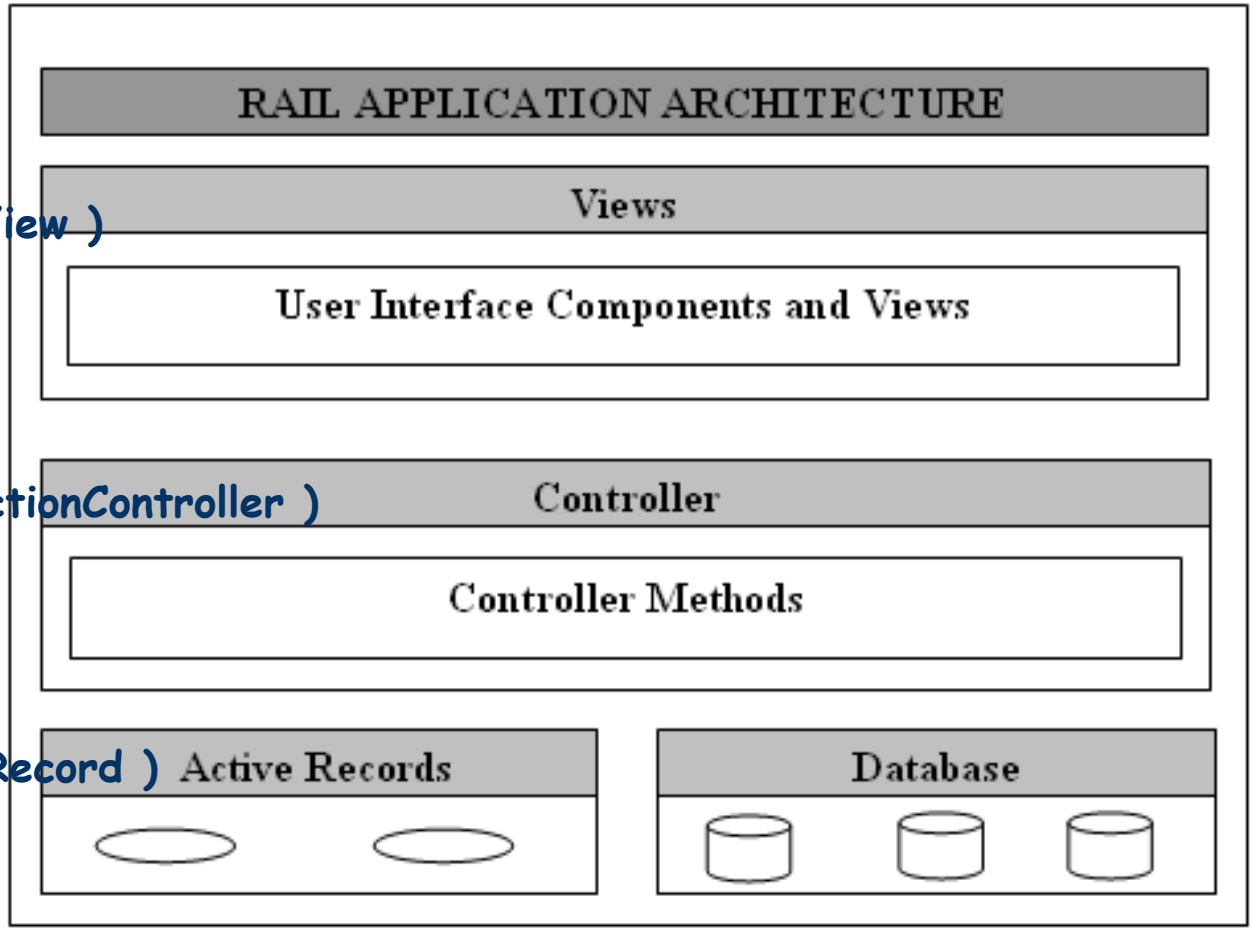

Command
Command
Command
Command
Controller
View Components
Data Objects
Local or Remote
Mediator
Mediator
Mediator
Mediator
UI
UI
UI
UI
UI
View
Model
Proxy
Proxy
Proxy
Proxy
Obj
Obj
Obj
Obj
Obj
Façade
Mediator
Command
Proxy
Any
Any
Any

Ruby on Rails MVC framework

View (ActionView)

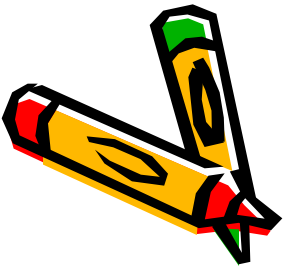
Controller (ActionController)

Model (ActiveRecord)



架构分类

- 层次特性
  - 分而治之：将应用根据逻辑划分成不同的部分，然后单独考虑并单独编码实现，每一部分实现不同的功能，并可能分布在不同的主机，不同的操作系统上，通常以层（layer）来描述划分的领域。
  - E.g., Java EE架构、企业应用集成（EAI）
- 数据特性
  - 根据数据的结构化或非结构化特性



架构分类

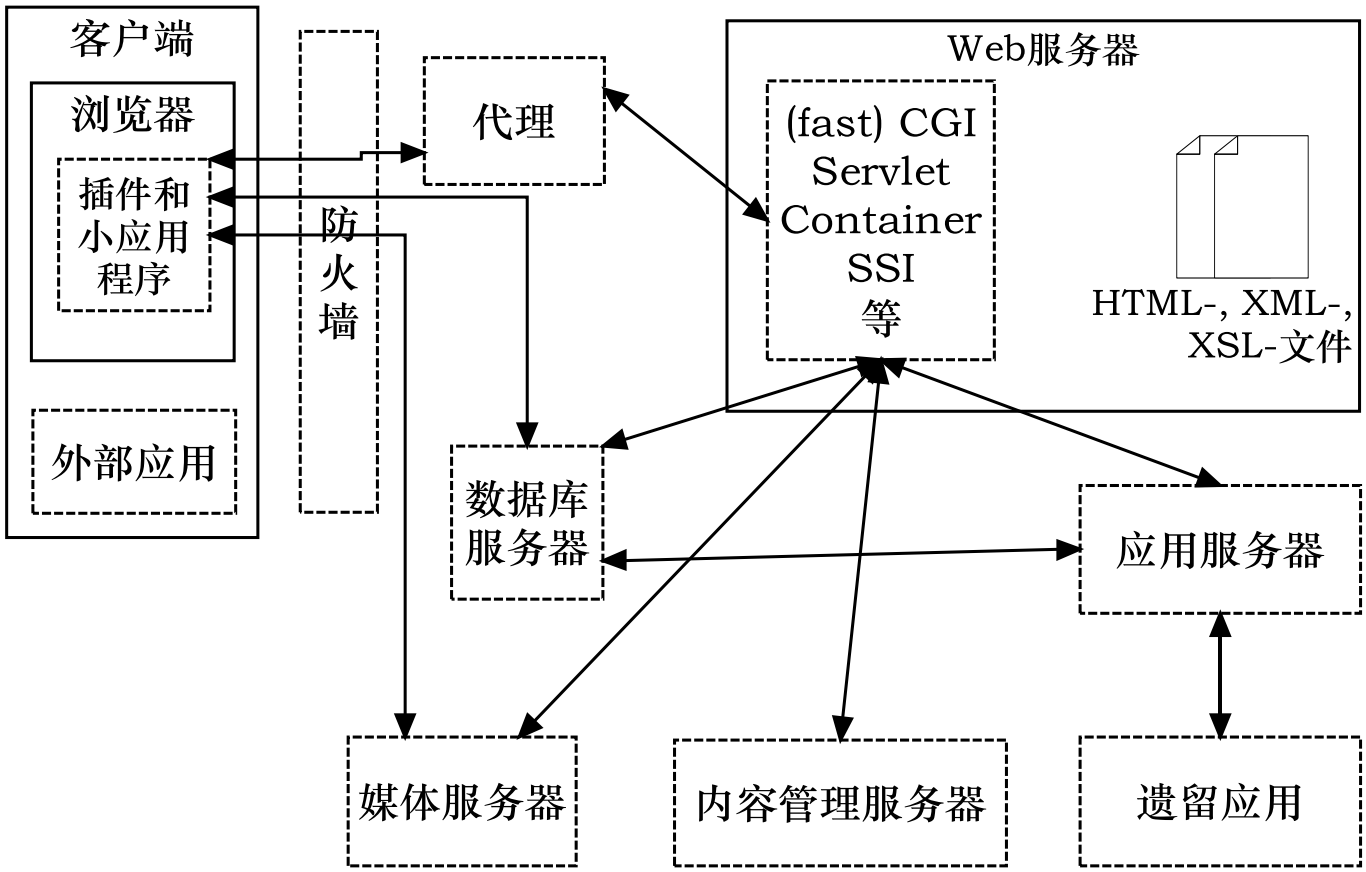
- 分布对象中间件（DOM）
  - 基于远程过程调用（RPC）机制，允许透明地访问远程对象。
- 虚共享内存（VSM）
  - VSM模型支持分布进程访问同样的数据。
- 面向消息中间件（MOM）
  - 异步消息交互
- P2P
  - 对等点可以直接通信而无需服务器
- 面向服务的中间件（SOM）
  - 在DOM系统的基础上加上服务的概念

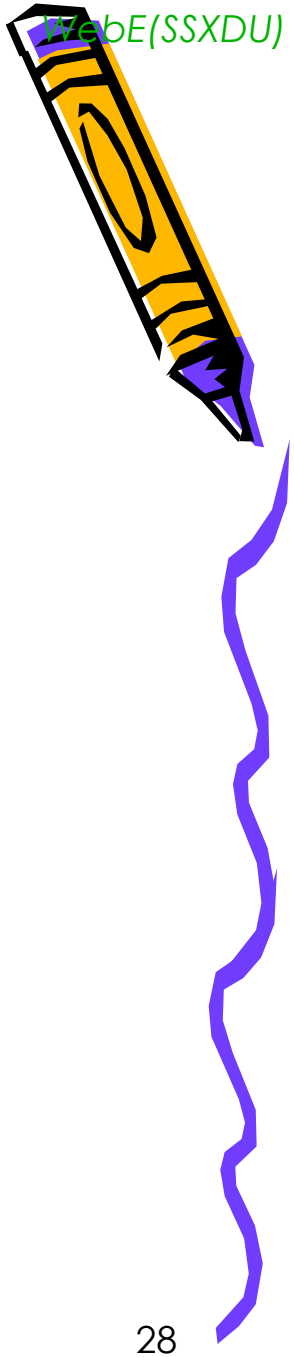
Web应用架构特性

- Web基础架构
  - Web平台架构（Web Platform Architecture, WPA）
  - Web应用架构（Web Application Architecture, WAA）强调Web应用所处的问题域
- WPA
  - 应用服务器如Java EE、.NET平台提供会话处理、协议包装、数据访问等基础服务
  - 特定架构:安全（如防火墙）、性能（缓存代理）或数据集成（如EAI）等方面
- 众多不同系统使得更难评估和维护各种质量需求
- 技术架构的异构性和不成熟性
- 国际化

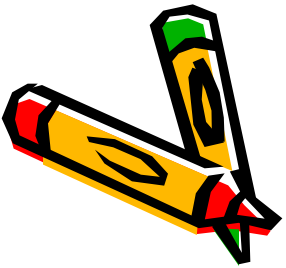
在构建Web应用架构的时候就要考虑所有这些特性.

Web应用架构--通用组件



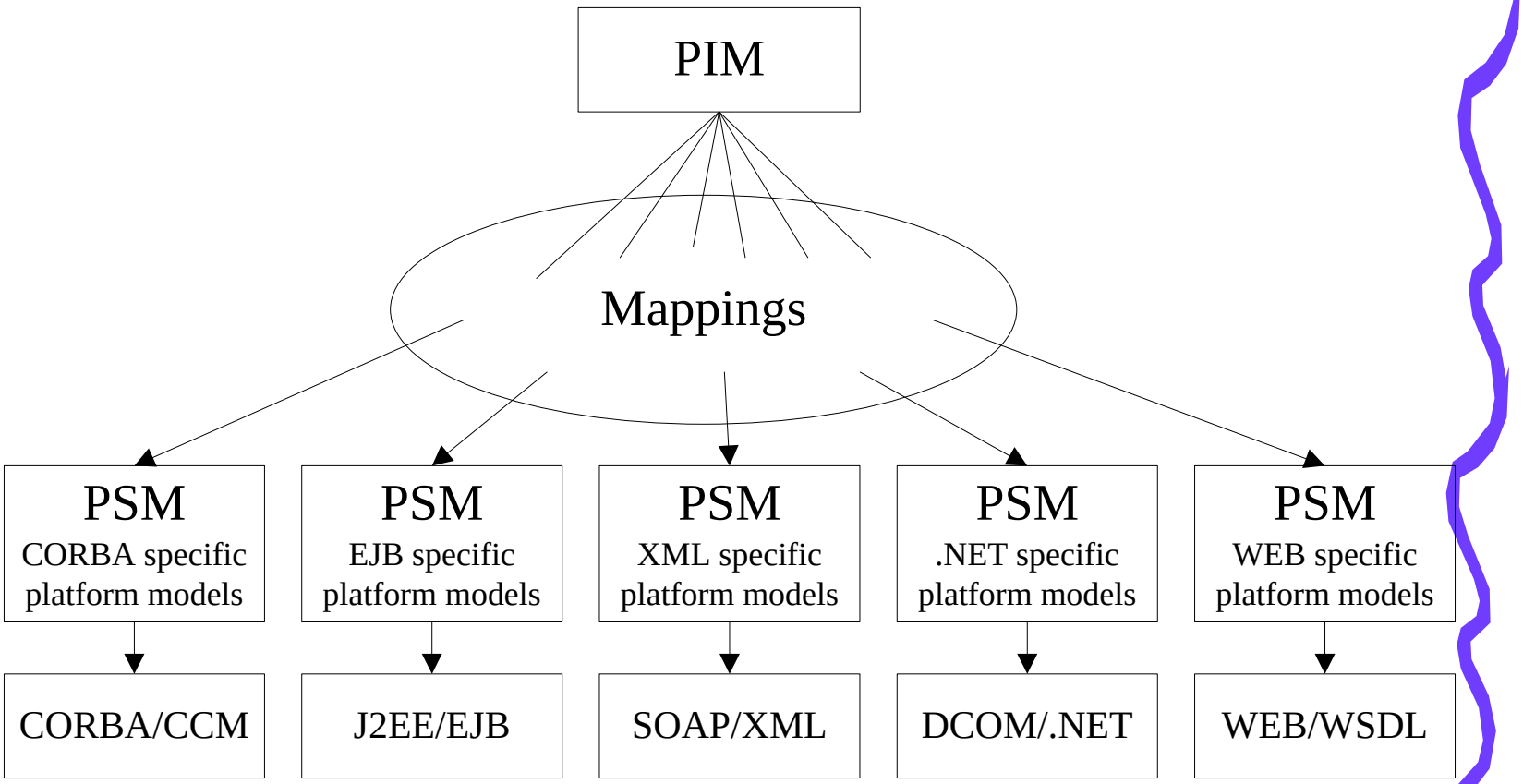


模型驱动架构



模型驱动架构(MDA)

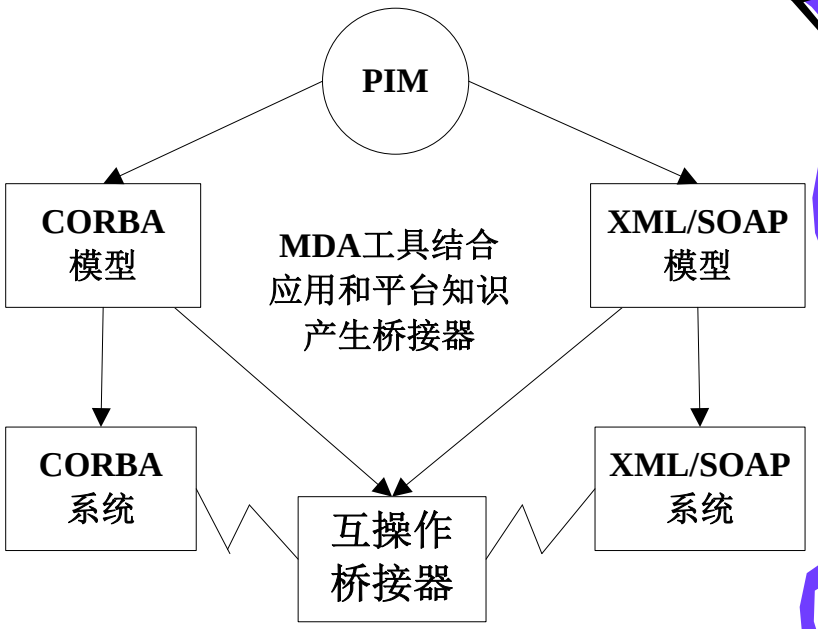
- MDA是一种开放的，独立于软件供应商的架构，支持众多应用领域和技术平台。



MDA的优势

- 提高生产效率
- 提高了可重用性
- 增强可移植性
- 支持互操作性

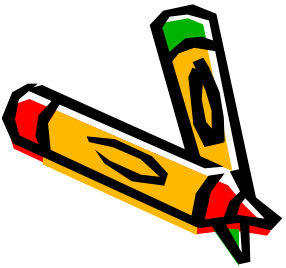
- 提高了系统的可验证性
- 便于维护



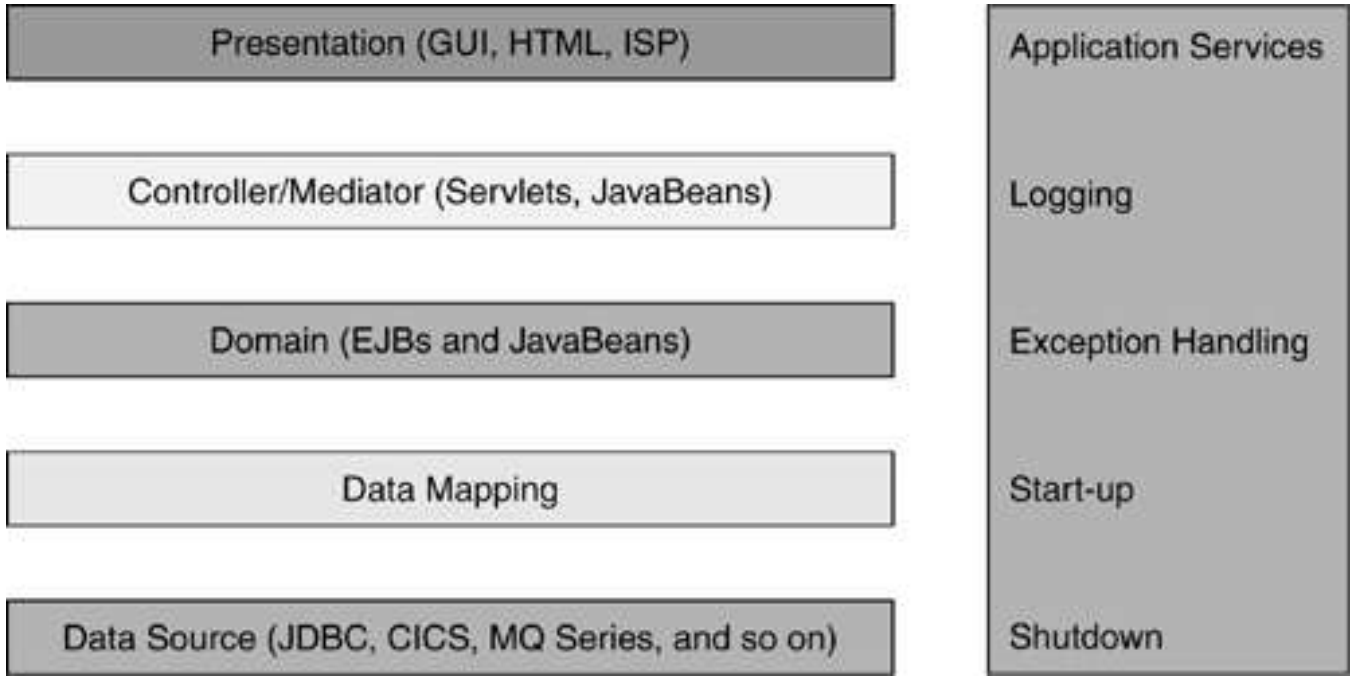
MDA工具

- 完全式，即完全支持整个开发过程，从UML建模，模型转换和代码生成。
  - Metanology Corporation的Meta Development Environment（MDE），Interactive Object Software的Arcstyler，Compuware Corp的OptimalJ，IBM的Rational XDE
- 不完全式，即支持将从其它模型工具得到的模型生成代码
  - Codagen Technology Corp的Architect，Telelogic的Tau

层次架构

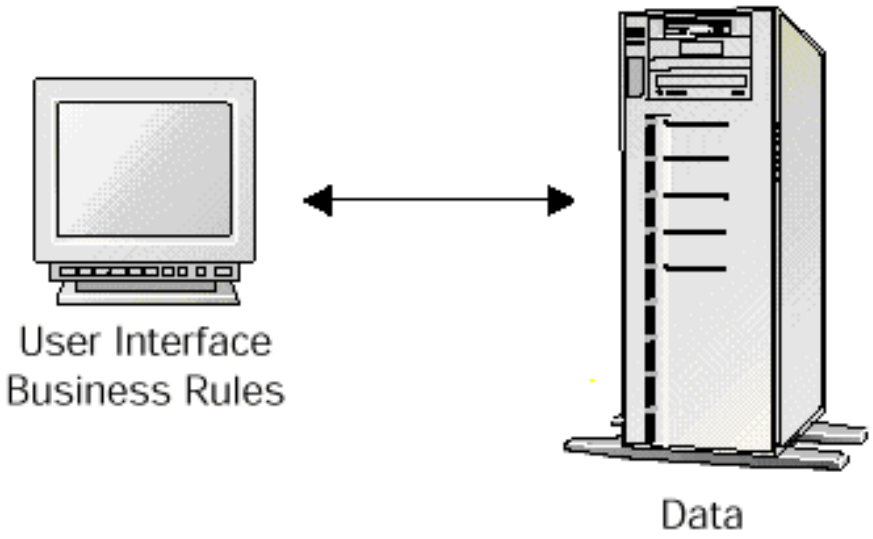


层次架构

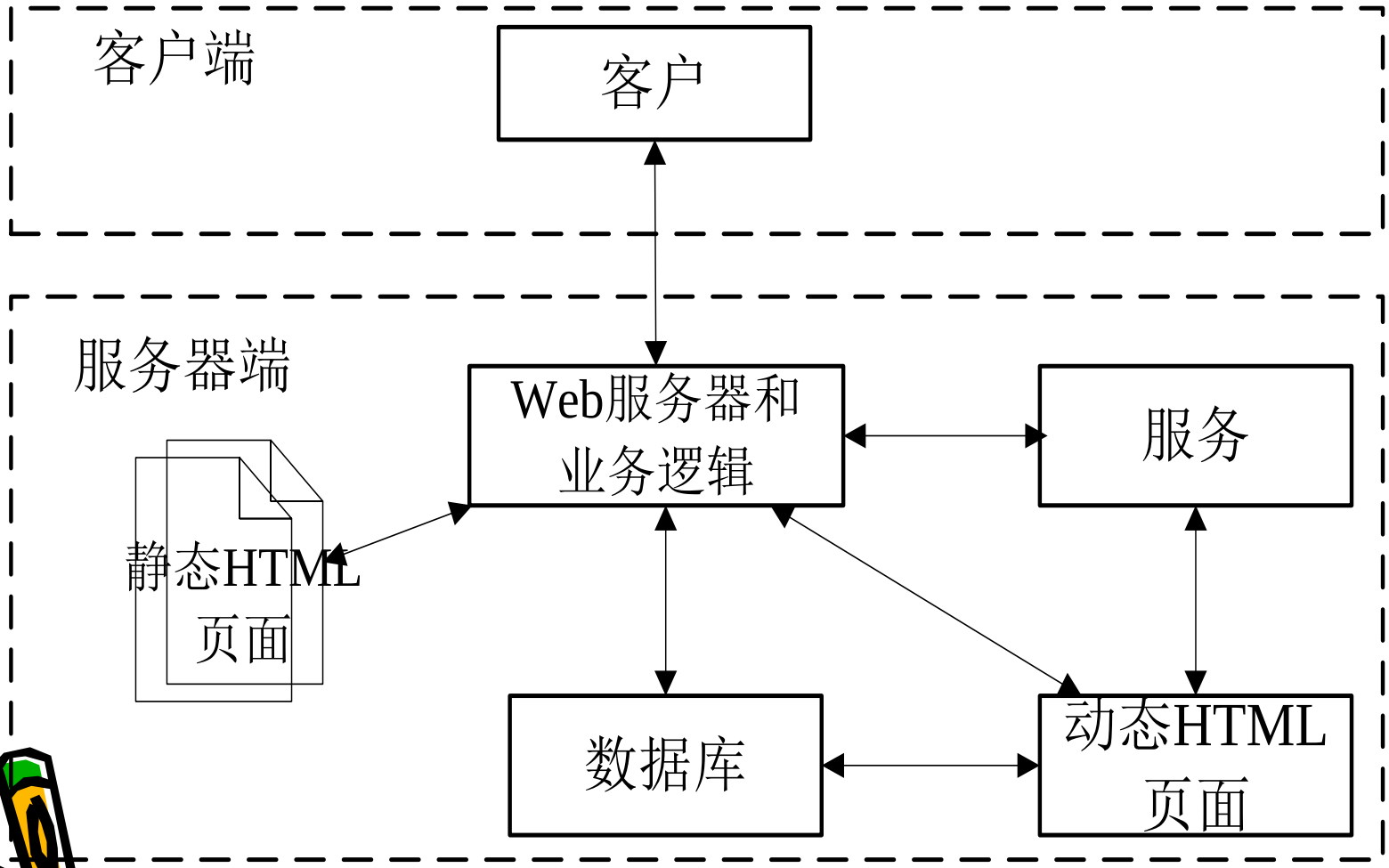

Presentation (GUI, HTML, ISP)
Controller/Mediator (Servlets, JavaBeans)
Domain (EJBs and JavaBeans)
Data Mapping
Data Source (JDBC, CICS, MQ Series, and so on)
Application Services
Logging
Exception Handling
Start-up
Shutdown

两层架构

- 两层（2-Tier）架构也称为客户/服务器架构，应用逻辑分布在服务器端，向客户端提供服务。

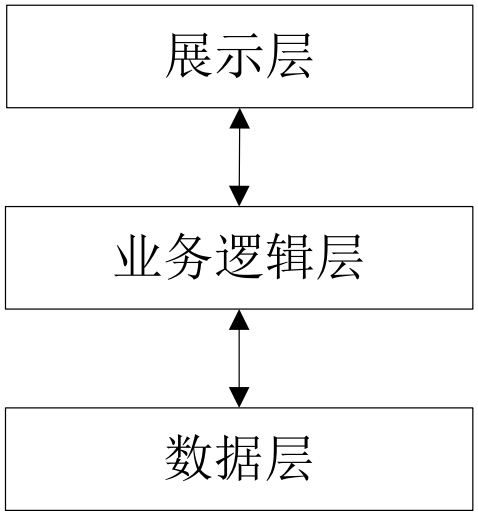


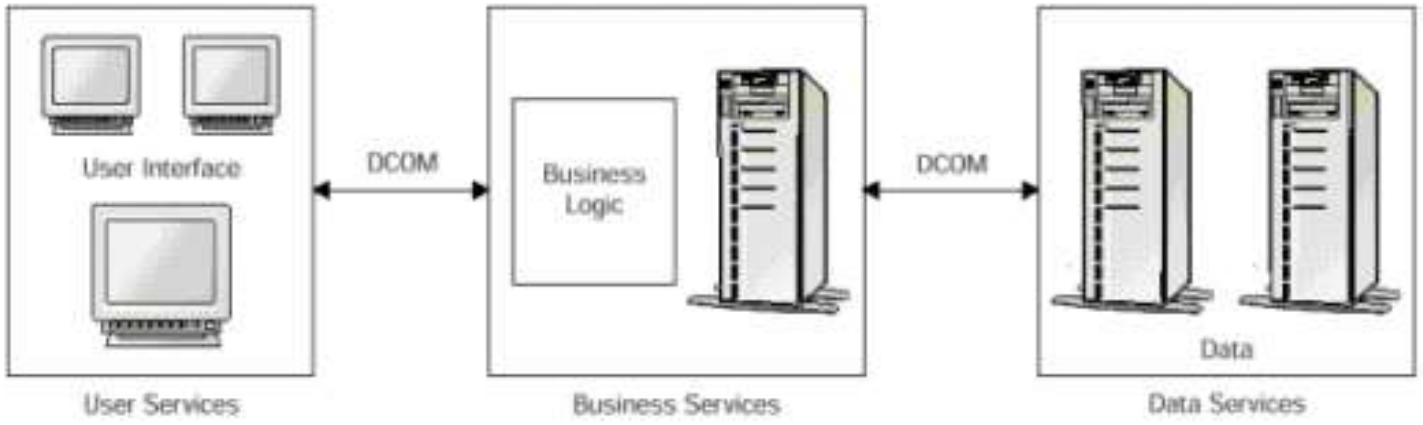
Web应用的两层架构



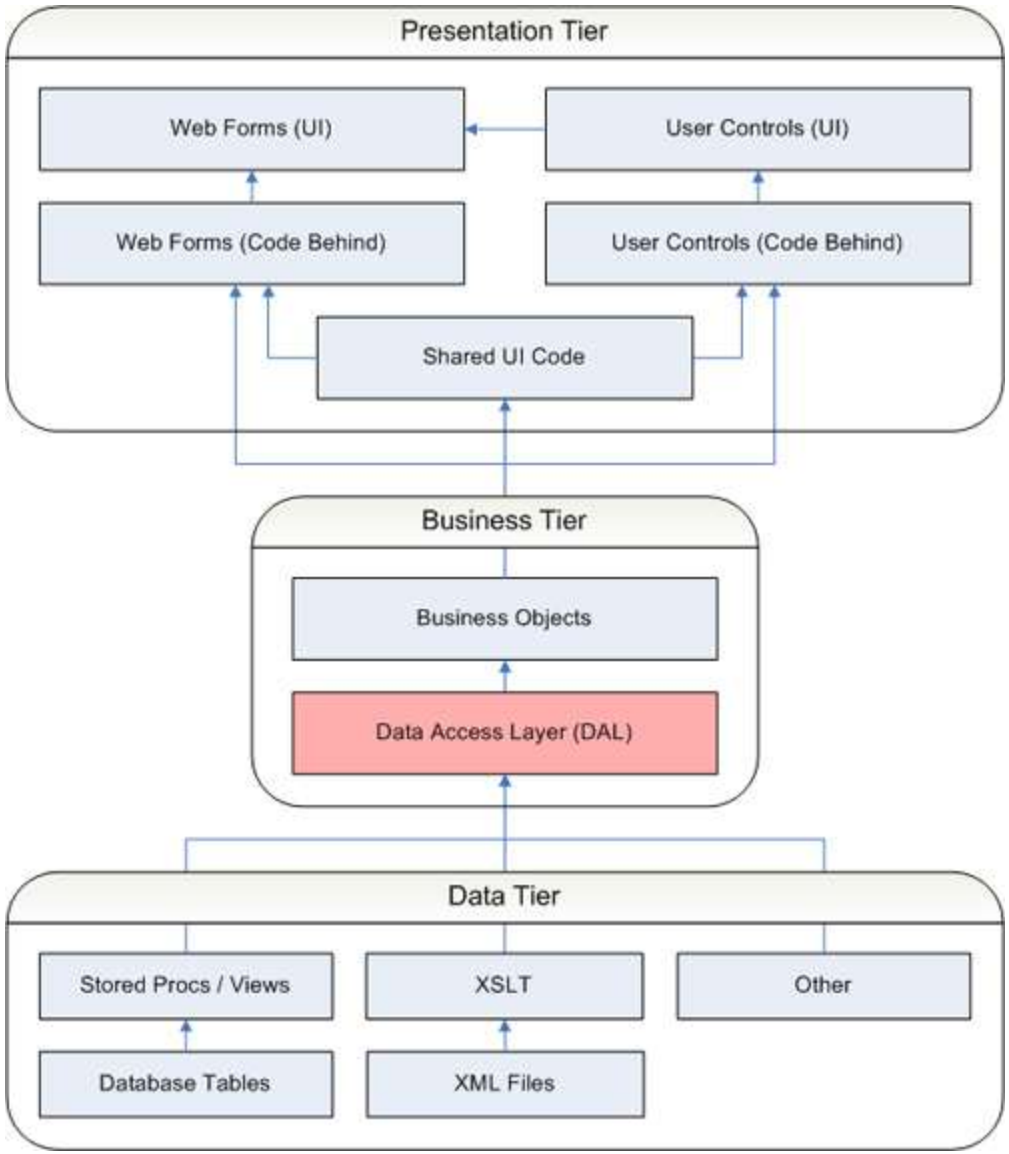
Web应用的三层架构

- 将Web应用中组件划分
  - 展示层: 封装和用户或者其它系统交互 (i.e.,浏览器)
  - 应用或逻辑层:组成业务逻辑
  - 数据层:封装持久存储

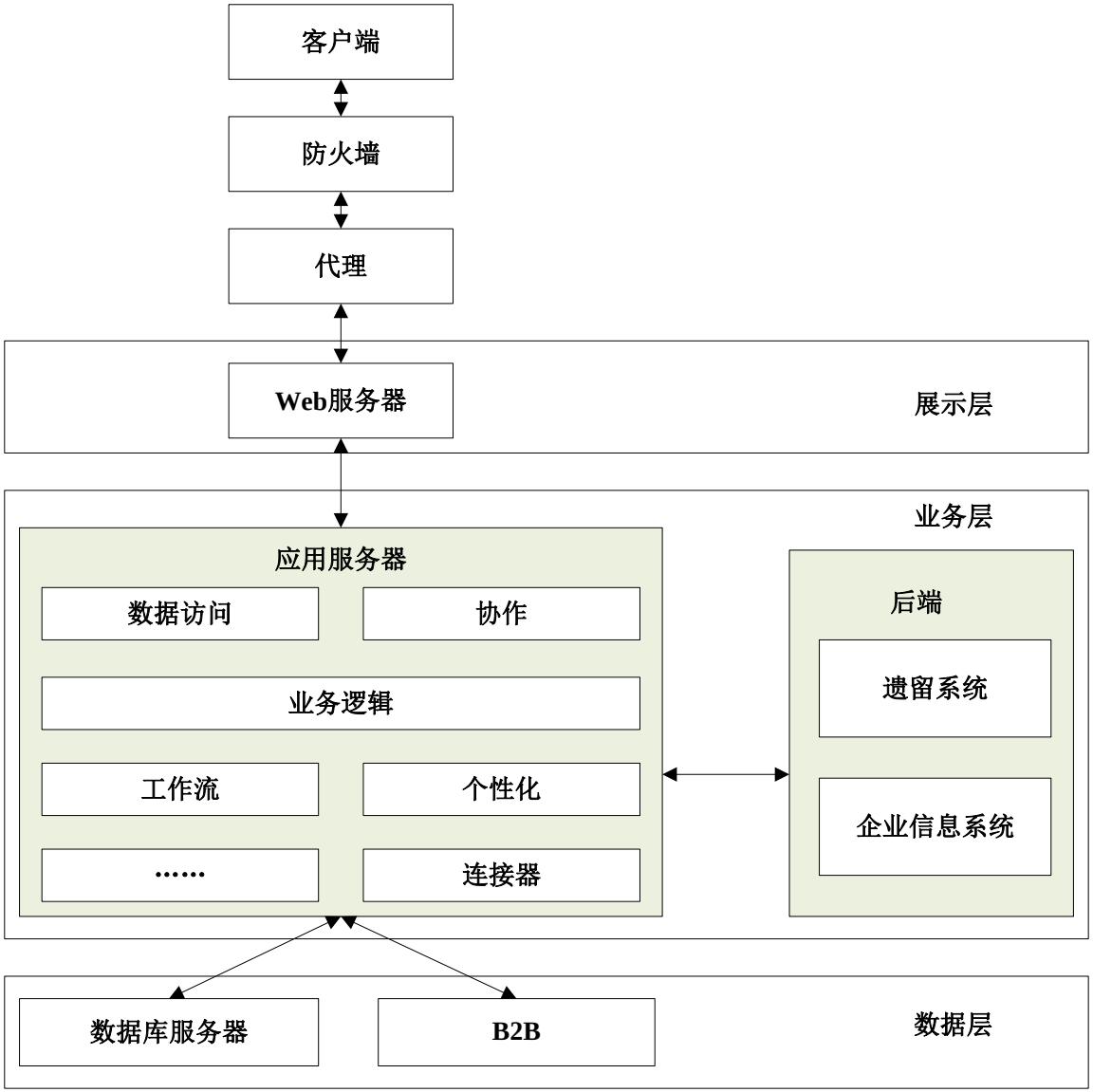




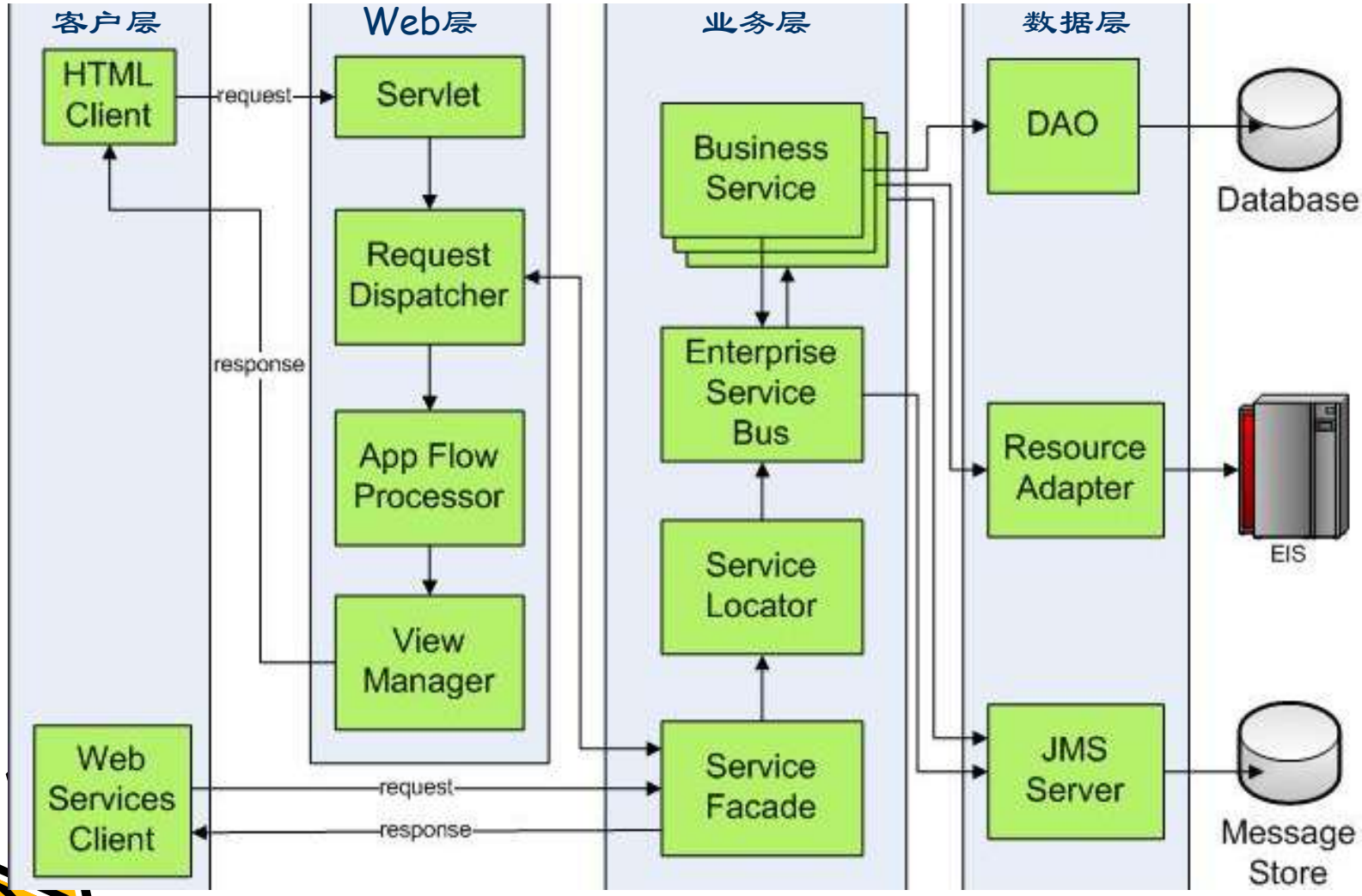
ASP.NET应用架构


Presentation Tier
Web Forms (UI)
User Controls (UI)
Web Forms (Code Behind)
User Controls (Code Behind)
Shared UI Code
Business Tier
Business Objects
Data Access Layer (DAL)
Data Tier
Stored Procs / Views
XSLT
Other
Database Tables
XML Files

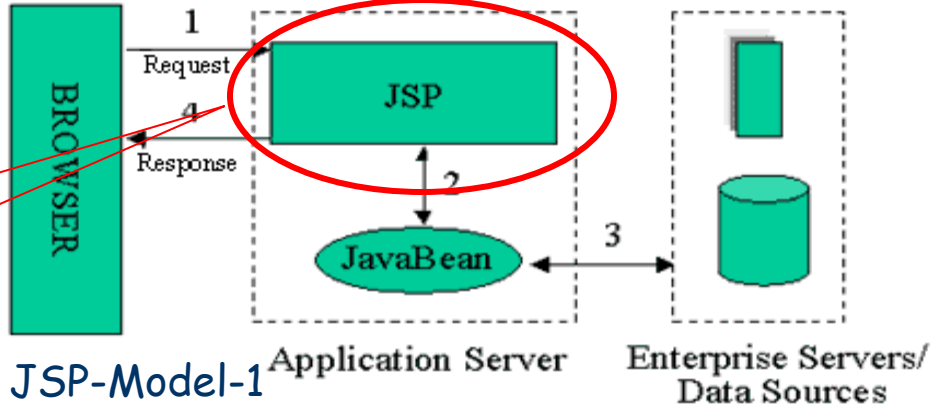
Web应用的N层架构


客户端
防火墙
代理
Web服务器
展示层
业务层
应用服务器
数据访问
协作
业务逻辑
工作流
个性化
……
连接器
后端
遗留系统
企业信息系统
数据库服务器
B2B
数据层

Java EE应用架构

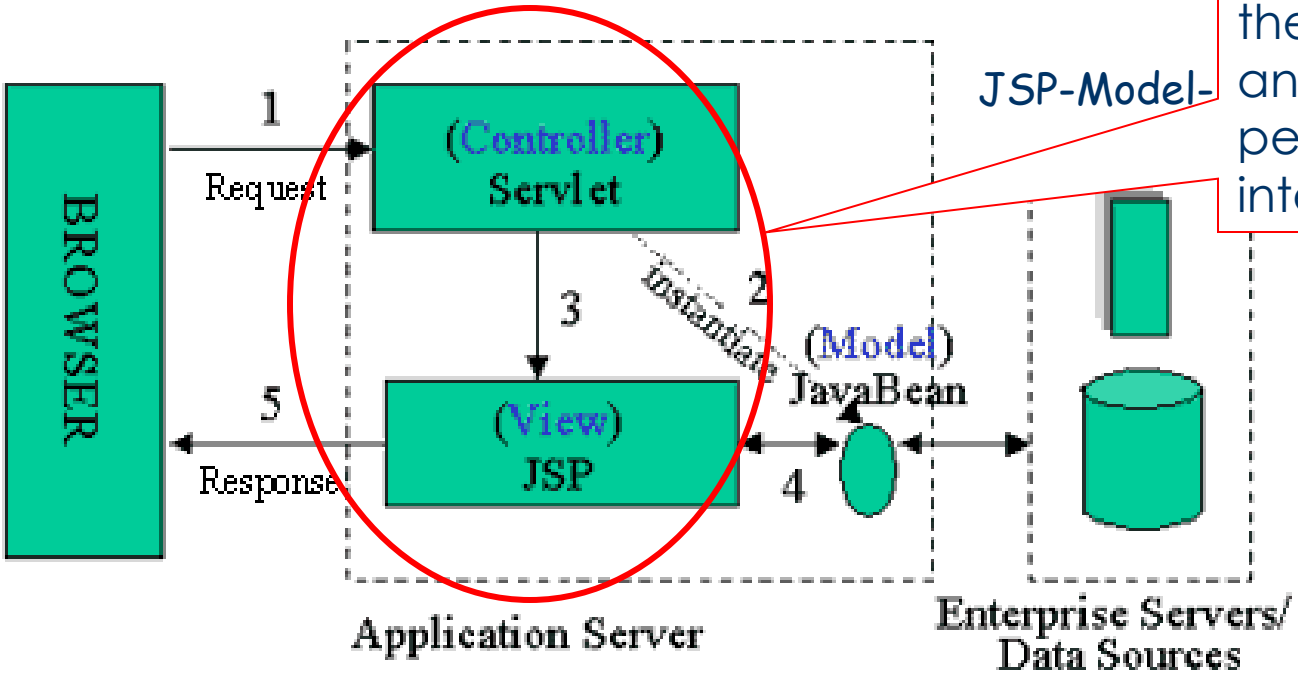

客户层
Web层
业务层
数据层
HTML Client
request
Servlet
Request Dispatcher
response
App Flow Processor
View Manager
Web Services Client
request
response
Business Service
Enterprise Service Bus
Service Locator
Service Facade
DAO
Database
Resource Adapter
EIS
JMS Server
Message Store

JSP-Model-2



JSP-Model-1

the JSP page alone is responsible for processing the incoming request and replying back to the client.

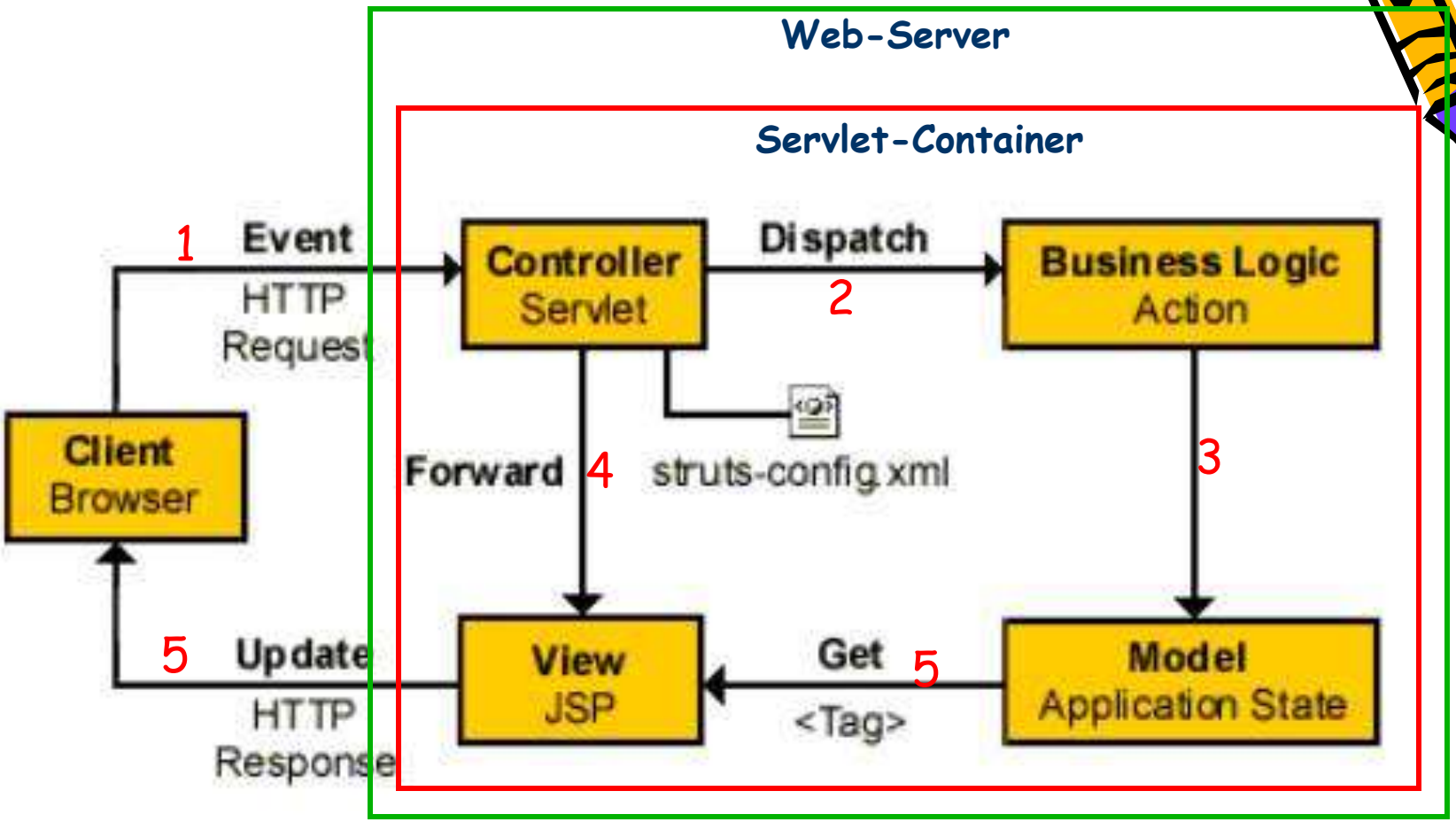


JSP-Model-

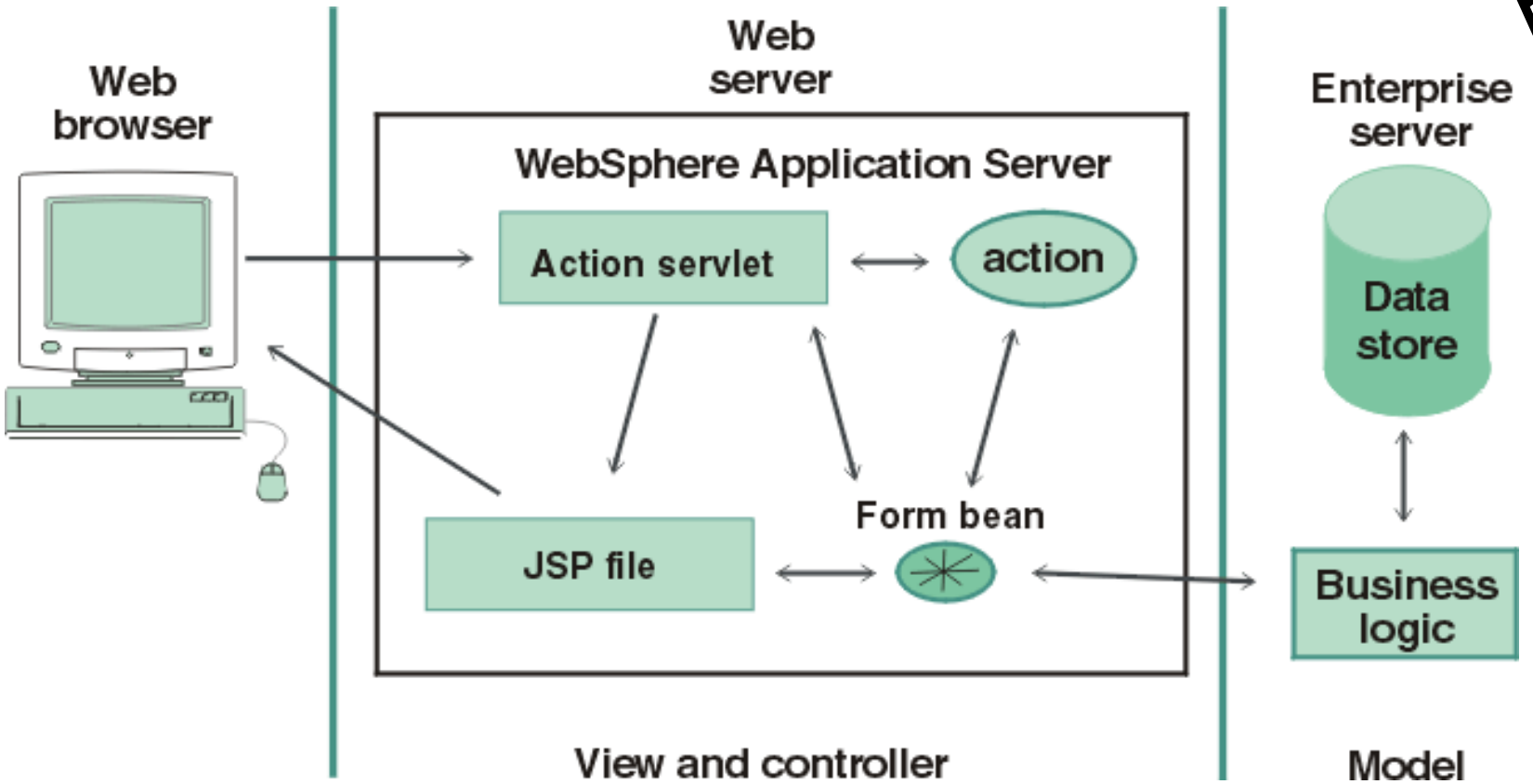
using JSP to generate the presentation layer and servlets to perform process-intensive tasks.

http://www.javaworld.com/javaworld/jw-12-1999/jw-12-ssj-jspmvc.html

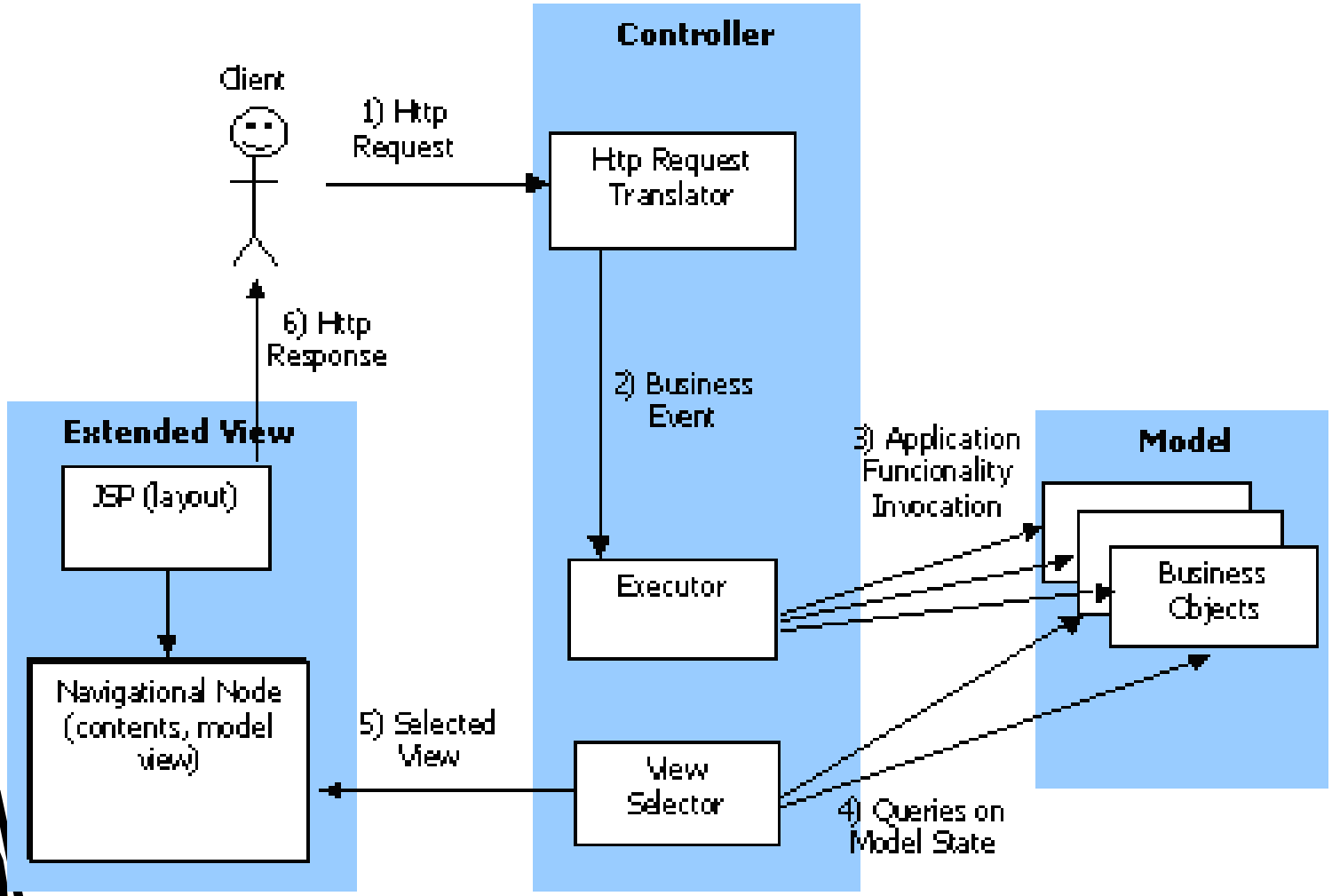
JSP-Model Implementation in Struts

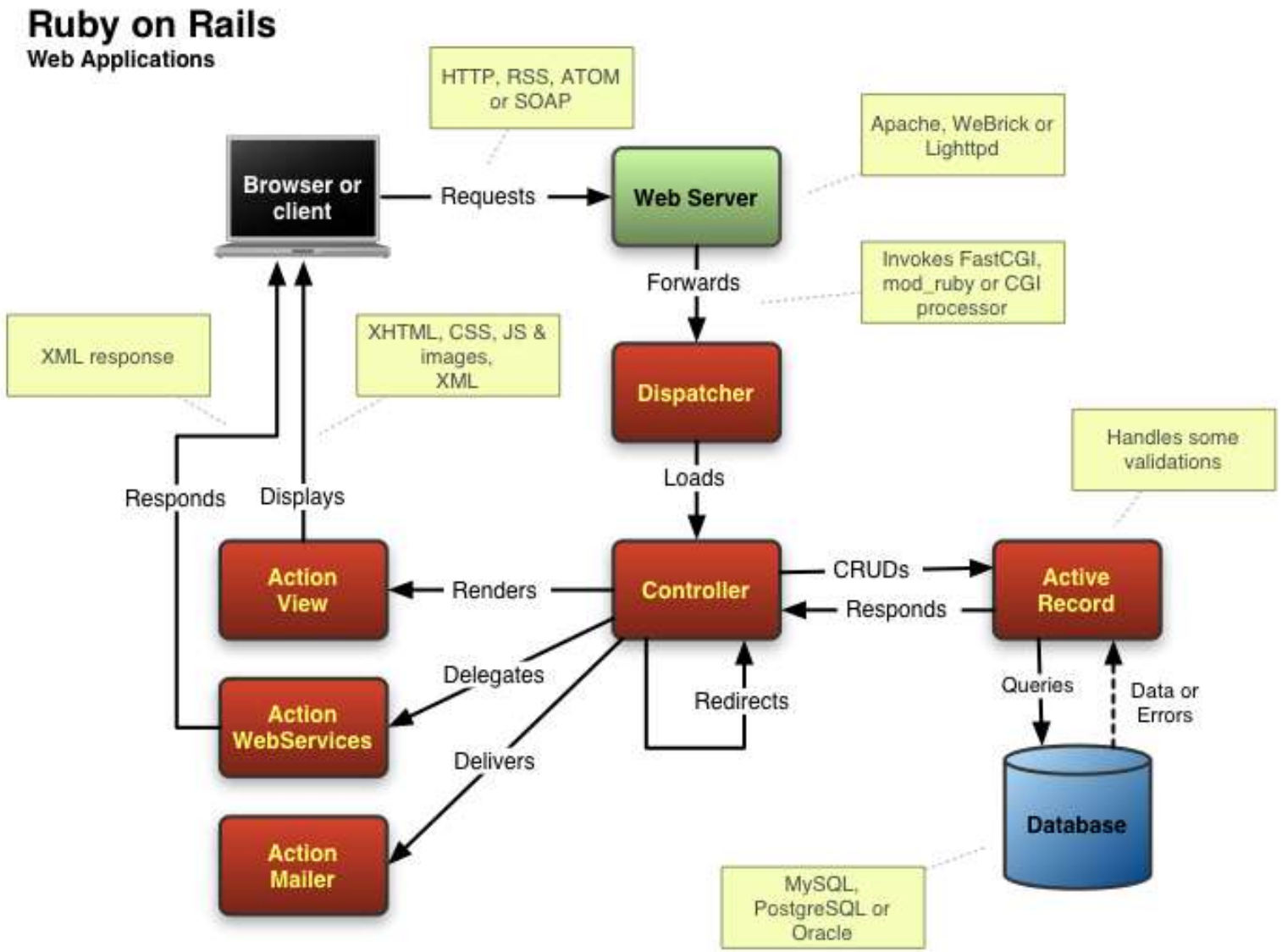


WebSphere: A example of JSP-Model Implementation in Struts



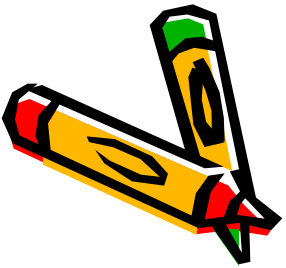
OOHDM-Java2


Controller
Client
1) Http Request
Http Request Translator
6) Http Response
2) Business Event
Extended View
JSP (layout)
3) Application Funcionality Invocation
Model
Executor
Business Objects
Navigational Node (contents, model view)
5) Selected View
View Selector
4) Queries on Model State


Ruby on Rails
Web Applications
HTTP, RSS, ATOM or SOAP
Apache, WeBrick or Lighttpd
Browser or client
Requests
Web Server
Forwards
Invokes FastCGI, mod_ruby or CGI processor
XML response
XHTML, CSS, JS & images, XML
Dispatcher
Handles some validations
Loads
Responds
Displays
Action View
Renders
Controller
CRUDs
Responds
Active Record
Delegates
Redirects
Queries
Data or Errors
Action WebServices
Delivers
Database
Action Mailer
MySQL, PostgreSQL or Oracle

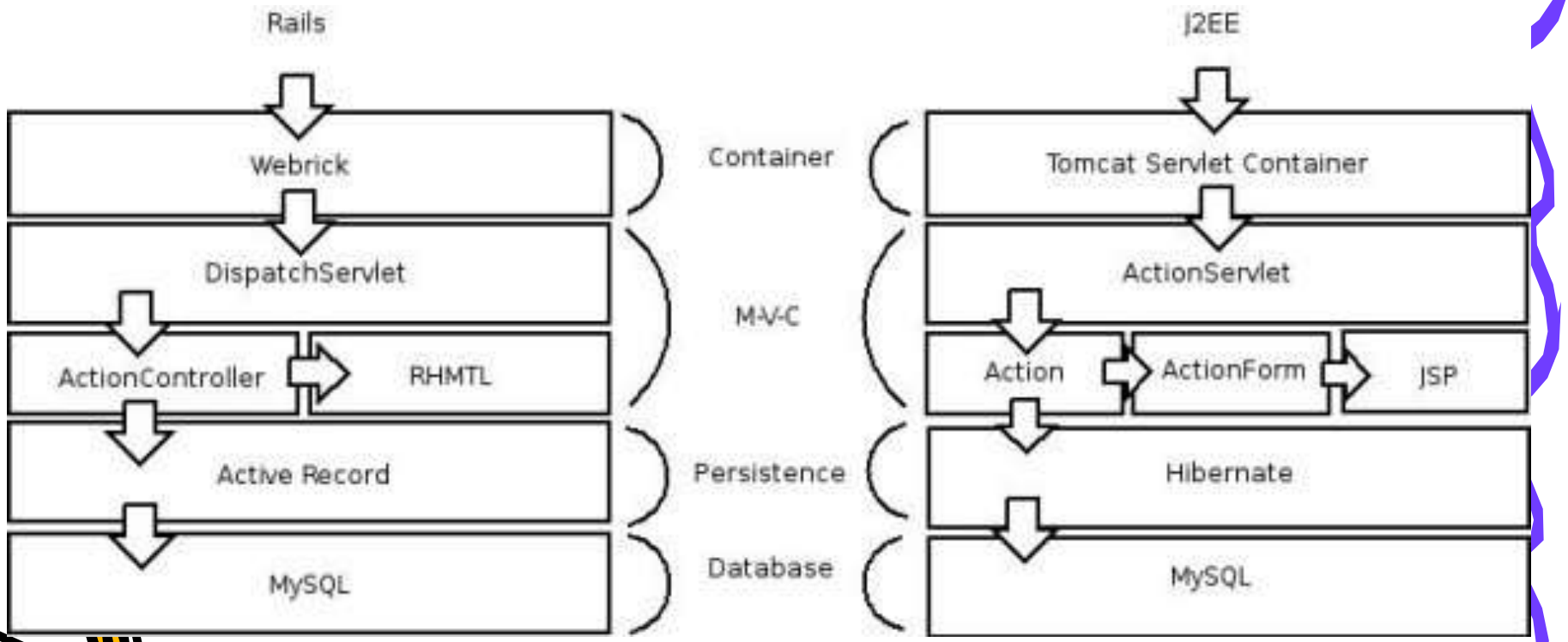
Web应用的N层架构

- 优点：重用
  - 松耦合(Loose-coupling) – 局部变化对全局影响小
  - 代码更易维护性
  - 模块可扩展性更好
- 缺点
  - 不必要的复杂性
  - 更多故障点



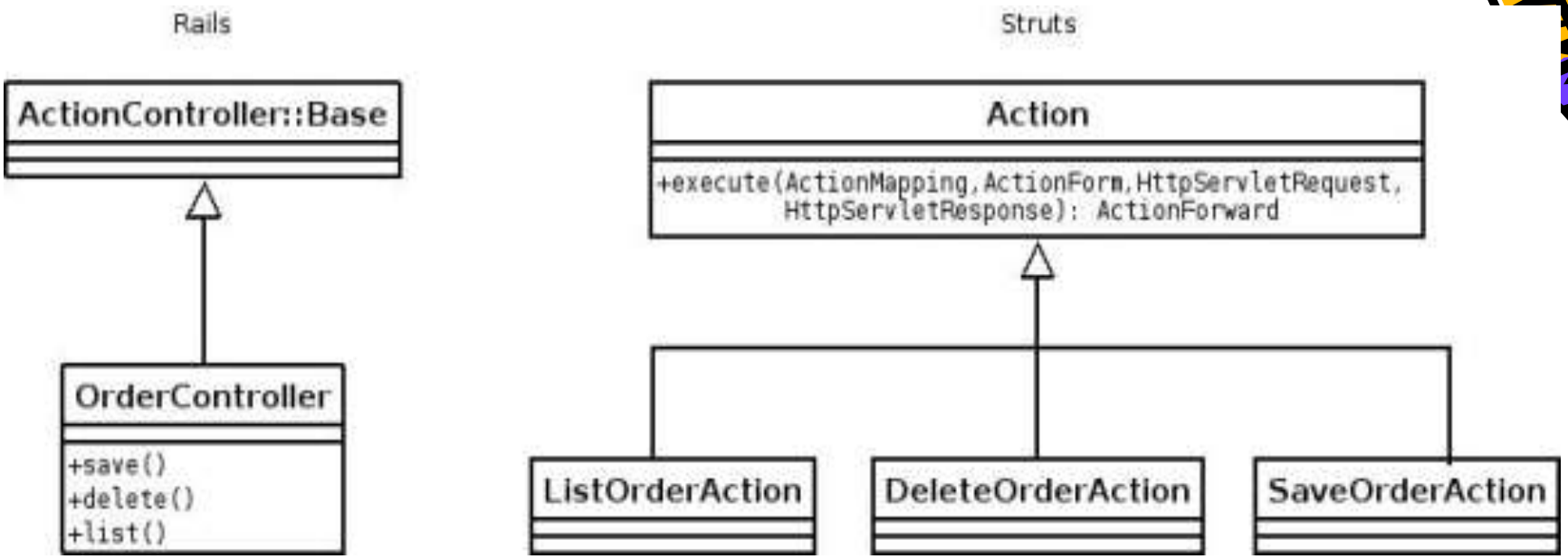
RoR(Ruby on Rails)架构

- Rails 和J2EE Web（Tomcat servlet容器, Struts Web应用框架, 以及Hibernate持久框架）

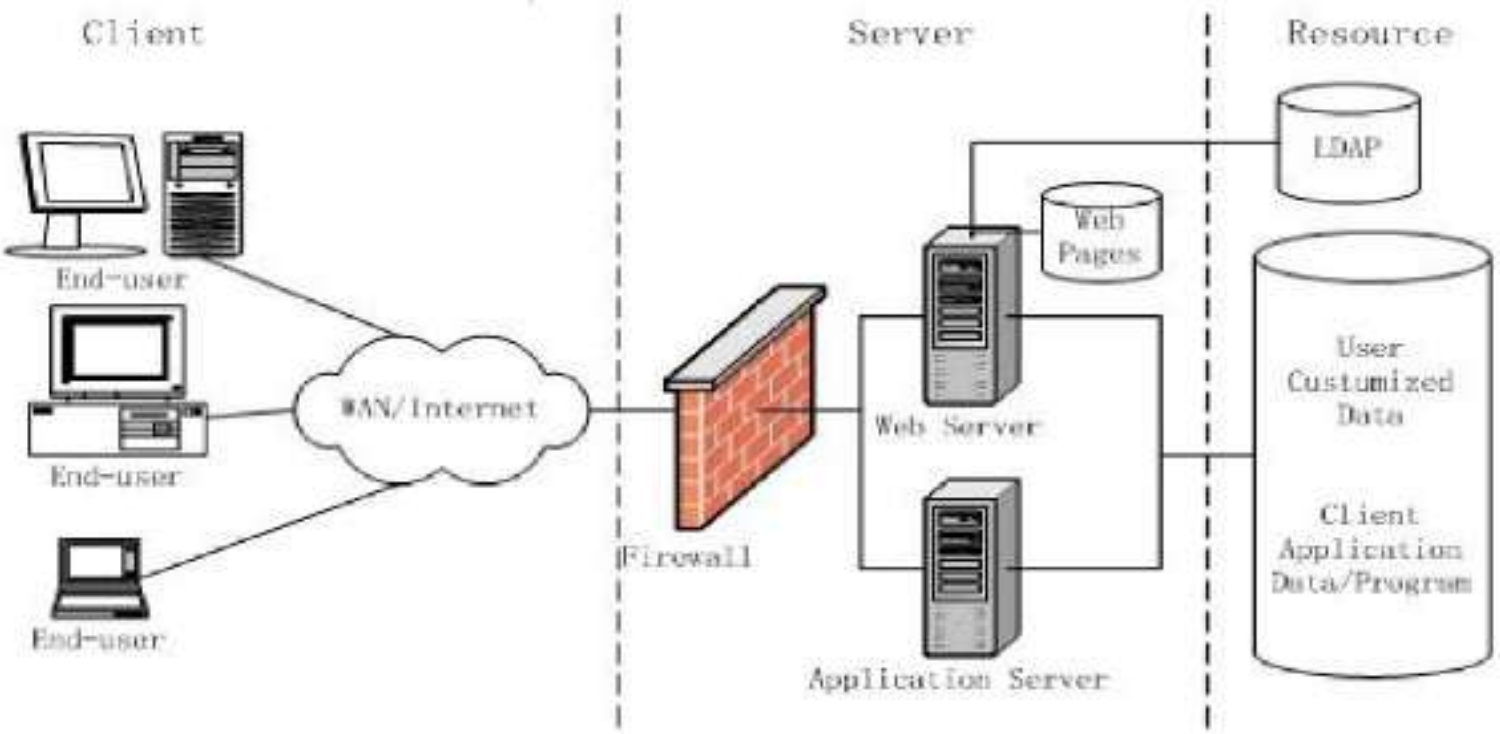


Rails和J2EE 层次对照

Rails和Struts的动作层次结构

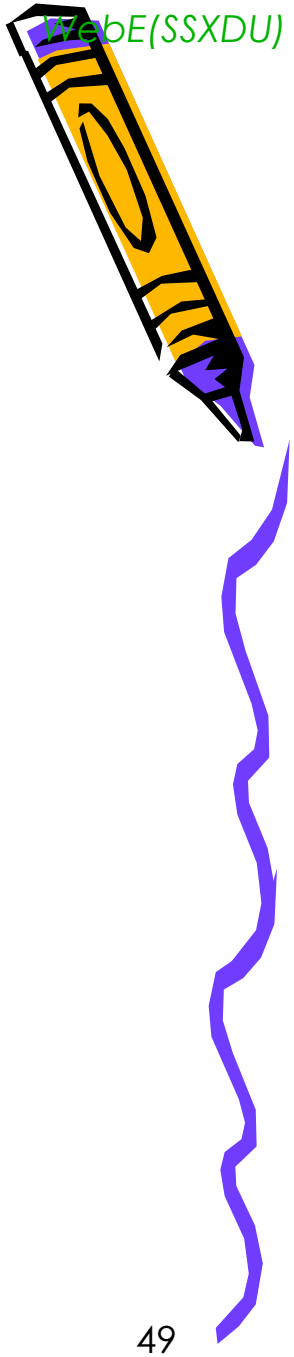


Embed Services – Example1

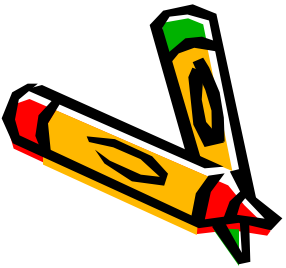


Services and interconnections with respect to workflow, security and business logic.

SCS System: A new architecture for Web-based Application Wu and Zhao (2003)

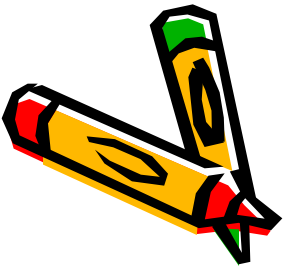


集成架构



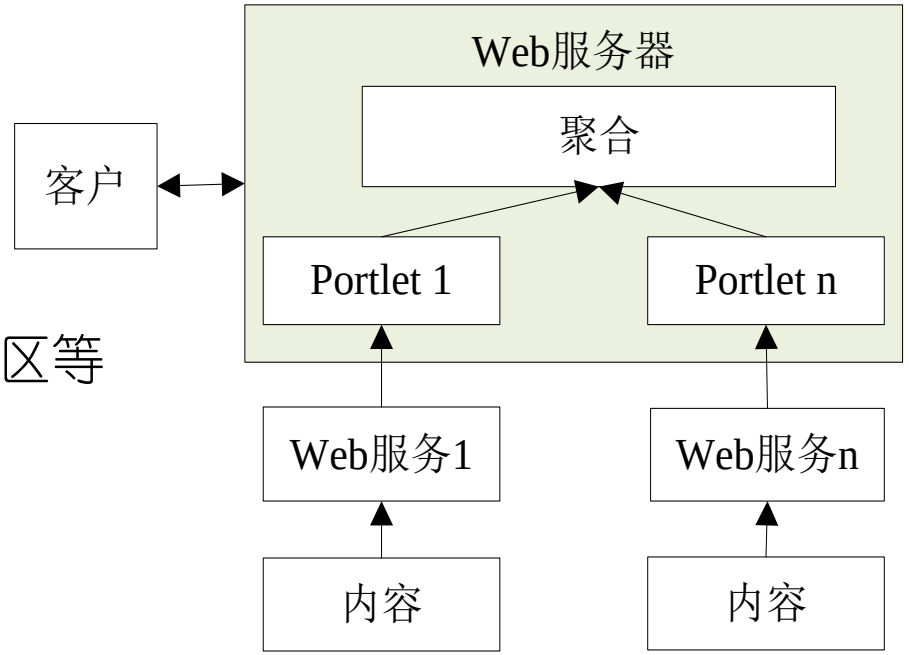
集成架构

- Web应用和外部系统或内部系统的集成
  - 展示层面
  - 应用逻辑层面
  - 内容层面



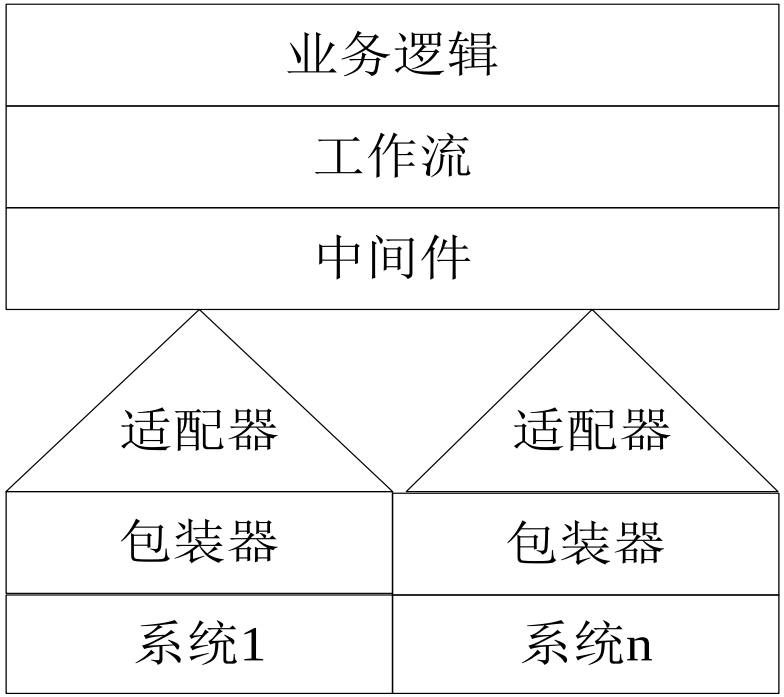
门户

- 门户（Portal）是指基于Web技术，并针对具体用户或社区的应用平台。
  - 展示层面的集成，集成多样化内容服务的Web应用
  - 水平门户
    - 新浪、腾讯等
  - 垂直门户
    - W3C、语义Web社区等



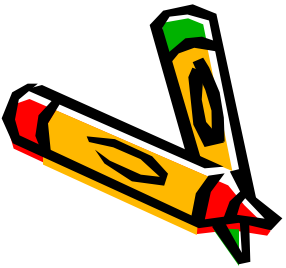
EAI（Enterprise Application Integration，企业应用集成）

- 强调内容层面和应用逻辑层面集成的架构
- 集成不同数据源、基于各种不同平台、用不同方案建立的异构应用
- 集成遗留系统
- 采用中间件

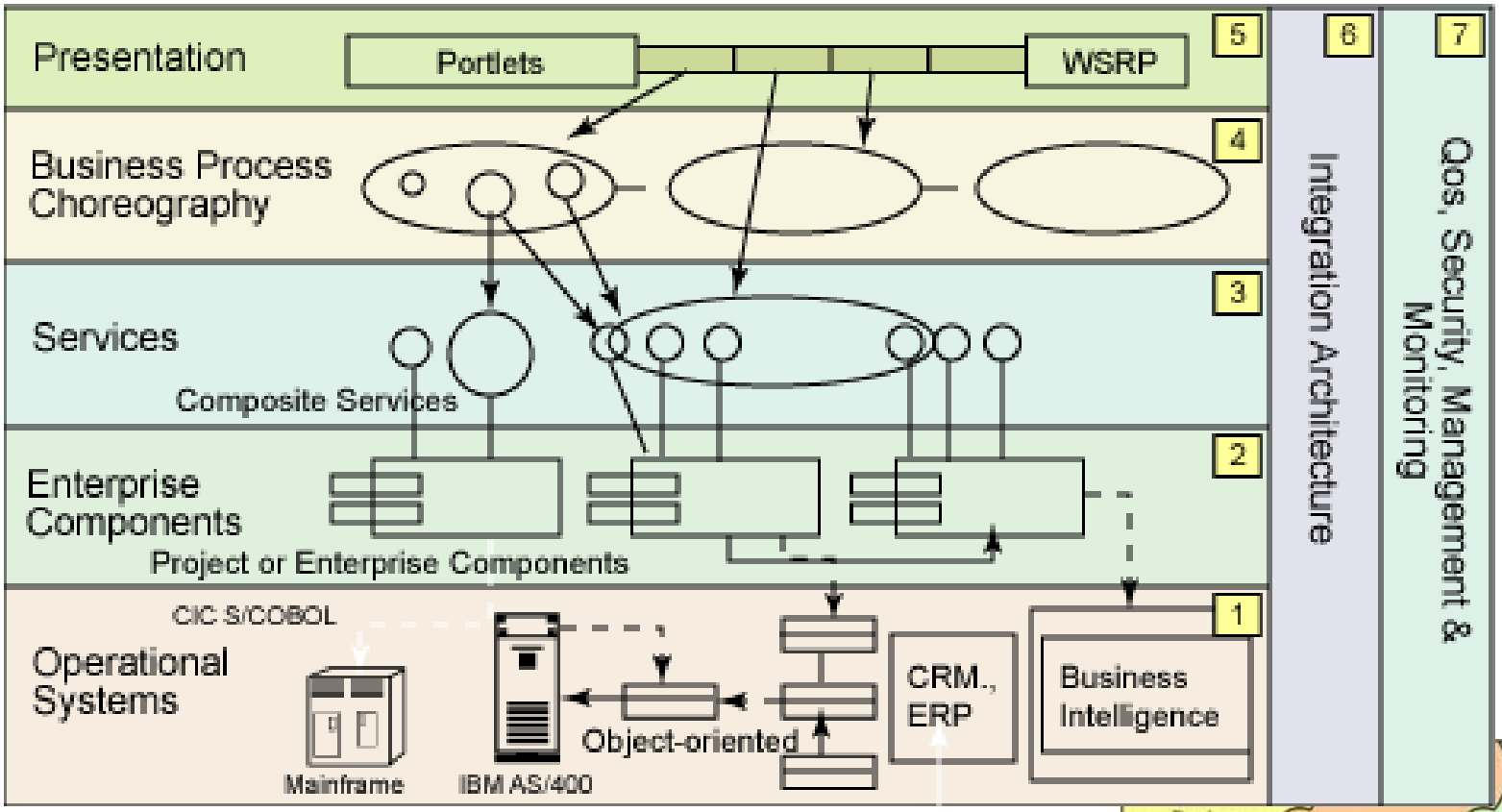


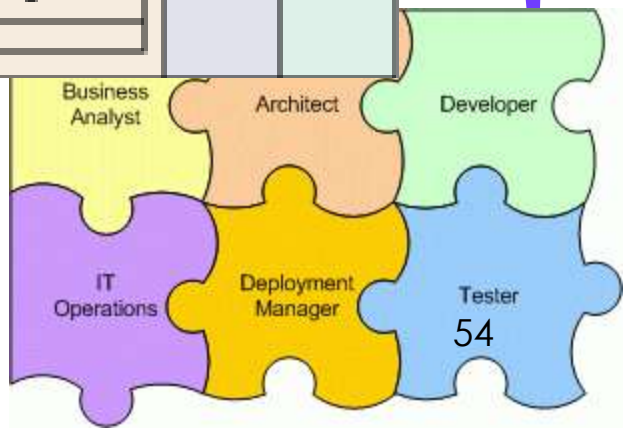
SOA（Service-Oriented Architecture，面向服务的架构）

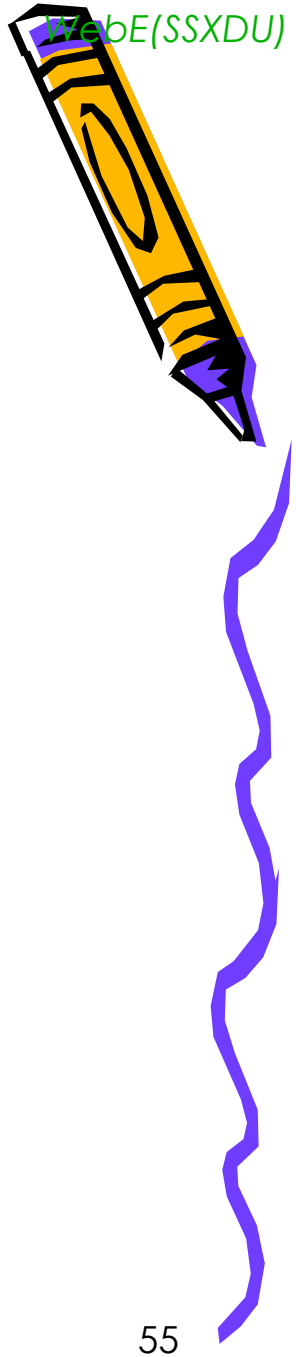
- 提供一种集成框架
- 关键是“服务”
  - 将应用程序的业务功能单元称为服务，通过这些服务之间定义好的接口和约定进行集成，形成一种架构模型，从而构成整个应用。
  - Web服务是实现SOA的方式之一。



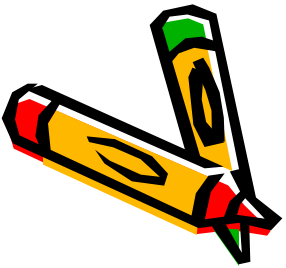
The layers of a SOA





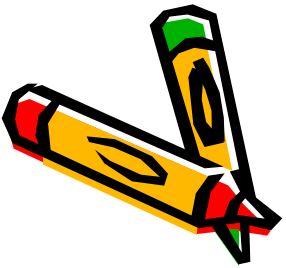


面向数据的架构



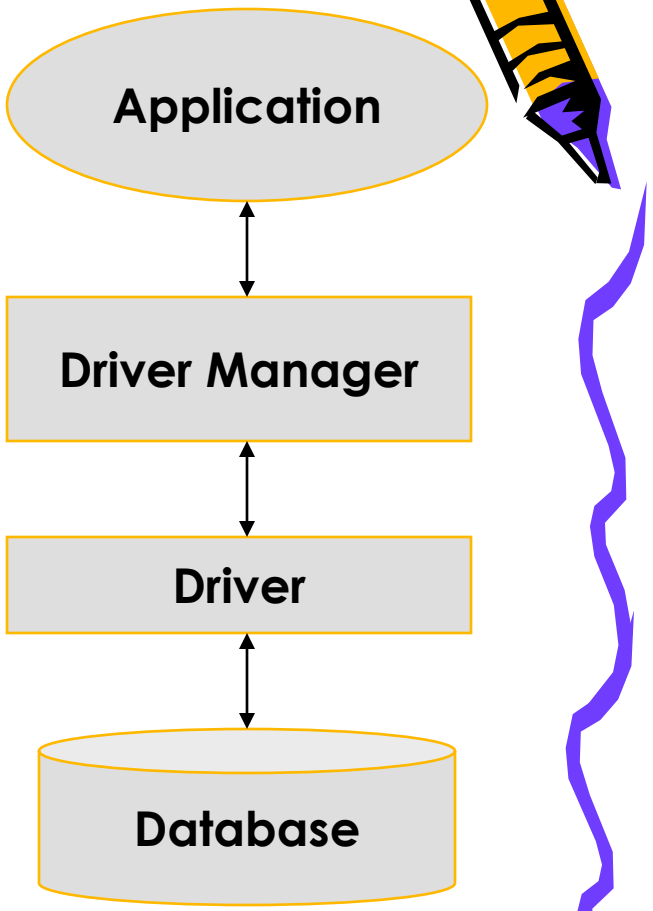
面向数据的架构

- 数据架构分类
  - 数据库中的结构化数据
  - 文档类存储于内容管理系统
  - 多媒体类数据存储与媒体服务器
- Web应用结合使用

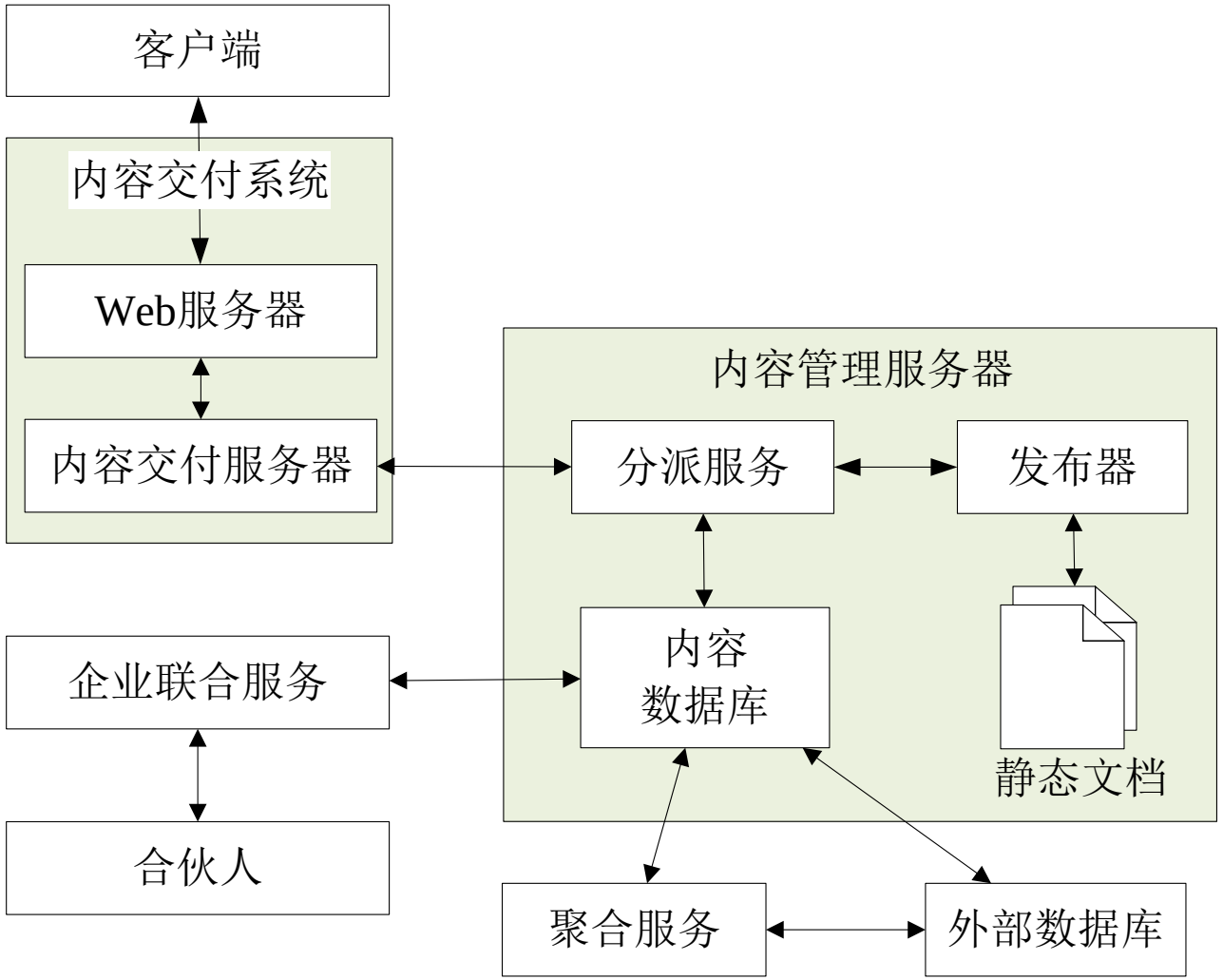


以数据库为中心的架构

- 以数据为中心的架构
  - 结构化数据(JDBC/ODBC)
  - 通过Web扩展或应用服务器进行访问
  - 很成熟
  - 易于实现



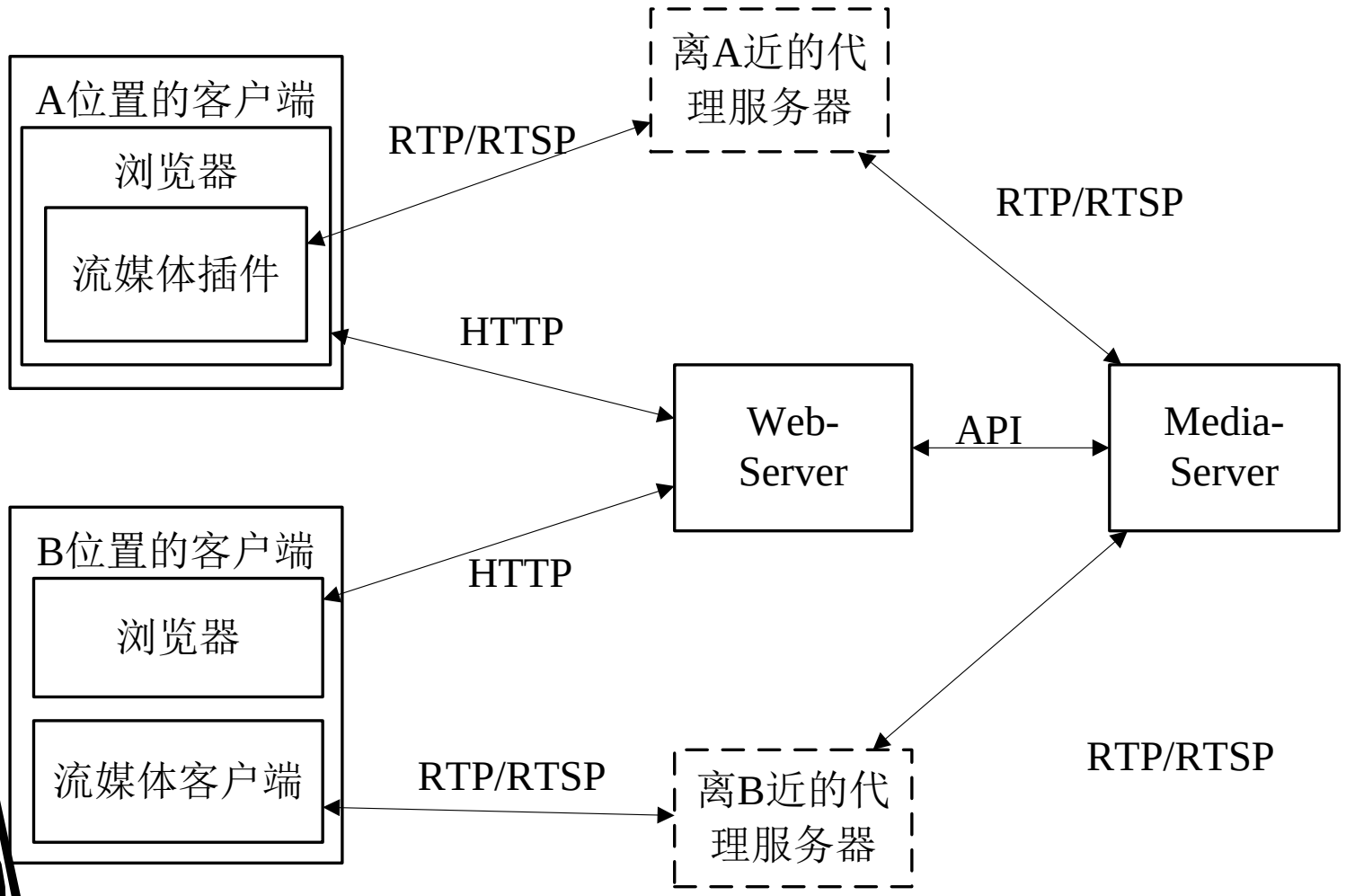
Web文档管理架构


客户端
内容交付系统
Web服务器
内容交付服务器
内容管理服务器
分派服务
发布器
内容
数据库
静态文档
企业联合服务
合伙人
聚合服务
外部数据库

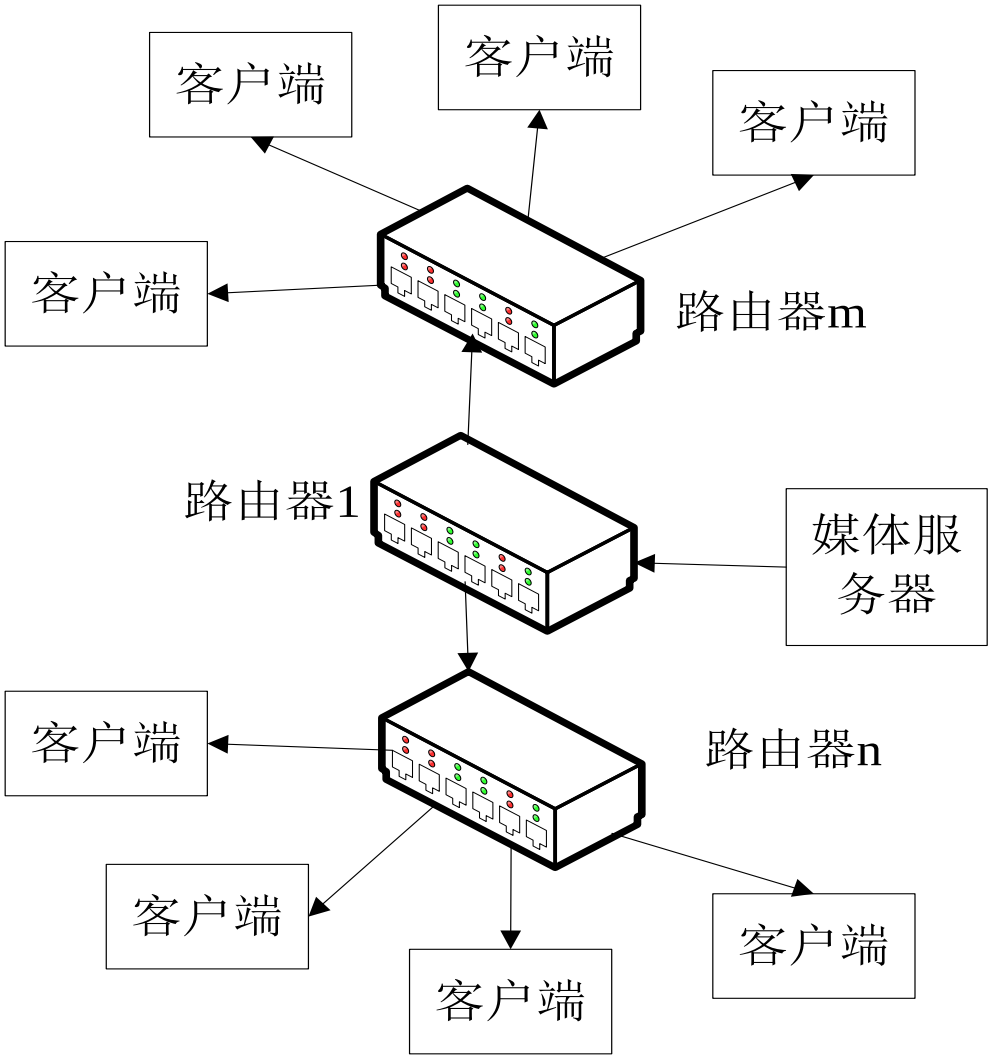
流媒体数据的架构

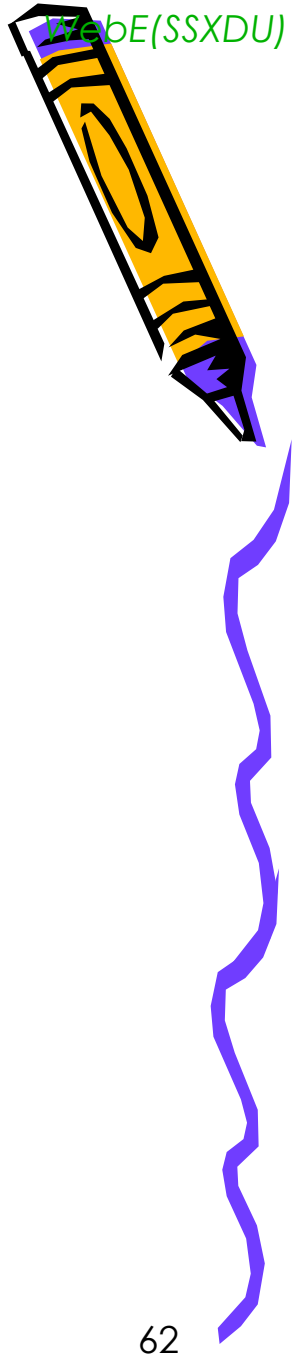
- 多媒体数据包括视频、音频等，通过标准的因特网协议（如HTTP、FTP等）进行传输--下载速度慢
- 流技术最小化多媒体内容播放的等待时间
  - RTP(Real Time Protocol，实时协议)
  - RTSP(Real Time Streaming Protocol，实时流协议)
  - ……
- 两种应用领域
  - 按需播放已存在的媒体，如：点播
  - 直播，如：Web casting

点对点连接的流媒体架构

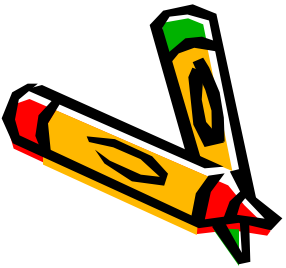


使用广播的流媒体架构



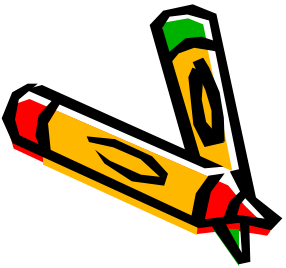


总结与展望



总结

- 好的Web应用架构可以提高Web应用的开发效率、提高Web应用的可重用性，易于维护和扩展。
  - 模型驱动架构
  - 架构模式
  - 层次架构
  - 面向数据的架构
  - 集成架构

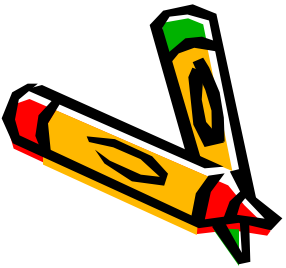


展望

- 基础设施
  - P2P→普适Web应用, NoSQL
  - 网格技术→增大Web应用的计算能力
- 普适计算和面向门户
  - 上下文
  - 集成淡化客户端和服务器端之间的界线
- 数字电视和在线游戏

Project Task：Task5

- Web应用架构设计
  - 结合本章内容，完成Web应用架构
- 展示的主要内容之一
  - 10 minutes
  - ~2 slides
- 架构报告



参考资料

- Chapter 5
- Suggested
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  - Martin Fowler: Analysis Patterns : Reusable Object Models. Addison-Wesley. 1996.
  - Different definitions of software architecture: http://www.sei.cmu.edu/architecture/definitions.html