Software Architectures

Web Application Development

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Outline

1. Software Architectures
   - Centralized Systems
     - Client-Server Model
     - n-Tier Architecture
   - Distributed Systems
     - Service Oriented Architecture
     - Microservices

2. Architecture of Web Applications

Notes
Monolithic Architecture
- Only one process
- Installed on a single computer
  - Mainframes
  - Desktop Applications
- Unix commands
  - ls, ln, ps, mkdir, grep, chmod, chown
- Computer Games, Word processors
- Off-line work
- Installation
- Complex computations
- Our first programs
  + Simple, easy-to-understand the Architecture
  + Independent from other applications
  + Self-contained
  - Unmaintainable Application
  - No Modularity

Component Based Design
- Independent development unit
- A part of the system
- Provide service via its interface
- Use other components
  - Tests
    - Unit
    - Component
    - Integration
  - Dependencies
  - Build process
  - Deployment

Client - Server Model
- Simple Model
  - Clients request services
  - Server waits for and serves requests
- Widely used
  - FTP, SSH
  - WWW, SMTP
- Web Applications
  - Information Systems
  - Search Engines
  - Social Media
  - Web Shops
  - e-Government
  - e-Banking
  - Monitoring Systems
n-Tier Architecture

- Detailed than Client–Server Model
- Tiers are not Layers
- Tiers have specific functions, purpose
- Typical tiers
  - Presentation
    - Client-side
    - Web sites
    - Mobile / Desktop applications
  - Business
    - Server-side
    - Business logic
  - Database
    - Server-side
    - Not available directly.

Distributed Systems

- Distributed System
  - Virtually a Single System
  - Collection of Independent Computers
  - Network Connection
- Motivation
  - Resource Sharing
    - Computation
    - Data
    - Hardware
  - Reliability
  - Scalability
  - Openness

Web Application are Distributed Systems

- Front-end
- Back-end
- Database
  - Front-end
    - Thin-, Thick Client
  - Back-end
    - Could be Distributed
- Database
  - Clusters, Replications

Service Oriented Architecture

- Collection of Services
- Service - Service communication
  - Simple data passing
  - Coordinating some activity
- Solutions
  - CORBA
  - DCOM
  - Web Services

A service
- represents an activity.
- is self-contained.
- is black box.
- may use other services.
- is deployed independently.
Micro services

Micro service is a process. Implementation of SOA. Popular since 2014.

Characteristics
- Fine-grained
- Cloud applications
- Continuous delivery
- Reusability of services.

EMailService
- Email notifications are required in many business activities.
- Each email has the same structure.
  - sender, receiver addresses
  - subject
  - content (generated by other services)
### Front-end

**Browser**
- HTML, CSS, Bootstrap
- JavaScript, AngularJS

**Mobile**
- Android
- iPhone

**Desktop**
- Thick clients

### Front-end & Back-end Communication

**Protocols**
- TCP/IP
- HTTP, HTTPS

**Techniques**
- AJAX
- REST API

**Data Format**
- XML
- JSON

**Tools**
- Postman
- Wireshark

### Back-end

**Script Languages**
- PHP, Python, Ruby

**Application Servers**
- Tomcat, GlassFish, JBoss

**Technology**
- Servlet Technology
- Spring Framework

**Deployment**
- Single Instance
- Integration
Back-end & Storage Communication

- Separation of Business Logic and Storage
- CPU- and I/O Bound Tasks

Network
- Low Latency
- High Performance

Protocols
- FTP, Samba, NFS
- JDBC

Technologies
- JDBC, myBatis
- ORM, Hibernate