Software Architectures
Web Application Development

Zsolt Tóth

University of Miskolc

2017
1. Software Architectures
   - Centralized Systems
     - Client - Server Model
     - n-Tier Architecture
   - Distributed Systems
     - Service Oriented Architecture
     - Micro services

2. Architecture of Web Applications
Abstract structure of Software Systems

- Independent of
  - Platform
  - Programming Language

- Depend on
  - Project Goal
    - Purpose of the System
    - Scalability
  - Target Users
    - 1, 100, 10,000, ...
    - Expected usage?
    - Expected load?
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
  - Thin-, Thick Client
  - Could be Distributed
  - 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)
Outline

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

2. Architecture of Web Applications
Overview

Architecture of Web Applications

Zsolt Tóth (University of Miskolc)
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
Storage

File System
- Static Content
  - File, Image
  - Video, Audio
- Indexing
  - Solr
  - Elasticsearch

SQL
- MySQL, Postgre
- Oracle, IBM Db2, SQLServer

NoSQL
- MongoDB
- Neo4j