Software Architectures

Web Application Development

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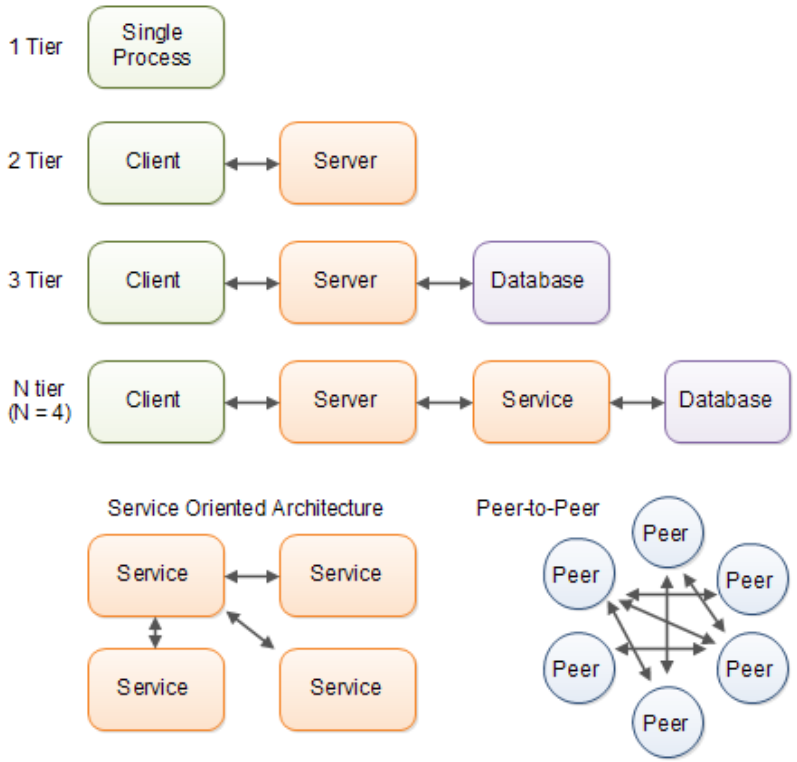
Outline

Software Architectures

- 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

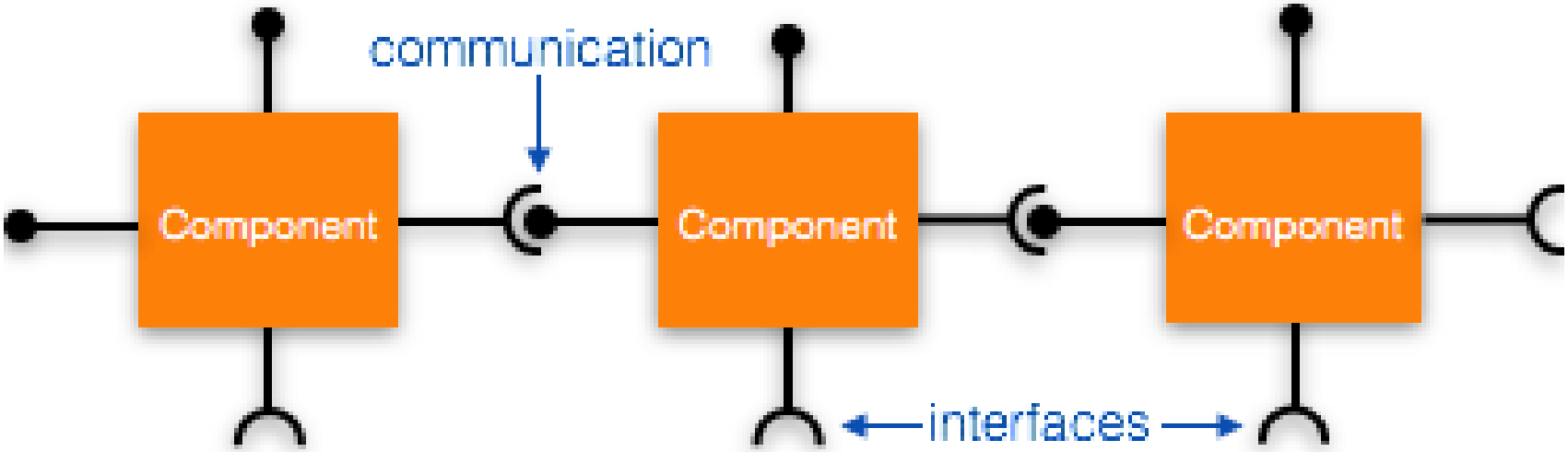
- Only one process
- Installed on a single computer
  - Mainframes
  - Desktop Applications
- Unix commands
  - `ls, ln, ps, mkdir, grep, chmod, chown`
- Computer Games, Word processors
- Off-line work
- Installation
- Complex computations
- Our first programs

+ Simple, easy-to-understand the Architecture
+ Independent from other applications
+ Self-contained
- Unmaintainable Application
- No Modularity

Component Based Design

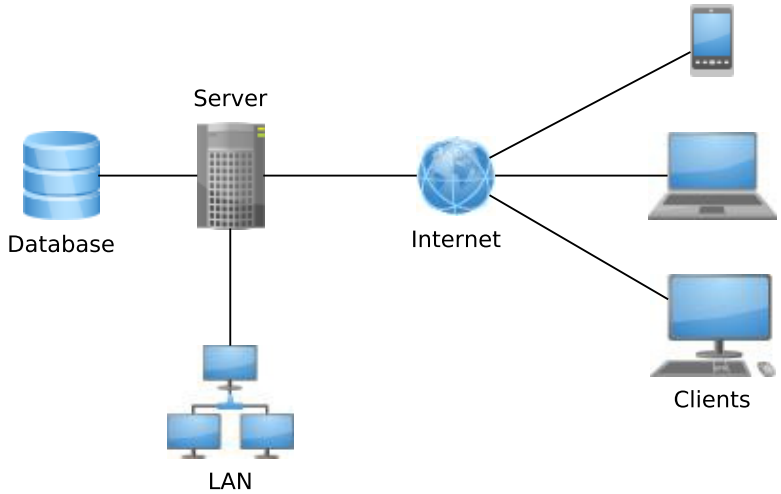
- Independent development unit
- A part of the system
- Provide service via its interface
- Use other components

- Tests
  - Unit
  - Component
  - Integration
- Dependencies
- Build process
- Deployment



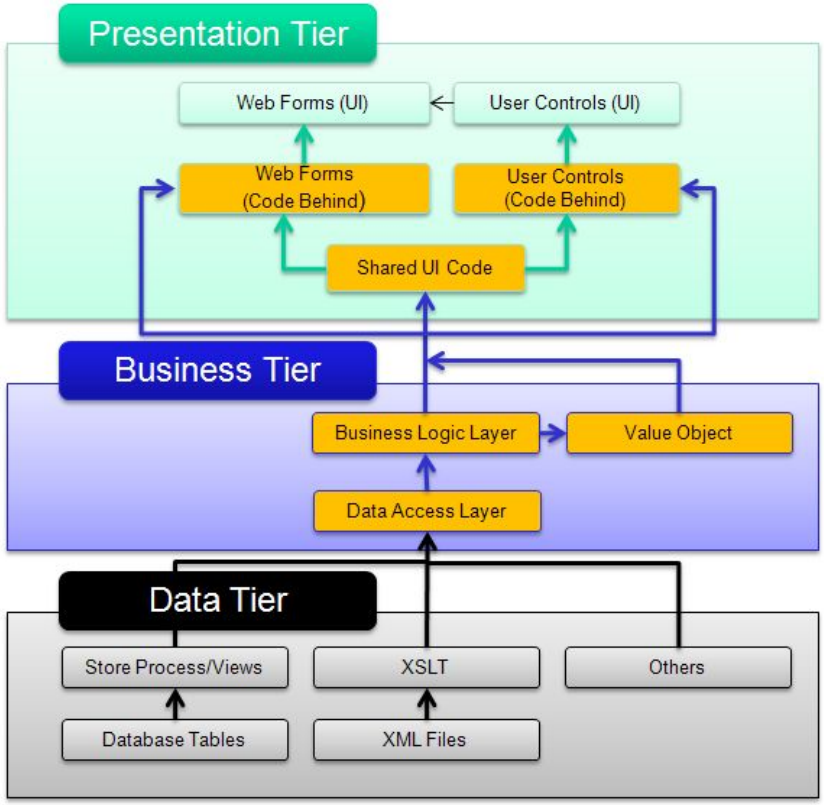
Client - Server Model

- 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

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

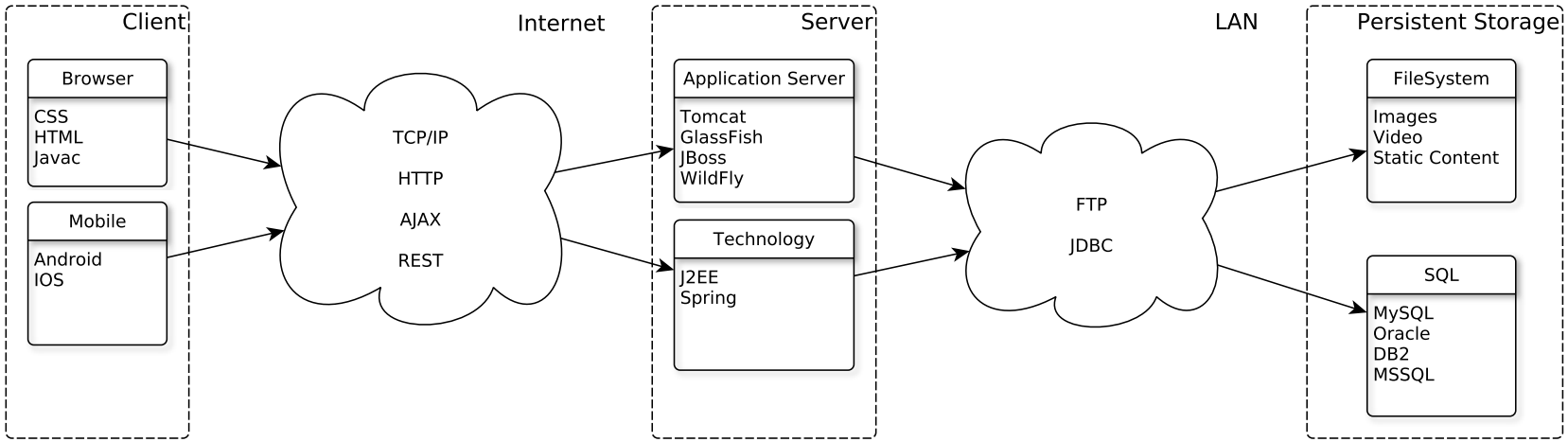
- Micro service is a process.
- Implementation of SOA.
- Popular since 2014.
- Characteristics
  - Fine-grained
  - Cloud applications
  - Continuous delivery
- Reusability of services.

EMailService

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

Outline

Overview


Client
Browser
CSS
HTML
Javac
Mobile
Android
IOS
Internet
TCP/IP
HTTP
AJAX
REST
Server
Application Server
Tomcat
GlassFish
JBoss
WildFly
Technology
J2EE
Spring
LAN
FTP
JDBC
Persistent Storage
FileSystem
Images
Video
Static Content
SQL
MySQL
Oracle
DB2
MSSQL

Front-end

Browser

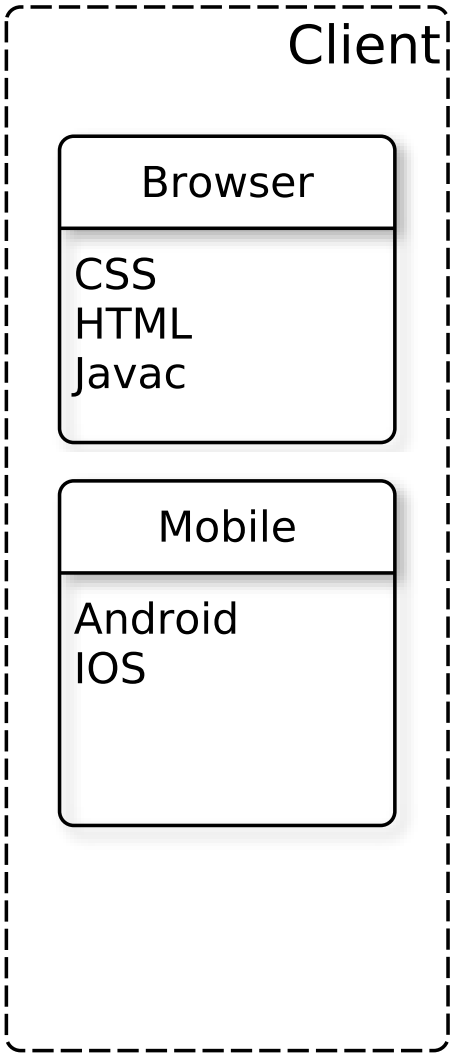
- HTML,
- CSS, Bootstrap
- JavaScript, AngularJS

Mobile

- Android
- iPhone

Desktop

- Thick clients



Front-end & Back-end Communication

Protocols

- TCP/IP
- HTTP, HTTPS

Techniques

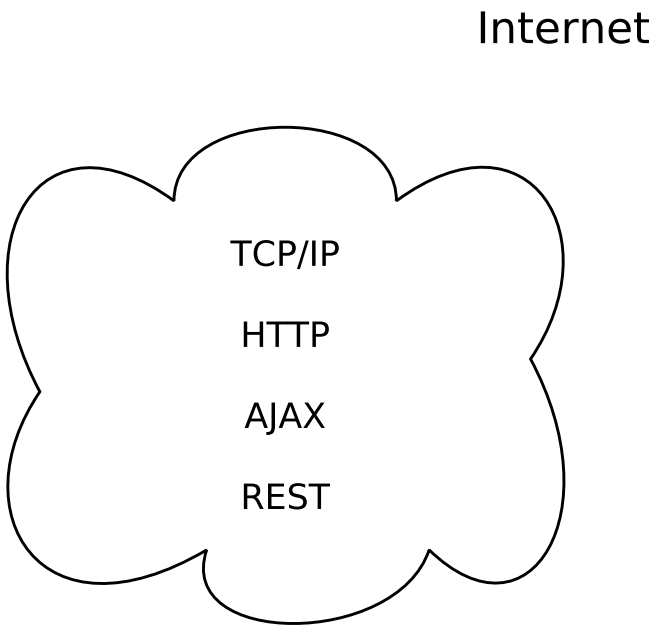
- AJAX
- REST API

Data Format

- XML
- JSON

Tools

- Postman
- Wireshark



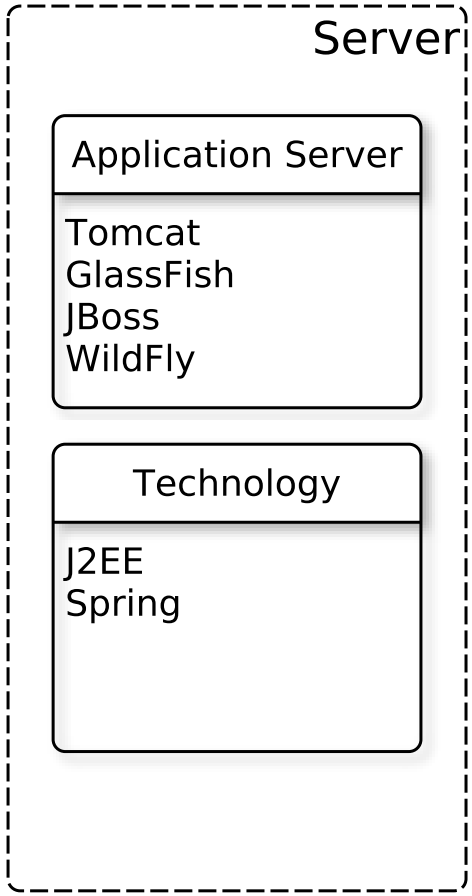
Back-end

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

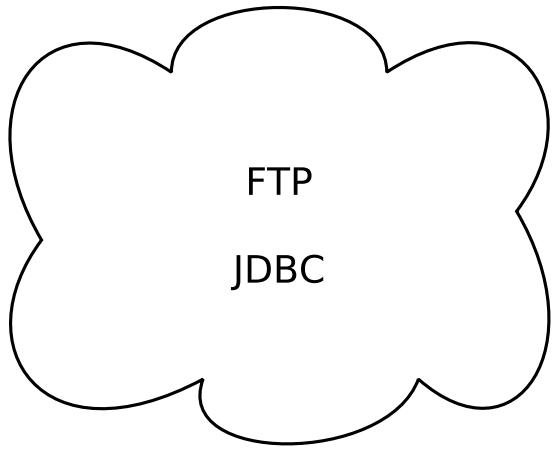
- Low Latency
- High Performance

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