Introduction to Internet Applications

Internet Applications, ID1354
Contents

- Distributed Architectures
- HTTP and Other Protocols
- Tools
- User Interface Design
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- Tools
- User Interface Design
We are familiar with an architecture where the entire application resides on the same computer.
Introducing a Server

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This architecture is not good, we also need layers for communication.
First, we add a server layer, normally called **view** (a bit confusing).
Server-Side Communication

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- However, the server side view layer performs tasks typical of a view:

![Diagram of server-side communication](image)

- Creates views (HTML), which are sent to the client.
- Interprets user gestures, a click in a web page creates a request to the server.

It might seem that we need yet a layer, for network handling. There is such a layer, but it is in the web server. We don't write it ourselves.
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This is a traditional web application.
The MVVM Pattern

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Programming Languages

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- The view is programmed in **HTML** and **CSS**, client side behavior is programmed in **JavaScript** and the entire server side code is written in **PHP**.
Three-Tier Architecture

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- We also introduce the integration layer, to handle the database calls.
Three-Tier Architecture (Cont’d)

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This is called three-tier architecture and is, since long time, the dominating architecture for web applications.
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The motive is to reduce communication latency. The browser informs the server about user actions, but does not wait for response before updating the view.
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- Data is sent in chunks, called packages. A package is like an envelope for a letter. It has sender and a receiver addresses and a content, which is the data being transmitted.
- A node (computer) receiving a packet can accept it, ignore it or retransmit it.
- A node dedicated to retransmitting packets across subnet borders is called a router.
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- Normally, an IP address must be unique, assigned only to one node.

- Some addresses, like 192.168.X.X are dedicated to private networks and can be used freely. Such an address is not transmitted on the public internet. Instead, it is translated to a public address by a router.
The TCP Protocol

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- TCP adds transport guarantees, for example the following.
  - Packets are delivered to the receiver in the same order they are sent by the sender.
  - Delivered packets have the same content as sent packets.
  - There are no lost packets.
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The TCP Protocol (Cont’d)

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- TCP handles ports, which makes it possible to have multiple connections with the same IP address open simultaneously. A port is identified by a number. An endpoint of a TCP connection has an IP address and a port number.
DNS

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DNS

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  - The address **www.ict.kth.se** consists of the subdomain **www**, which is part of the subdomain **ict**, which is part of **kth**, which is part of **se**, which is part of the root, .
- The translation between numbers and names is managed by DNS, Domain Name System.
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URN and URI

- A **Uniform Resource Name**, **URN** is a resource identifier without host name and port number. A typical example is a isbn identifying a book.
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- A Uniform Resource Identifier, URI is either a URL or URN.
HyperText Transfer Protocol, HTTP is used for communication between web browsers and web servers.
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- HTTP is based on TCP, which means a TCP connection is established for each browser-server communication.
The Request-Response Cycle

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3. The server sends a response to the client. Also the response consists of HTTP headers, and data if the response required data.
4. The server closes the TCP connection.
The Request-Response Cycle (Cont’d)

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- HTTP is stateless. Neither server nor browser remembers anything about previous request-response cycles. Session handling must be added in server-side code.

- To establish a TCP connection is expensive. Therefore, TCP connections might be kept alive and reused for multiple request-response cycles. This is specified with the keep-alive HTTP header, see below.
Cookies

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- Cookies can be used to store the user’s settings, for example display language.
HTTP Sessions

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- If a request has a cookie with a session identifier, it identifies the user. If there is no such cookie, the user does not have a running session.
- On the server, the session id can be associated with any amount of data related to the user with that session. This is called conversational state.
HTTP Message Format

- A HTTP message has **start-line**, **headers** and **body**.

```
GET /index.html HTTP/1.1
Host: www.example.com
Accept-Charset: utf-8
User-Agent: Firefox
```

```
HTTP/1.1 200 OK
Date: Sun, 06 Nov...
Content-Length: 962
Content-Type: text/html
```

```xml
<?xml version="1.0"?>
<DOCTYPE ...>
<html>
<head>
....
</head>
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HTTP Message Format

- A HTTP message has **start-line**, **headers** and **body**.

- The request start-line consists of **HTTP method** (e.g., GET), **URL path** and **HTTP version**, e.g., GET /page1.html HTTP/1.1

- The response start-line consists of **HTTP version**, **status code** and **reason**, e.g., HTTP/1.1 200 OK

```plaintext
GET /page1.html HTTP/1.1
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- Sample request (top) and response (bottom) messages are depicted to the left.
Status Codes

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- **3xx** Redirection, for example **301**, Moved Permanently.
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5xx  Server error, for example 500, Internal Server Error
HTTP Methods

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Safe and Idempotent Methods

- **GET** and **HEAD** are *safe* methods, which means they should not take any action other than to retrieve the specified resource.

- **POST** is not idempotent. If you submit the same purchase order multiple times in a web shop you will probably buy multiple items. The purchase is typically a **POST** request.
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  - The URL is **shorter than 255 bytes**. Note that a **GET** URL is longer than a **POST** URL since data is included in the URL which **GET**, but is in the message body with **POST** (see below).
  - You want to be able to **write** the entire request, including data, in the **browser**. This is useful when debugging.
When to Use POST

▶ Use **POST** when
  ▶ The required action **updates** server state, for example saves something in a database.
When to Use POST

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When to Use POST

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  - The required action **updates** server state, for example saves something in a database.
  - The data **does not fit** within the 255 byte limit for URLs.
  - The data shall **not appear** in the URL. Note that this is not a matter of security, data is sent in clear text also when using **POST**.
HTTP Parameters

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- When using the **POST** method, parameters are included in the message body.
HTTP Headers

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## HTTP Headers

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  - **Host**: The receiver address or domain name.
  - **User-Agent**: Identifies the sender browser and operating system.
  - **Content-Length**: Message body length in bytes.
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Sample response headers are:

- **Content-Length**: Message body length in bytes.
- **Content-Type**: Media type (see below) of response.

**HTTP and Other Protocols**

**Tools**

**User Interface Design**
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  - User-Agent: Identifies the sender browser and operating system.
  - Content-Length: Message body length in bytes.
  - Connection: Keep connection open future requests.
- Sample response headers are:
  - Content-Length: Message body length in bytes.
  - Content-Type: Media Type (see below) of response.
Media Type

Media Type (or MIME Type) defines message content. This tells the receiver how to interpret the data.
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- Some media types are:
  - text/html: HTML markup
  - text/plain: Plain text
  - image/png: A png image
  - video/ogg: A ogg video.
Web Browsers

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- It is important to test the web application with all different browsers that shall be able to display it.
- Browsers behave differently, and you should expect that some break specifications.
Web Servers

- The web server can deliver **static content** and also call server-side **programs**, like PHP, Java or .NET programs.
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- The most commonly used web server is apache, [https://httpd.apache.org/](https://httpd.apache.org/)
- Other common web servers are nginx, [http://wiki.nginx.org/Main](http://wiki.nginx.org/Main) and Microsoft IIS.
Web Servers (Cont’d)

- You need to **install a web server** on your laptop. All labs will be reported on your own laptop, there is no web server in ICT school where you can run all the labs.
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It might take time to get the web server running. You are advised to start installing the web server **now**.
Section

- Distributed Architectures
- HTTP and Other Protocols
- Tools
- User Interface Design
Web Development Tools

There are many tools that facilitate developing web applications.
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- Browser support varies between tools, most examples will be using Firefox.
- You are strongly advised to start using some of the following tools, they will help you a lot.
Browser Web Console

Most browsers have a built-in console.

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- It enables you to run JavaScript expressions in the web page.
- It also lets you choose elements from the web page and have their HTML and CSS displayed.
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The console is opened with Ctrl-Shift-K in Firefox and Ctrl-Shift-J in Chrome.
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- There is a cross-browser version of Firebug, written in JavaScript, that offers a subset of the functionality for most other browsers.
Web Developer

Web Developer is a powerful plug-in to Firefox, which allows you to:

- edit HTML and CSS.
- See the area covered by a chosen element.
- See the page in different screen resolutions.
- Edit cookies.
- Validate HTML and CSS.

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http://www.kth.se/

Mobile portrait (320x480)
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- Remember to **always validate** your HTML and CSS code.
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- NetBeans will be used for examples during the course. Make sure to download the All version, see image above.
- Most important is that you actually use an IDE, do not program in a text editor unless you are really sure it is what you prefer.
JSFiddle and JSLint

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W3Schools Try It Yourself

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- All examples are presented with an online editor where you can experiment with your code.
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- Here follows the 10 usability heuristics mentioned above.
J. Nielsen’s UI Design Principles

1. The system should always keep users informed about what is going on.
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3. Implement undo and redo.
4. Follow platform conventions, users should not have to wonder whether different words, situations, or actions mean the same thing.
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6. Minimize the user’s memory load by making objects, options, etc. visible. The user should not have to remember information.

7. Use accelerators to speed up interaction for expert users.

8. Remove irrelevant information.
9. Error messages should be expressed in plain language, precisely indicate the problem, and suggest a solution.
J. Nielsen’s UI Design Principles

9. **Error messages** should be expressed in plain language, precisely indicate the problem, and suggest a solution.

10. If necessary, provide **help and documentation**. The help should be easy to search, focused on the user’s task, and list concrete steps to be carried out.