Internet Essentials

Internet Applications, ID1354

Contents

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Internet Essentials

Protocols Enabling
HTTP

The HTTP Protocol

Web Browsers and
Web Servers

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- ▶ 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.

IP Address

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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.
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  - ► Delivered packets have the same content as sent packets.
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The TCP Protocol (Cont'd)

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The TCP Protocol (Cont'd)

- ▶ TCP is connection-oriented, think of a telephone line as opposed to sending a letter. To establish a TCP connection is a slow operation.

- ▶ 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.

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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, **.**

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Web Servers

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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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    4. A path, which identifies the resource's location on the server.
       http://www.kth.se:8080/abc/index.html

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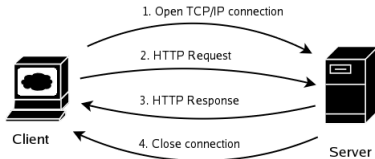- ▶ A Uniform Resource Identifier, URI is either a URL or URN.

HTTP

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- ▶ HyperText Transfer Protocol, HTTP is used for communication between web browsers and web servers.
- ▶ HTTP is based on TCP, which means a TCP connection is established for each browser-server communication.

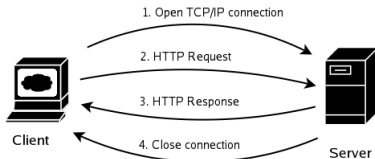# The Request-Response Cycle

1. Open TCP/IP connection
2. HTTP Request
3. HTTP Response
4. Close connection

Client

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A HTTP communication typically proceeds as follows.

1. The client opens a TCP connection to the server.

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Client   Server

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1. The client opens a TCP connection to the server.

2. The client sends a request for a resource on the server. The request consists of a HTTP header, and data if the user submitted data to the server.

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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.

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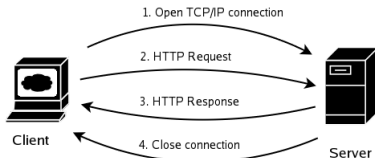Web Browsers and
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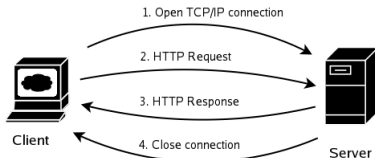
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4. The server closes the TCP connection.

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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, se below.

Cookies

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- ▶ The cookie is tagged with the server's domain name and included in every request to that server.
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- ▶ Cookies can be used to store the user's settings, for example display language.

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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 /sida1.html HTTP/1.1
Host: www.dn.se
Accept-Charset: utf-8
User-Agent: Firefox
```

```
HTTP/1.1 200 OK
Date: Sun, 06 Nov...
Content-Length: 962
Content-Type: text/html
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<?xml version...>
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- ▶ Sample request (top) and response (bottom) messages are depicted to the left.

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5xx Server error, for example **500**, Internal Server Error

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- ▶ **GET** and **POST** are the most common methods and the only ones we will use in this course.

Safe and Idempotent Methods

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- ▶ **GET**, **HEAD**, **PUT**, **DELETE**, **OPTIONS** and **TRACE** are idempotent methods, which means the same request can be sent multiple times without any side-effects on the server.
- ▶ **POST** is not idempotent. If you submit the same purchase order multiple times in a web shop you will probably by multiple items. The purchase is typically a **POST** request.

When to Use GET

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    - ▶ You want to be able to write the entire request, including data, in the browser. This is useful when debugging.

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  - ▶ The required action updates server state, for example saves something in a database.
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  - ▶ 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

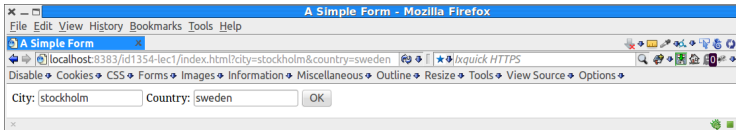- ▶ HTTP parameters are data included in a request to a web server.

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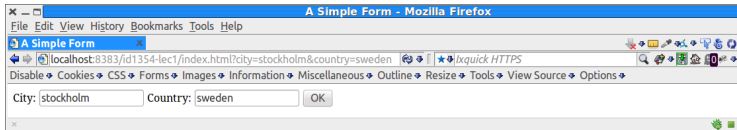- ▶ A typical example is when the user has entered data in a HTML form.

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- ▶ When using the **GET** method, parameters are appended to the URL as a query string, **http://some.domain/ some/path?city=stockholm&country=sweden**
- ▶ When using the **POST** method, parameters are included in the message body.

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  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.

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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
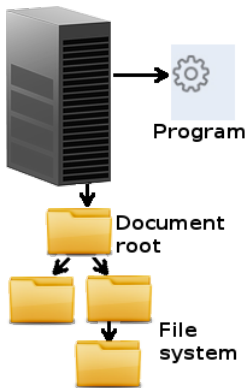
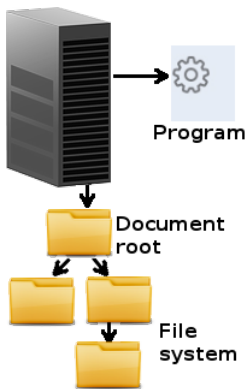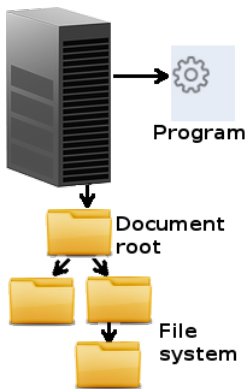- The web server can deliver static content and also call server-side programs, like PHP, Java or .NET programs.

Web Servers

- ▶ The web server can deliver static content and also call server-side programs, like PHP, Java or .NET programs.
- ▶ The most commonly used web server is apache, `https://httpd.apache.org/`

Web Servers

Program

Document root

File system

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

Web Servers (Cont'd)

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- ▶ It might take time to get the web server running. You are advised to start installing the web server now.