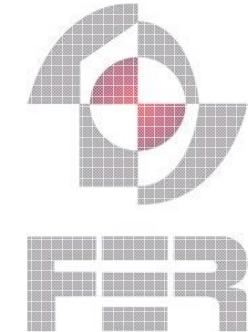




UNIZG-FER 86518



Računarstvo zasnovano na uslugama *(Service-Oriented Computing)*

<http://www.fer.unizg.hr/predmet/rznu>

Doc. dr. sc. Dejan Škvorc

Prof. dr. sc. Siniša Srbljić

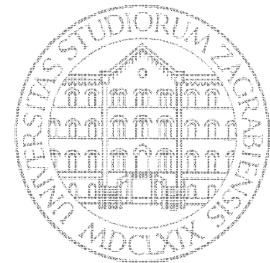
Doc. dr. sc. Ante Đerek

Sveučilište u Zagrebu

Fakultet elektrotehnike i računarstva

Zavod za elektroniku, mikroelektroniku, računalne i inteligentne sustave

Service...What???



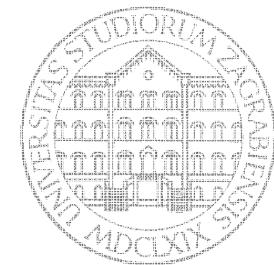
<https://www.facebook.com/dejan.skvorc/friends>

A screenshot of a Facebook profile page for "Dejan Skvorc". The top navigation bar shows "Timeline", "About", "Photos 14", "Friends 194", and "More". Below the header, there's a section titled "Friends" with "All Friends 194". It lists five friends with their names, profile pictures, and friend counts: Stjepan Groš (203 friends), Maja Kostić (220 friends), Marija Budigam Škvorc (169 friends), Melita Mihaljević (538 friends), and Mirjana Pristav (51 friends). Each friend entry has a "Friends" button.

<https://graph.facebook.com/625589/friends>

```
{
  "data": [
    {
      "name": "Stjepan Gros",
      "id": "https://graph.facebook.com/670874"
    },
    {
      "name": "Maja Kostic",
      "id": "https://graph.facebook.com/281205"
    },
    {
      "name": "Marija Budigam Skvorc",
      "id": "https://graph.facebook.com/281288"
    },
    {
      "name": "Melita Mihaljevic",
      "id": "https://graph.facebook.com/526274"
    },
    {
      "name": "Mirjana Pristav",
      "id": "https://graph.facebook.com/828064"
    },
    {
      "name": "Frank Franjo Plavec",
      "id": "https://graph.facebook.com/428934"
    }
  ]
}
```

Service...What???



<https://twitter.com/dejanskvorc>

A screenshot of a Twitter profile for Dejan Skvorc (@dejanskvorc). The profile picture is a white square with a blue plus sign. The name is 'Dejan Skvorc' and the handle is '@dejanskvorc'. Below the profile are statistics: 3 tweets, 3 following, and 20 followers. There are 'Edit profile' and 'Email' buttons. The main section shows 'Tweets' with three entries:

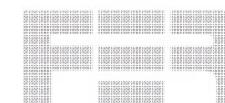
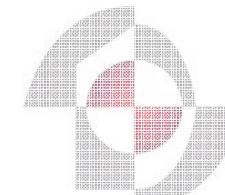
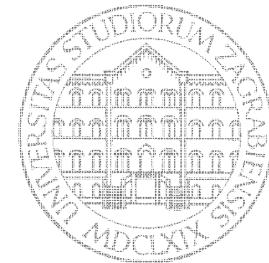
- Dejan Skvorc @dejanskvorc Bodies Revealed exhibition to open in Zagreb http://www.culturenet.hr/default.aspx?id=30963 9 Apr 10 Expand
- Dejan Skvorc @dejanskvorc http://www.culturenet.hr/default.aspx?id=30963 9 Apr 10 Expand
- Dejan Skvorc @dejanskvorc at work 9 Apr 10 Expand

A modal window titled 'What's happening?' is open in the foreground, containing the text 'I am posting on Twitter through browser GUI'. It has a camera icon, a location pin icon, and a 'Tweet' button. The number '97' is visible near the bottom left of the modal.

<https://api.twitter.com/1.1/statuses/update.json>

```
status=I+am+programmatically+posting+on+Twitter&
lat=45.801319&
long=15.970826
```

Service...What???



<http://translate.google.com>

A screenshot of the Google Translate interface. It shows a text input field containing "Hello World". The "From" language is set to English and the "To" language is set to Croatian. The translated text "Pozdrav svijetu" is displayed below. The interface includes a "Translate" button and tabs for English, Spanish, French, and Croatian.

[https://www.googleapis.com/language/translate/v2?
key=WTjTodZba7ky7&source=en&target=hr&
q>Hello%20World](https://www.googleapis.com/language/translate/v2?key=WTjTodZba7ky7&source=en&target=hr&q>Hello%20World)

```
{  
  "data": {  
    "translations": [  
      {  
        "translatedText": "Pozdrav svijetu"  
      }  
    ]  
  }  
}
```

Service...What???



Human Web

<https://graph.facebook.com/625589/friends>

```
{  
  "data": [  
    {  
      "name": "Stjepan Gros",  
      "id": "https://graph.facebook.com/670874"  
    },  
    {  
      "name": "Melita Minaljevic",  
      "id": "https://graph.facebook.com/526074"  
    }  
  ]  
}
```

<https://api.twitter.com/1.1/statuses/update.json>

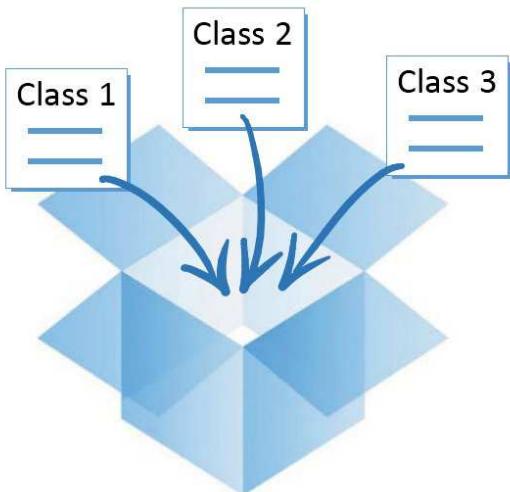
```
status=I+am+programmatically+posting+on+Twitter&  
lat=45.801319&  
long=15.970826
```

```
{  
  "name": "Melita Minaljevic",  
  "id": "https://graph.facebook.com/526074"  
}
```

<https://www.googleapis.com/language/translate/v2?key=WTjTodZba7k7&source=en&target=hr&q>Hello%20World>

```
{  
  "data": {  
    "translations": [  
      {  
        "translatedText": "Pozdrav svijetu"  
      }  
    ]  
  }  
}
```

Service...What???



apply preinstalled components
buy components
get open source components
develop components by yourself

local installation and execution



software as a product

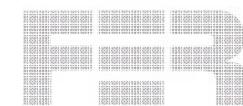
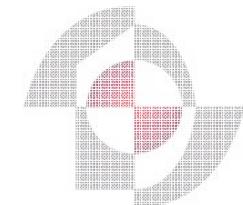
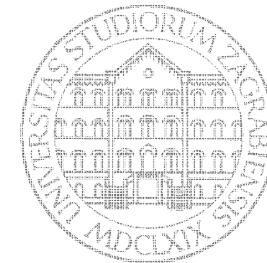


Course Motivation

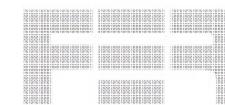
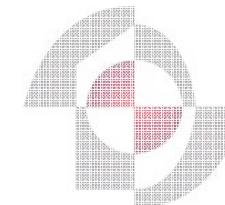
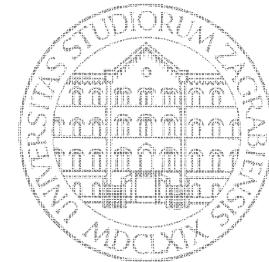
Communications of the ACM (07, 2008)

Web Science **Approach to Understanding the Web**

W3C: *James Hendler*
 Nigel Shadbolt
 Wendy Hall
 Tim Berners-Lee
MIT: *Daniel Weitzner*



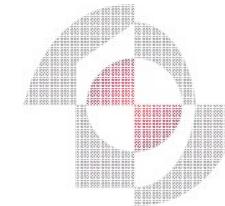
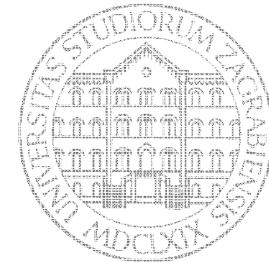
Course Motivation



Web Science: Approach to Understanding the Web

- *Despite the Web's great success it remains, as an entity, surprisingly unstudied*
- *If you look at CS curricula in most universities worldwide you are **unlikely to find a course that teaches Web architecture or protocols***
- *The **protocols, architectures, and underlying principles of the Web are rarely covered***

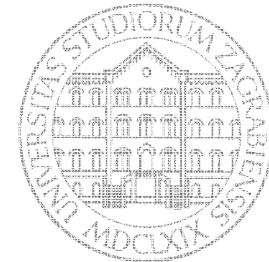
Course Motivation



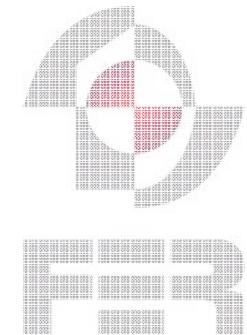
Web Science: Approach to Understanding the Web

- *What are the **fundamental theoretical properties**?*
- *What kinds of **algorithms** are needed?*
- *What underlying **architectural principles** are needed to guide the design of new Web infrastructure?*
- *How can we **extend the current Web infrastructure**?*

Course Motivation



WCCCE 2012
17th Western Canadian Conference on Computing Education
Vancouver, Canada
(05, 2012)



Criticizing and Modernizing Computing Curriculum

The Case of the Web and the Social Issues Courses

Randy Connolly
Mount Royal University, Calgary, Canada

Course Motivation

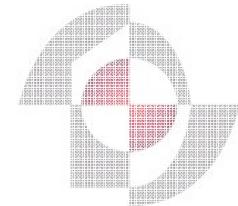
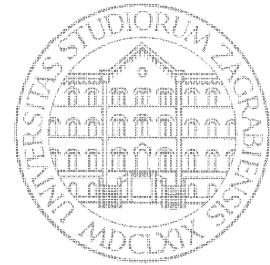
Some computing topic areas
(e.g., first-year programming)
have been rigorously examined
in the education literature.

Other common topic areas have
not been as adequately
examined.

Source:

<http://www.slideshare.net/randyconnolly/criticizing-and-modernizing-computing-curriculum-the-case-of-the-web-and-the-social-issues-courses>

- 1 web development
- 2 ethics/social issues



Course Motivation

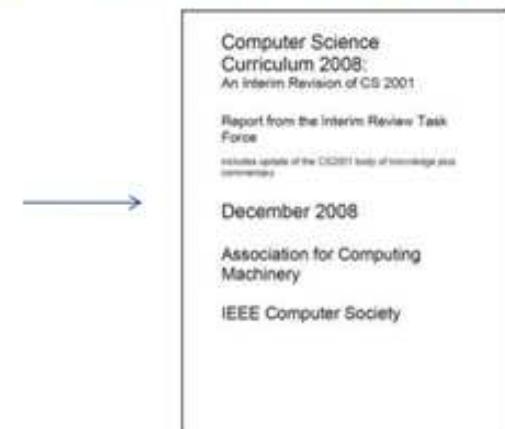
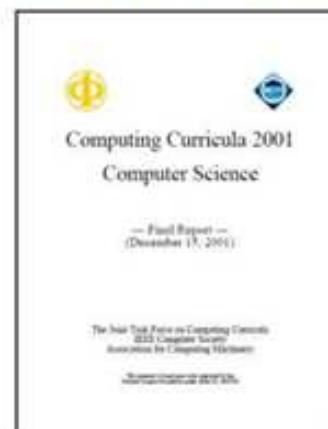
In the past decade,
the world of web development,
has experienced a remarkable
transformation



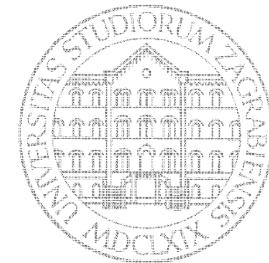
The web development topics in the ACM Computer Science Curriculum barely changed from 2001 to 2008.

Source:

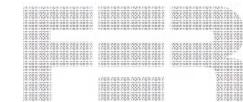
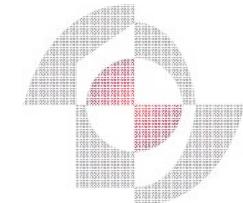
<http://www.slideshare.net/randyconnolly/criticizing-and-modernizing-computing-curriculum-the-case-of-the-web-and-the-social-issues-courses>



Course Motivation



Examining the literature,
web content is usually being taught using the
broad but shallow
All-the-Web-in-One-Course (AWOC)
approach



Back in the early 1970s, a math program
might have had a single course in
programming in Fortran,
but eventually it was recognized that a body
of knowledge as complex as programming
requires multiple courses to teach the
material properly.

Source:

<http://www.slideshare.net/randyconnolly/criticizing-and-modernizing-computing-curriculum-the-case-of-the-web-and-the-social-issues-courses>

Web development
should be in a
similar state today

Course Motivation

partying
like it's

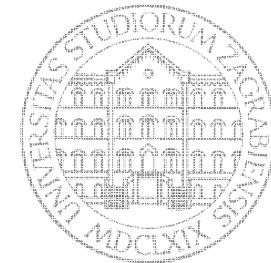
2014 → 2020, 2030?

Source:

<http://www.slideshare.net/randyconnolly/criticizing-and-modernizing-computing-curriculum-the-case-of-the-web-and-the-social-issues-courses>

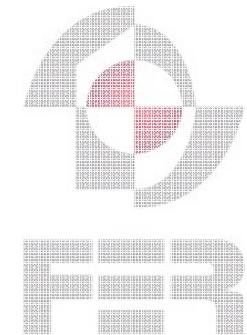


Course Motivation



Computer Science Curricula 2013

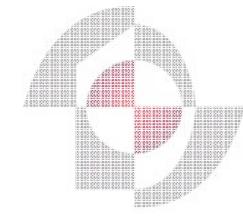
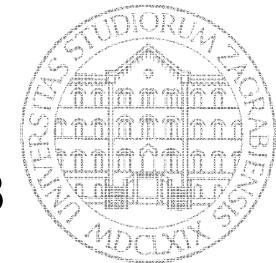
Ironman Draft
(February, 2013)



The Joint Task Force on Computing Curricula
IEEE Computer Society
Association for Computing Machinery

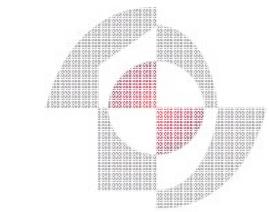
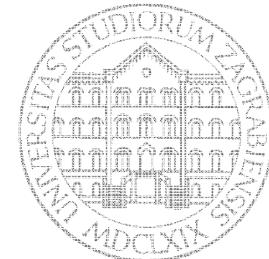
Course Motivation

- The CS2013 Body of Knowledge is organized into a set of 18 Knowledge Areas (KAs)
 - AL - Algorithms and Complexity
 - AR - Architecture and Organization
 - CN - Computational Science
 - DS - Discrete Structures
 - GV - Graphics and Visual Computing
 - HCI - Human-Computer Interaction
 - IAS - Information Assurance and Security
 - IM - Information Management
 - IS - Intelligent Systems
 - **NC - Networking and Communications**
 - **PBD - Platform-based Development**
 - PD - Parallel and Distributed Computing
 - PL - Programming Languages
 - SDF - Software Development Fundamentals
 - SE - Software Engineering
 - SF - Systems Fundamentals
 - SP - Social Issues and Professional Practice



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Course Motivation

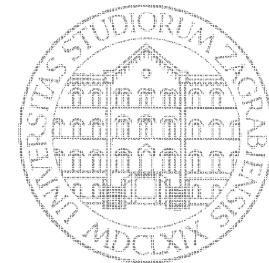


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- NC - Networking and Communication
 - CC2001 introduced a KA entitled “Net-Centric Computing” which encompassed a combination of topics including traditional networking, web development, and network security. Given the growth and divergence in these topics since the last report, we renamed and re-factored this KA to focus specifically on topics in networking and communication. Discussions of web applications and mobile device development are now covered in the new PBD-Platform-Based Development KA. Security is covered in the new IAS-Information Assurance and Security KA.
- PBD - Platform-Based Development
 - PBD is a new KA that recognizes the increasing use of platform-specific programming environments, both at the introductory level and in upper-level electives. Platforms such as the Web or mobile devices enable students to learn within and about environments constrained by hardware, APIs, and special services (often in cross-disciplinary contexts). These environments are sufficiently different from “general purpose” programming to warrant this new (wholly elective) KA.

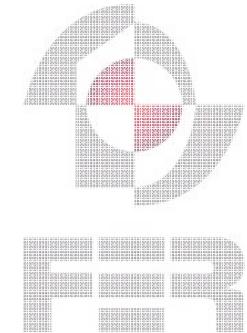
Course Motivation

- PBD / Web Platforms



Topics:

- Web programming languages (HTML5, Java Script, PHP, CSS, etc.)
- Web platform constraints
- Software as a Service (SaaS)
- Web standards

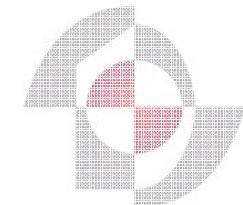
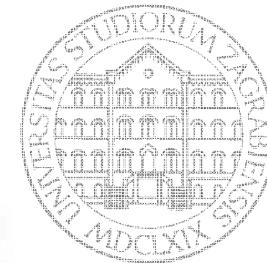


Learning Outcomes:

- Design and implement a simple web application
- Describe the constraints that the web puts on developers
- Compare and contrast web programming with general purpose programming
- Describe the differences between Software-as-a-Service and traditional software products
- Discuss how web standards impact software development
- Review an existing web application against a current web standard

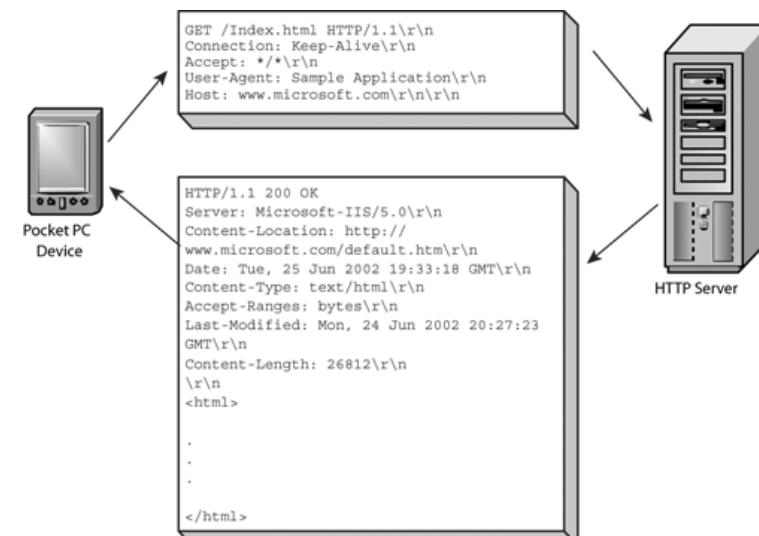
What This Course IS About?

- Web as a global information system
 - How it works?
 - Browser
 - Server
 - Search engine
- Web architecture
 - REST
 - Principles
 - Properties
- Protocols and interaction technologies
 - Hypermedia
 - URIs
 - HTTP
- RESTful API design
 - Resources
 - Naming and addressing
 - Representation and manipulation
 - Best practices

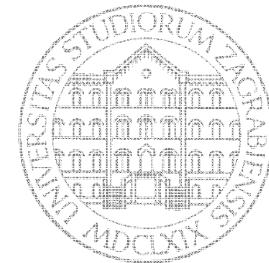


FER

```
ALL  = Type.new "*/*", :all
TEXT = Type.new "text/plain", :text
HTML = Type.new "text/html", :html, %w
JS   = Type.new "text/javascript", :js
ICS  = Type.new "text/calendar", :ics
CSV  = Type.new "text/csv", :csv
XML  = Type.new "application/xml", :xm
```



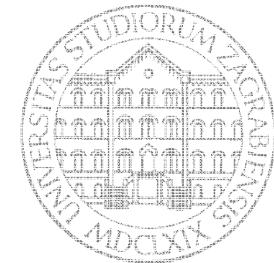
What This Course IS NOT About?



- Web application development
 - Client side technologies
 - HTML
 - CSS
 - JavaScript
 - XML
 - Server side technologies
 - Java, JSP
 - PHP
 - CGI
 - ASP, ASP.NET
 - Database design
 - Application design paradigms
 - Three-tiered architecture
 - Model-View-Controller
 - Development frameworks
 - Ruby on Rails
 - Django
 - Joomla



Course Organization



Lecturers

Doc. dr. sc. Dejan Škvorc

Prof. dr. sc. Siniša Srbljić

Doc. dr. sc. Ante Đerek

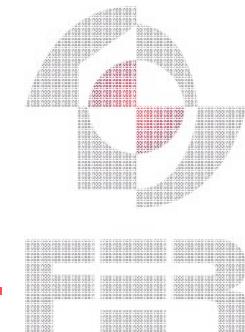
Assistants

Dr. sc. Klemo Vladimir

Dr. sc. Marin Šilić

Dr. sc. Goran Delač

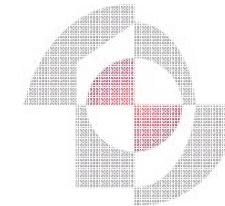
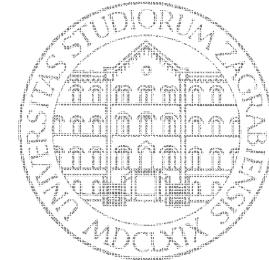
Zvonimir Pavlić, mag. ing.



ECTS: 4

Lecture type	Total load
Lectures	30
Laboratory exercises	15

Lectures



FER

PART 1

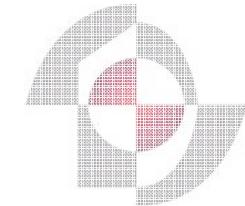
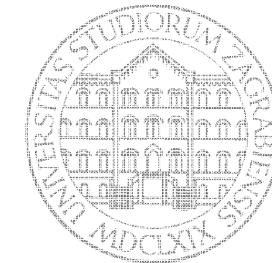
- RESTful web services
 - REST architectural style
 - REST triangle
 - Resource-oriented architecture
 - Addressability
 - Statelessness
 - Uniform interface
 - Connectedness
 - HTTP
 - Resources
 - URLs
 - Methods
 - Media types
 - Representations
 - Response codes
 - Caching
 - Security
 - Content negotiation
 - REST maturity model



Lectures

PART 2

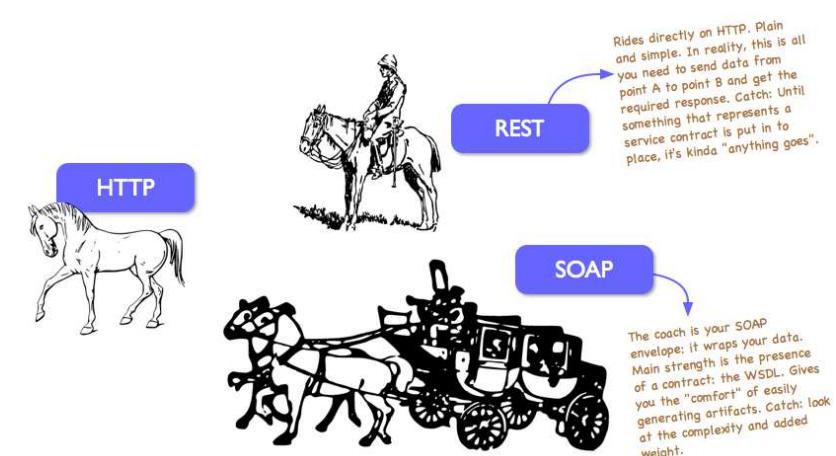
- SOAP-based web services
 - Service-oriented architecture
 - SOA triangle
 - WS-* technology stack
 - SOAP
 - WSDL
 - UDDI
 - WS-Security
 - Quality of service
 - Service composition
 - Service-oriented programming model



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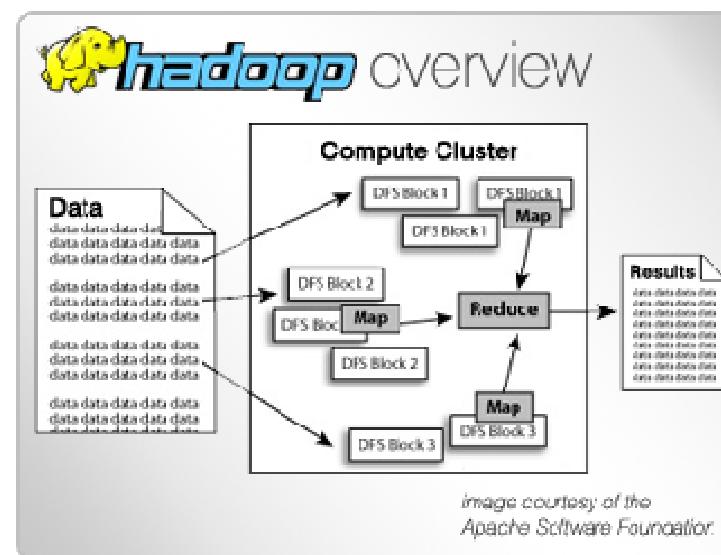
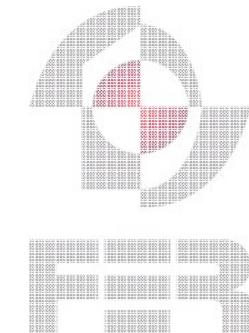
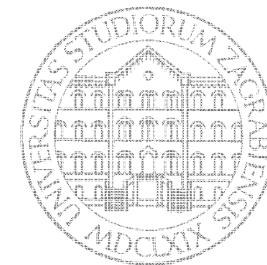
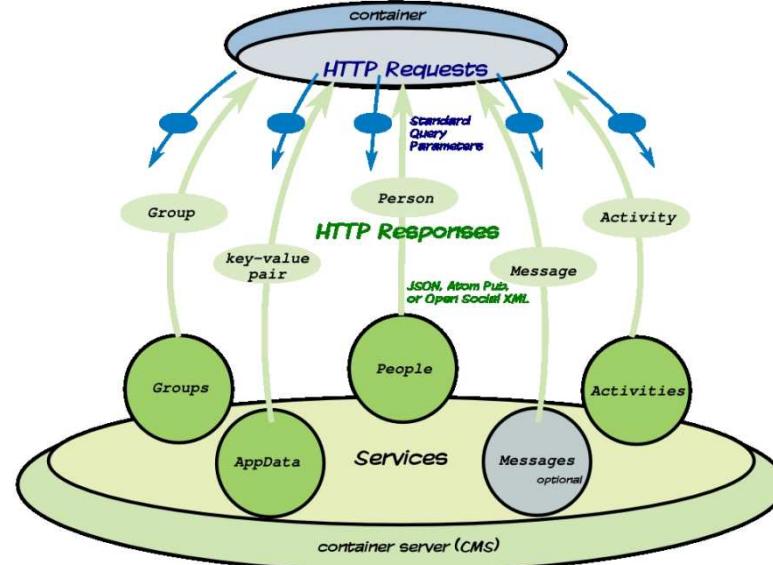
PART 3

- Comparison of the two models
 - REST vs. SOAP



Laboratory Exercises

- Individual work
- Two assignments
 - REST
 - Apache Hadoop
- Oral examination
 - Program demonstration
 - Oral examination



Reading Material

- **RESTful Web Services**

Leonard Richardson, Sam Ruby

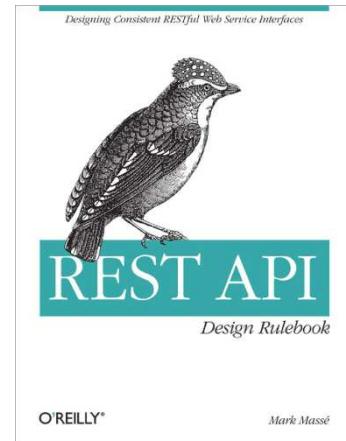
O'Reilly Media, May 2007 (total pages: 454)



- **REST API Design Rulebook**

Mark Masse

O'Reilly Media, October 2011 (total pages: 116)

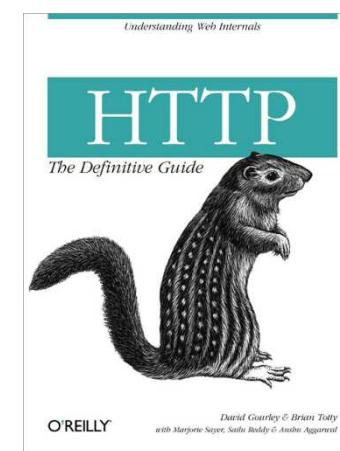


- **HTTP The Definitive Guide**

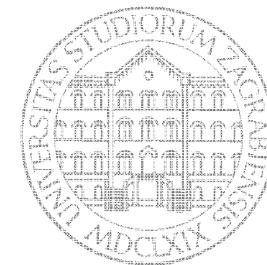
David Gourley, Brian Totty, Marjorie Sayer,

Anshu Aggarwal, Sailu Reddy

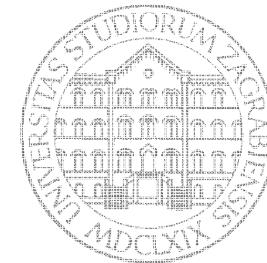
O'Reilly Media, September 2002 (total pages: 658)



- Scientific articles, technical papers, excerpts from master theses and doctoral dissertations
- Web search (podcasts, blogs, discussion sites)



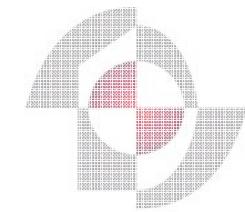
Provjera znanja i ocjenjivanje



1) Kontinuirana provjera znanja

Teorijski dio ocjene

- Međuispit 30 bodova
- Završni ispit 30 bodova
- Sudjelovanje u nastavi 5 bodova
- Ukupno **65 bodova**



FER

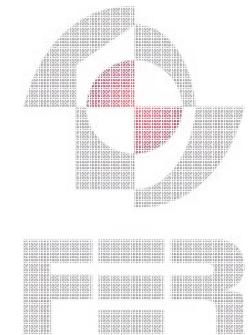
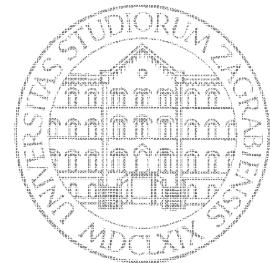
Praktični dio ocjene

- Laboratorijske vježbe 35 bodova
- Ukupno **35 bodova**

UKUPNO TEORIJA + PRAKSA

- **100 bodova**

Provjera znanja i ocjenjivanje



1) Kontinuirana provjera znanja

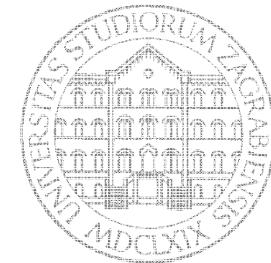
Bodovni pragovi

- za dobivanje pozitivne ocjene
 - prag iz teorijskog dijela ocjene 30 / 65 bodova ($\approx 46\%$)
 - prag iz praktičnog dijela ocjene 15 / 35 bodova ($\approx 43\%$)

Određivanje ocjene

- dovoljan (2) 45 bodova
- dobar (3) 63 bodova
- vrlo dobar (4) 75 bodova
- izvrstan (5) 88 bodova

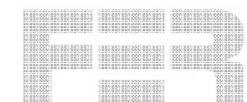
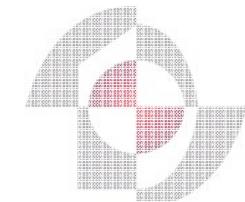
Provjera znanja i ocjenjivanje



2) Ispitni rok

Pismeni ispit

- 100 bodova



Bodovni pragovi za izlazak na ispitni rok

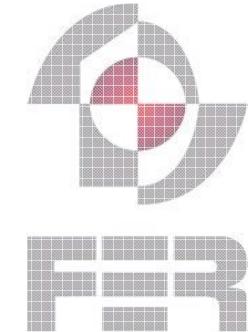
- prag iz praktičnog dijela ocjene 15 / 35 bodova ($\approx 43\%$)
- NE ULAZI U OCJENU PISMENOG ISPITA

Određivanje ocjene

- | | |
|------------------|-----------|
| • dovoljan (2) | 50 bodova |
| • dobar (3) | 63 bodova |
| • vrlo dobar (4) | 75 bodova |
| • izvrstan (5) | 88 bodova |

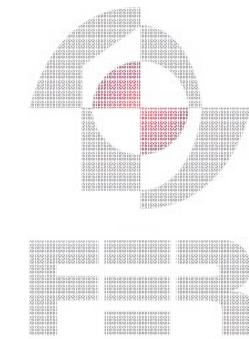
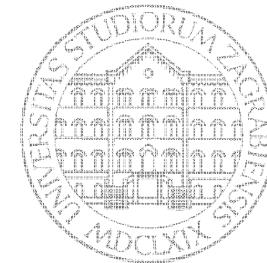


UNIZG-FER 86518
Service-Oriented Computing



Short Introduction to the World Wide Web

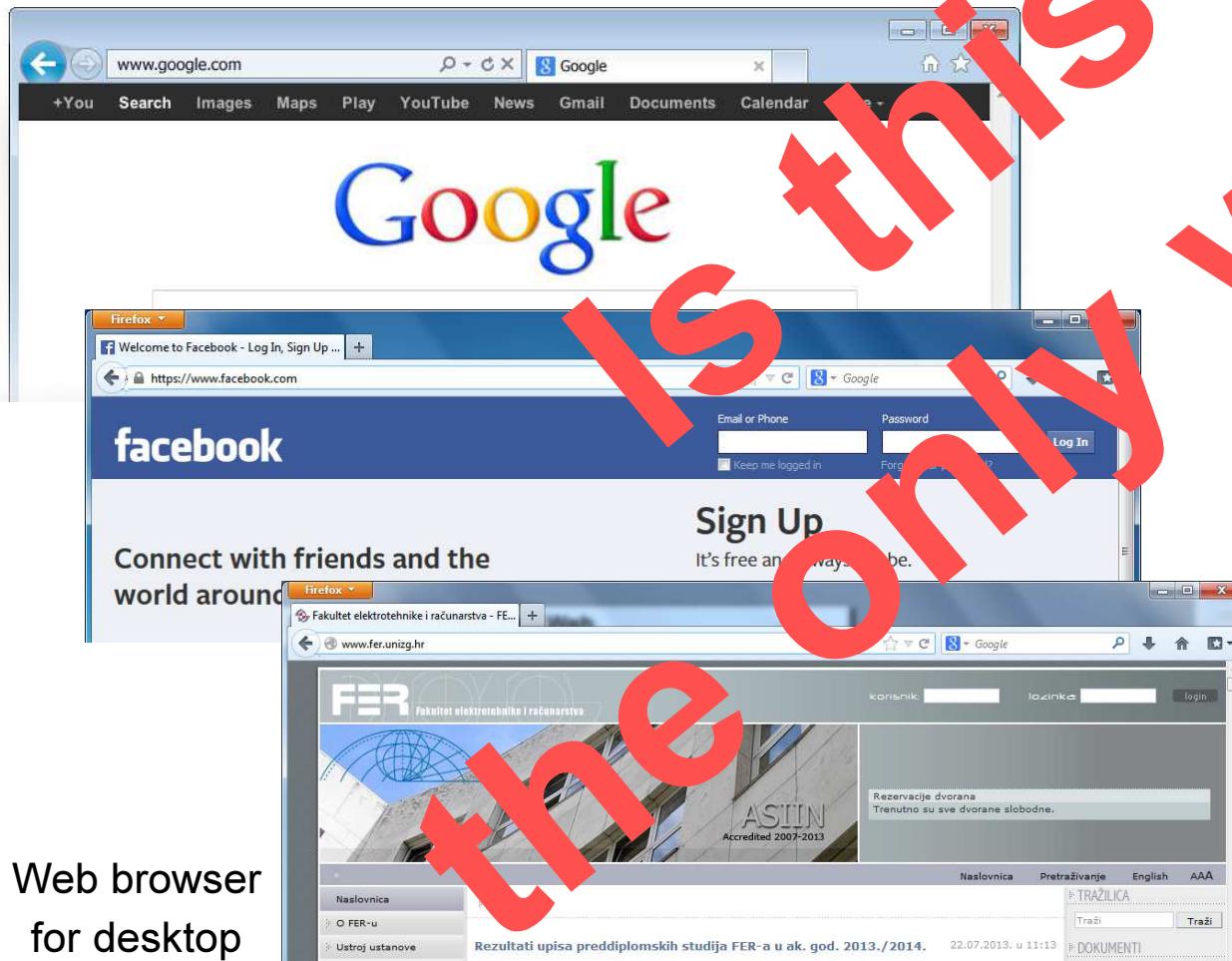
Internet vs. World Wide Web



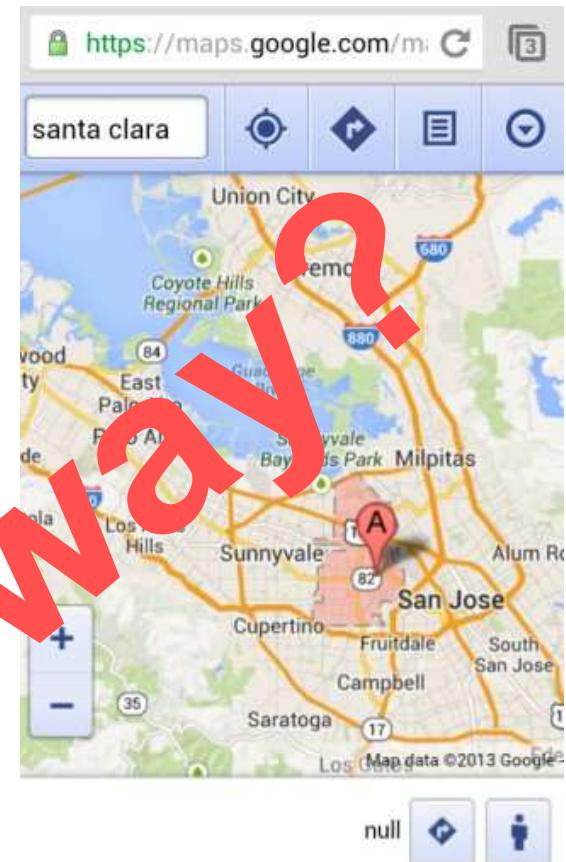
- Internet
 - Global network of networks, all using the same protocol: TCP/IP
- World Wide Web = Web = WWW
 - Just one application among many that uses the Internet

Internet vs. World Wide Web

- Access to the World Wide Web
 - Typically using a Web browser

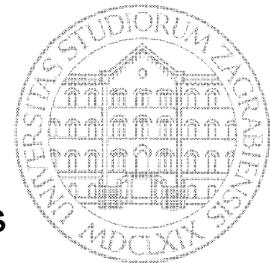


Web browser
for desktop

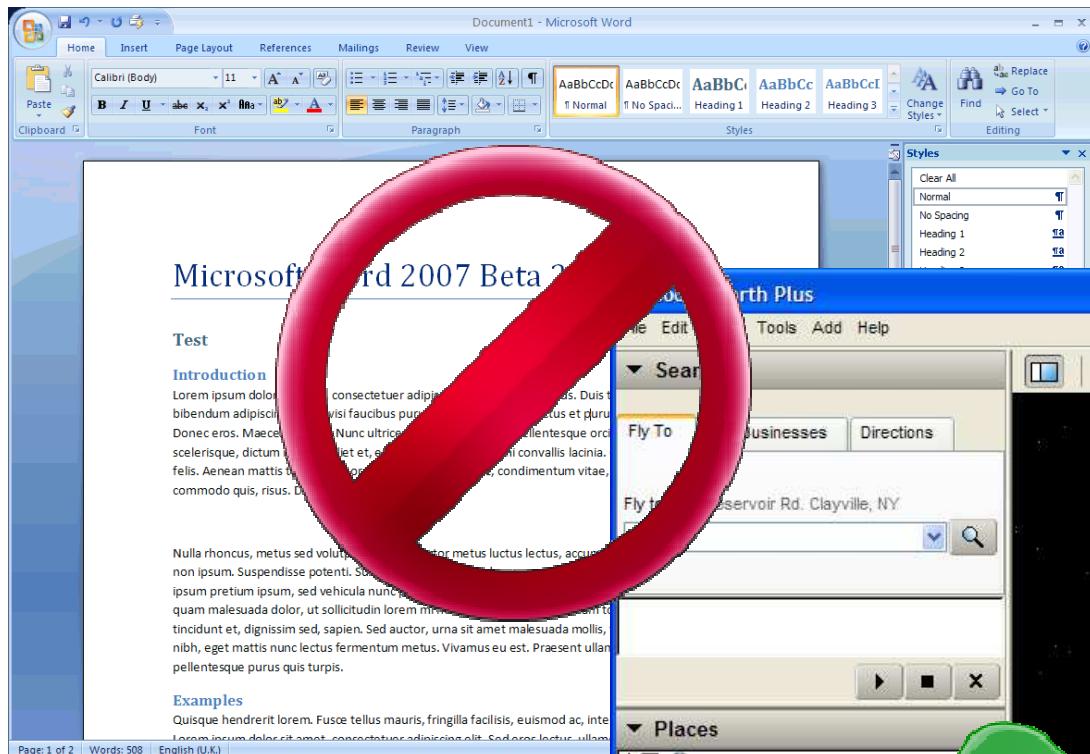


Web browser
for mobile

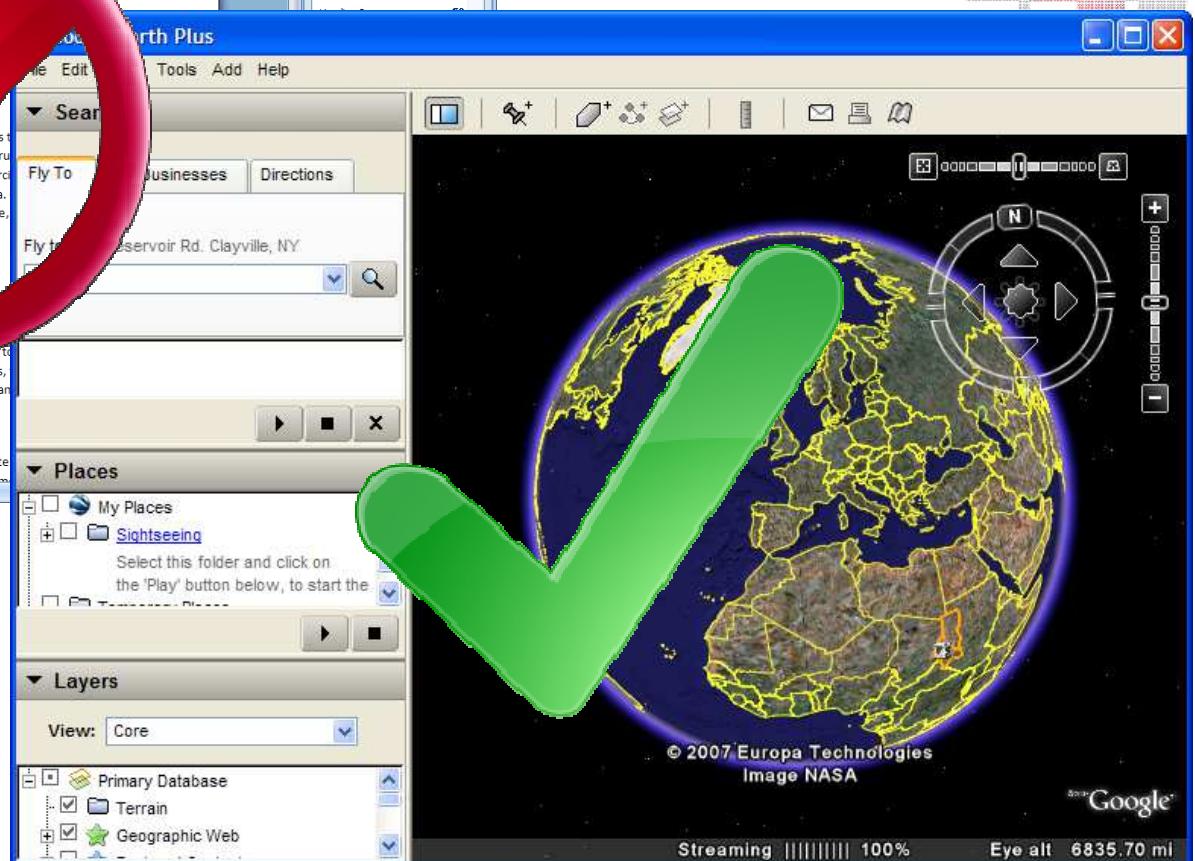
Internet vs. World Wide Web



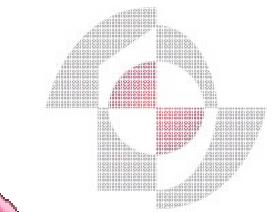
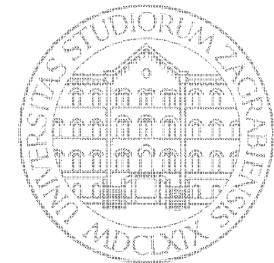
Desktop applications
(Microsoft Word)



Desktop applications
(Google Earth)



Internet vs. World Wide Web

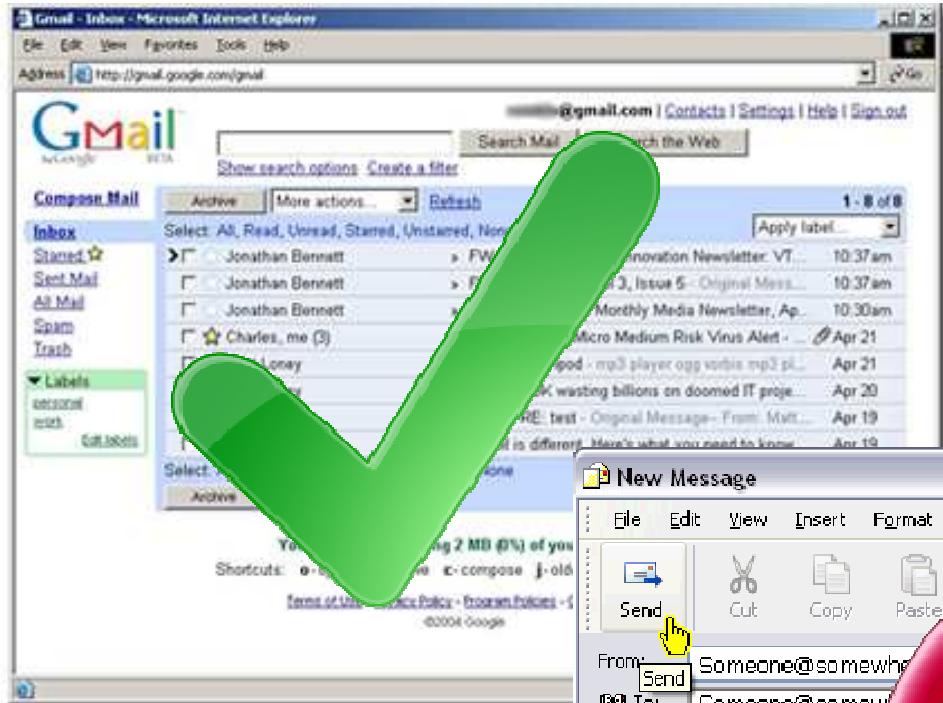
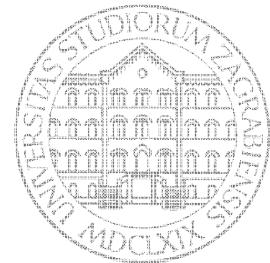


Native mobile applications
(Google Maps, Facebook)

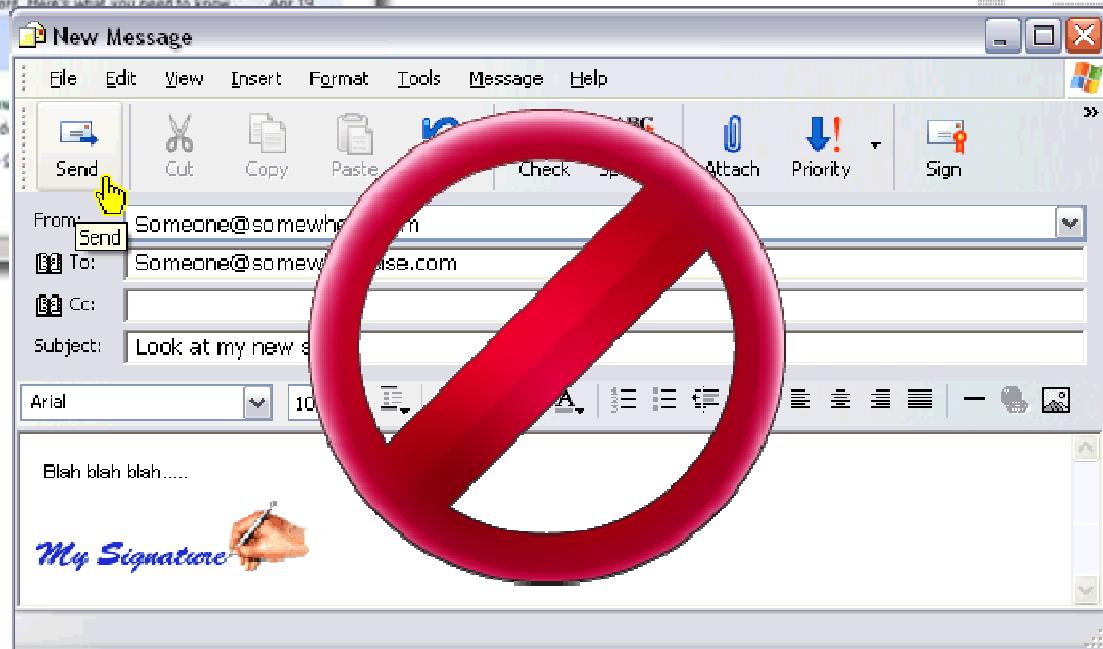


Native mobile applications
(Phone, Camera)

Internet vs. World Wide Web

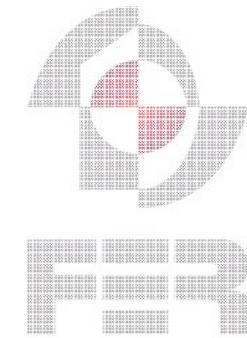
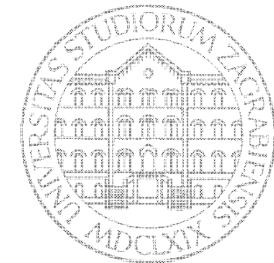


Webmail
(*GMail*,
Hotmail,
Yahoo! Mail)

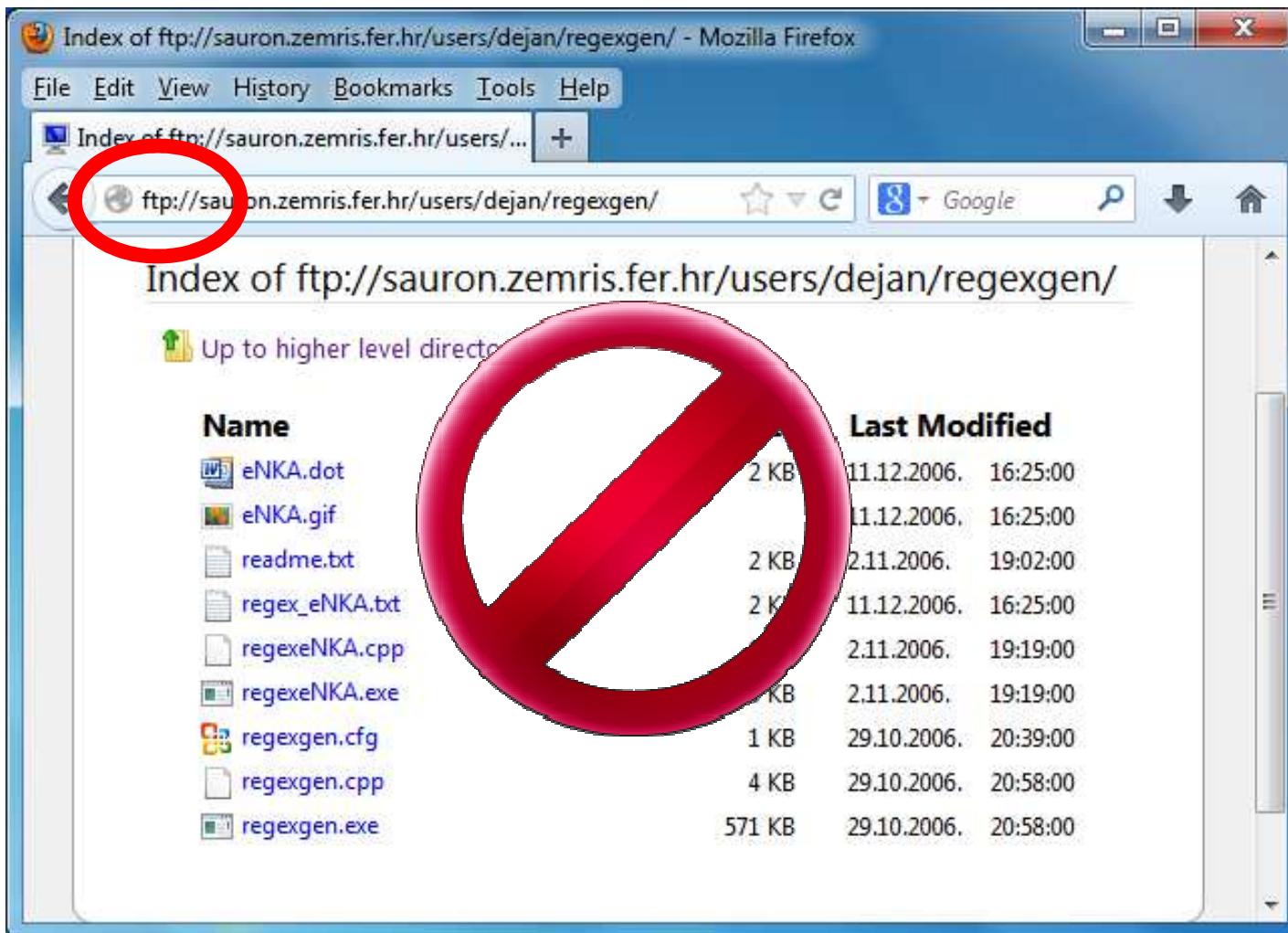


Desktop email client
(*MS Outlook*,
Mozilla Thunderbird)

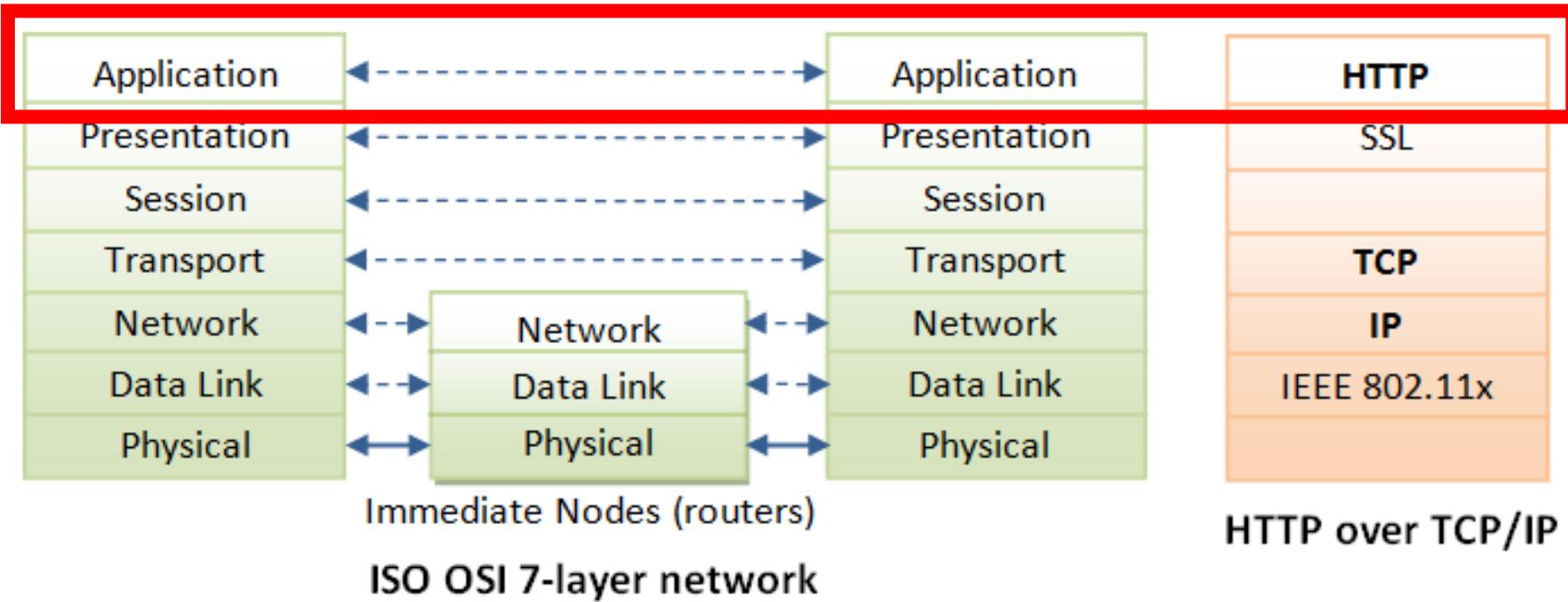
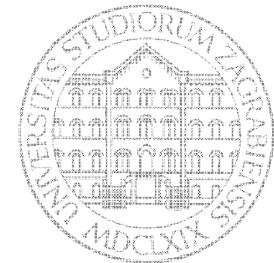
Internet vs. World Wide Web



- Are we always on the Web when using a web browser?

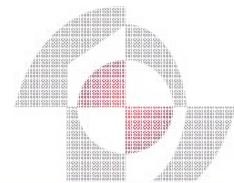
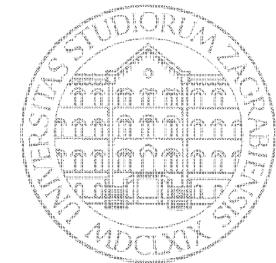


Internet vs. World Wide Web

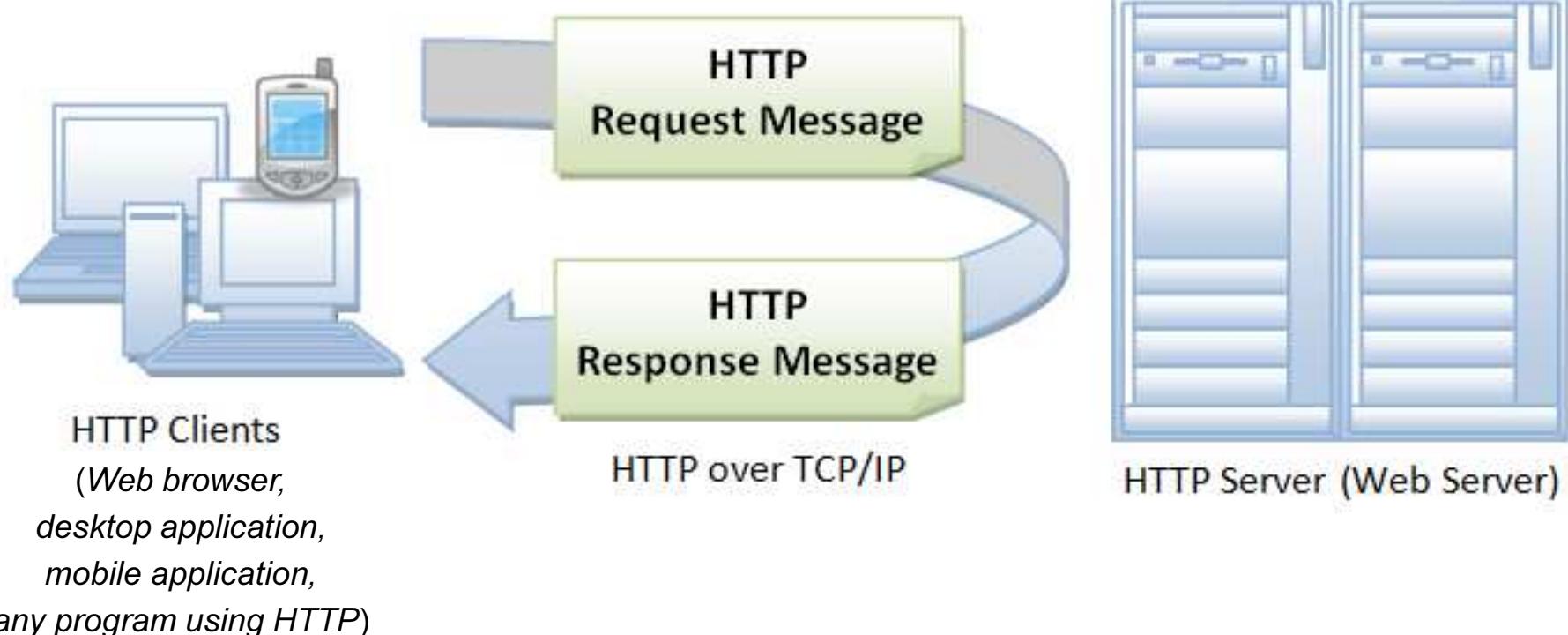


- **World Wide Web**
 - Applications and services based on HTTP protocol

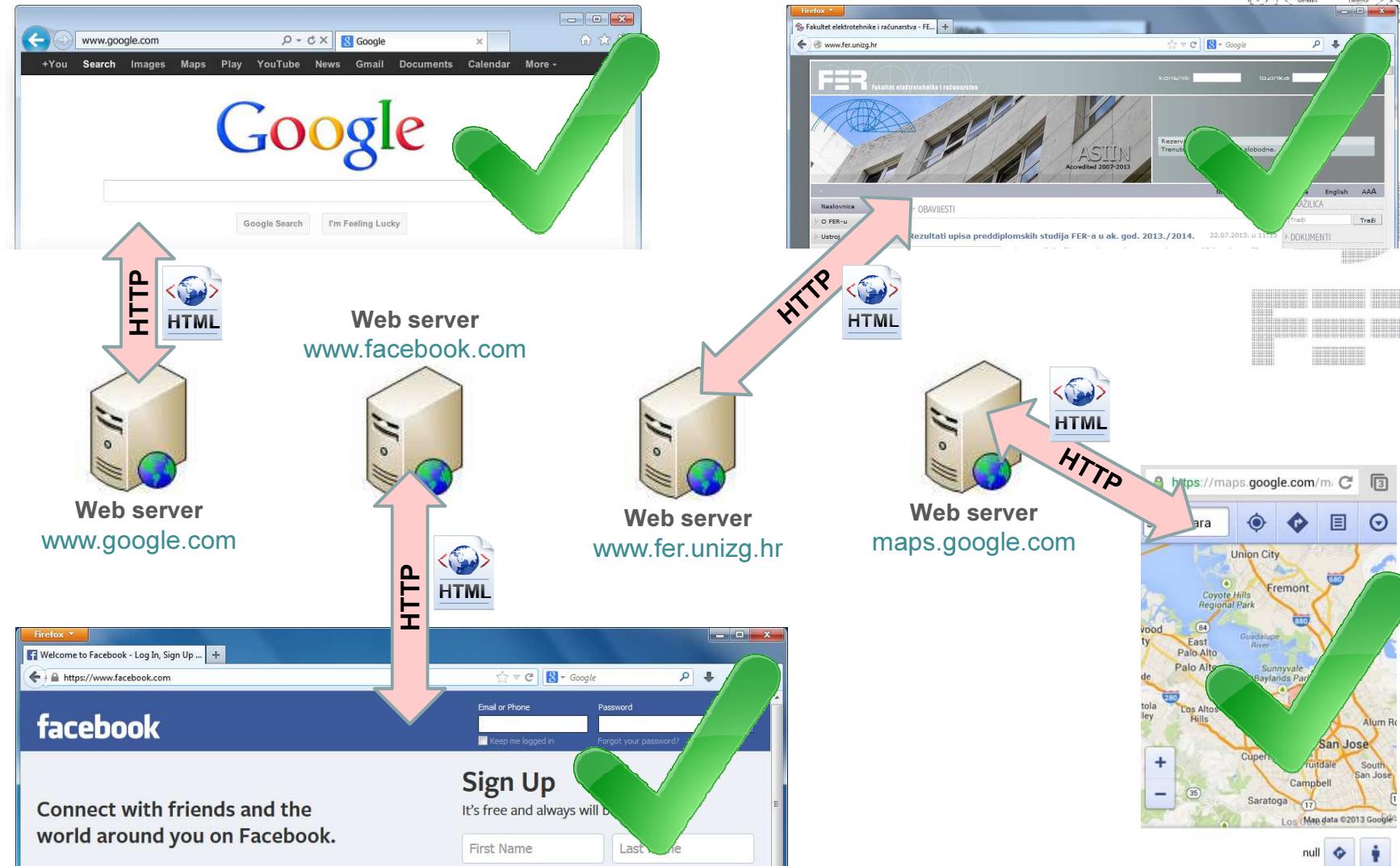
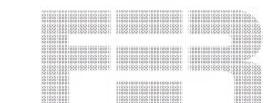
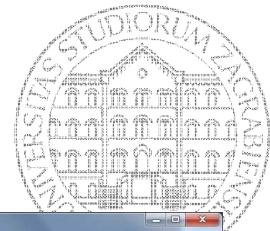
Internet vs. World Wide Web



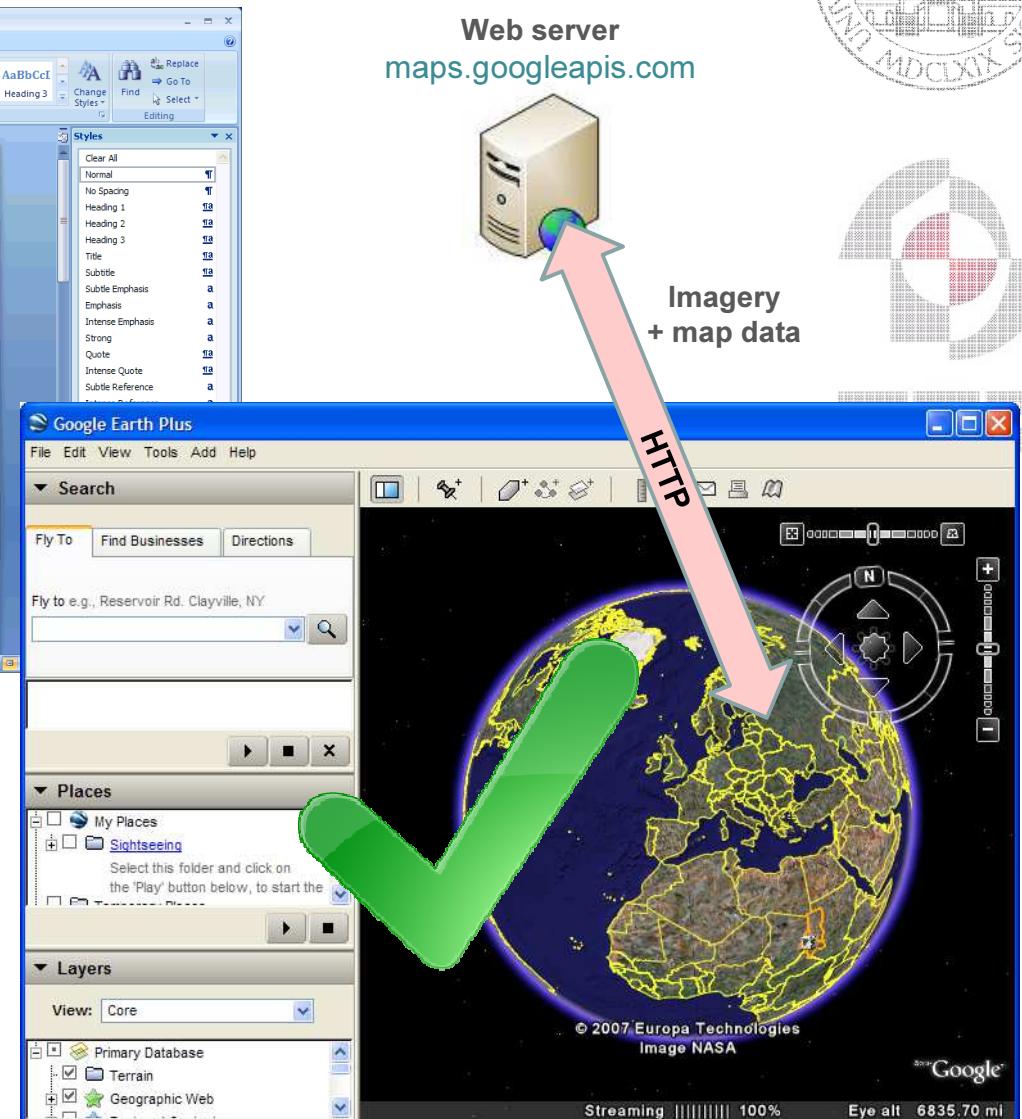
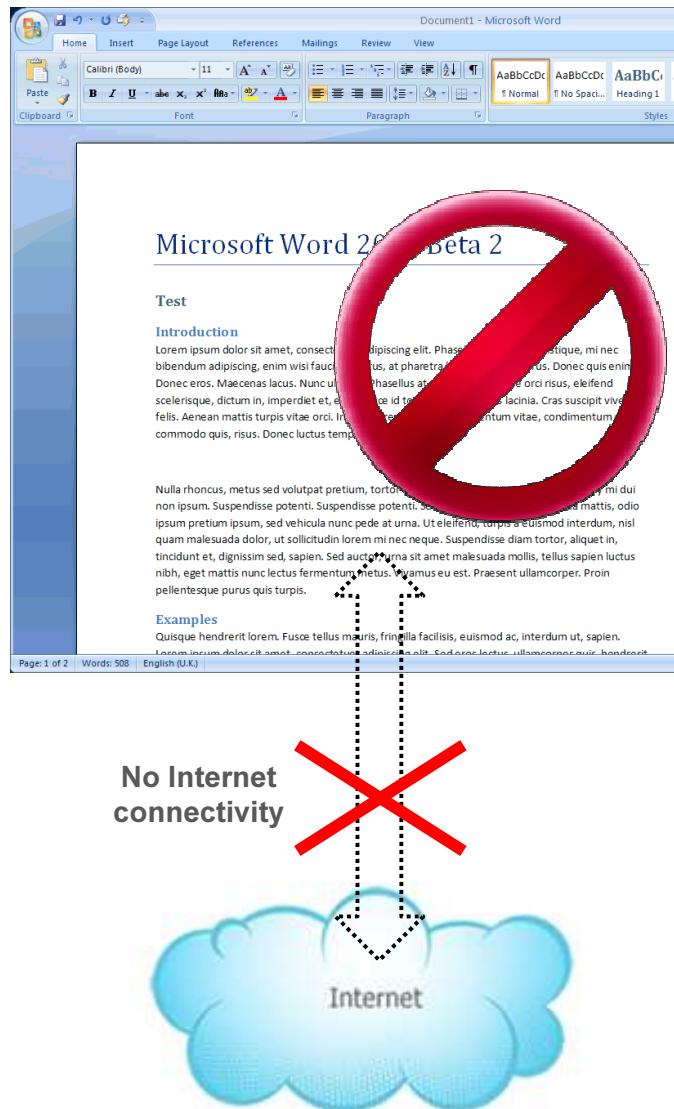
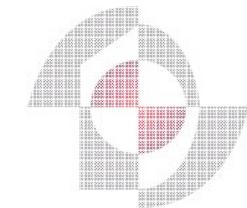
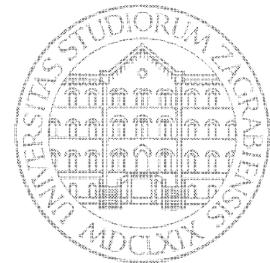
- HTTP (*HyperText Transfer Protocol*) protocol
 - Client-server architecture
 - Request-response paradigm



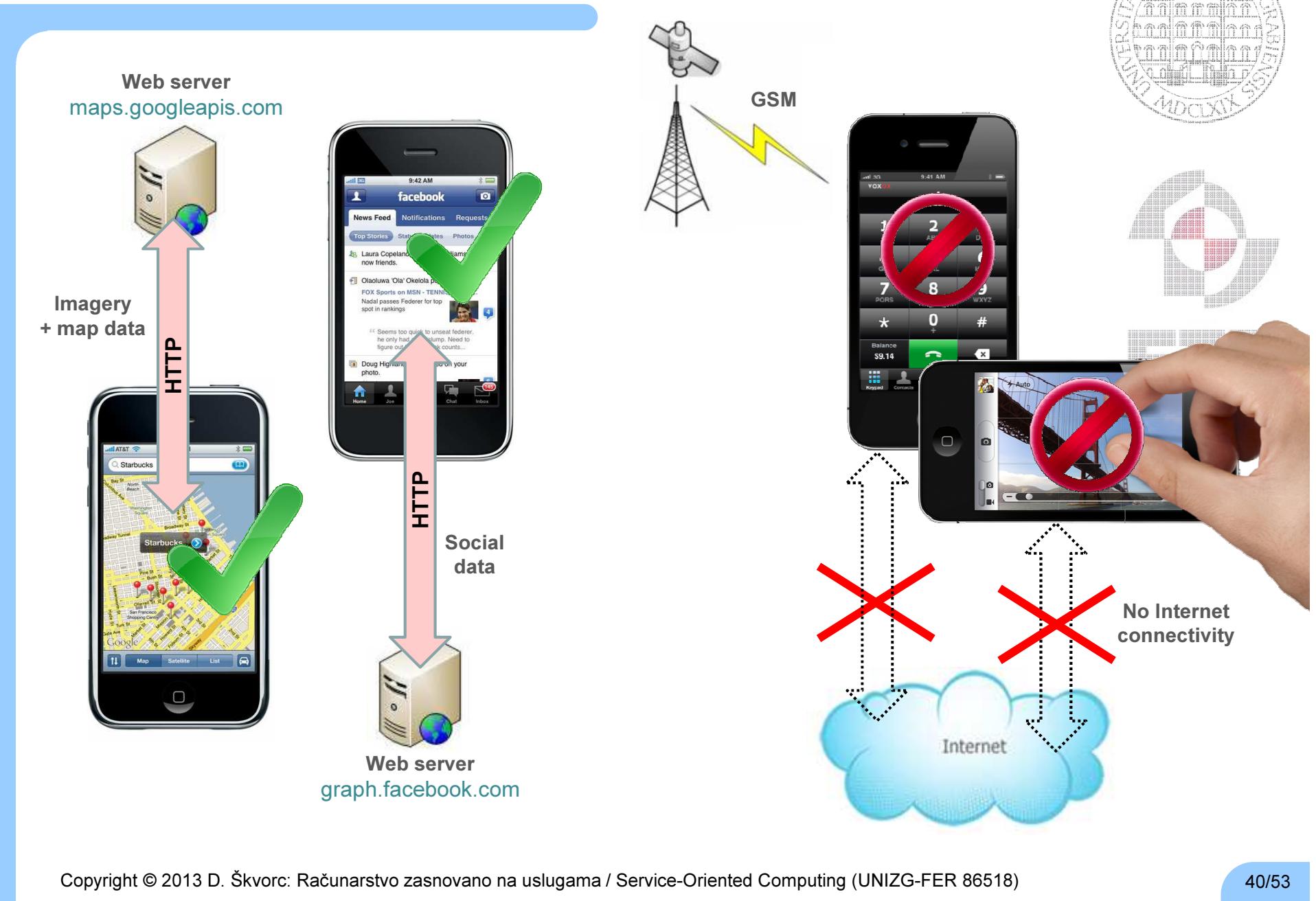
Internet vs. World Wide Web



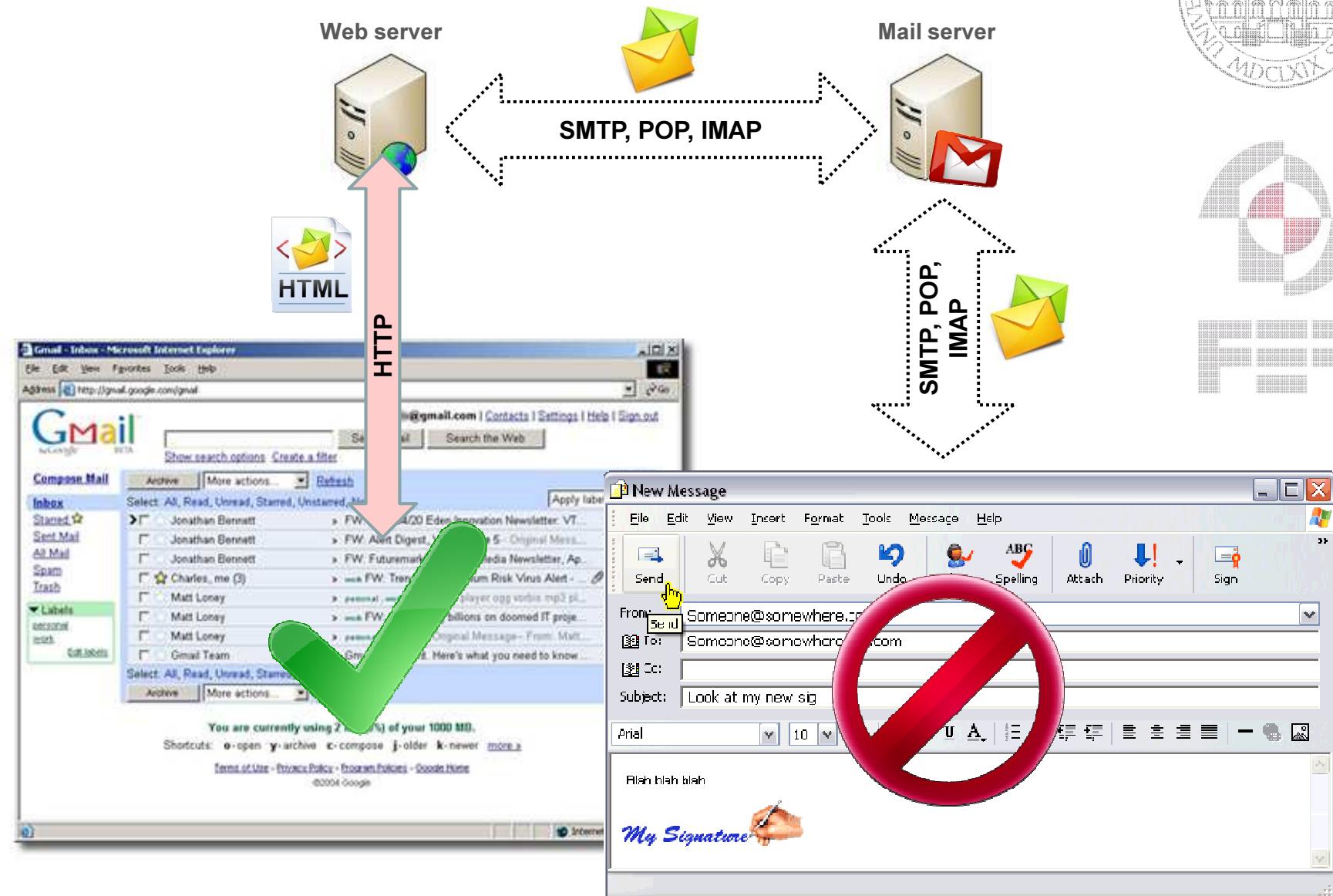
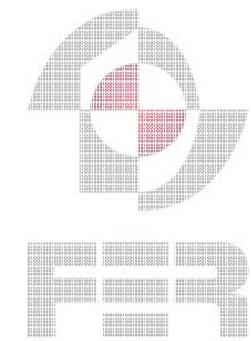
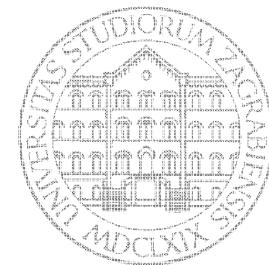
Internet vs. World Wide Web



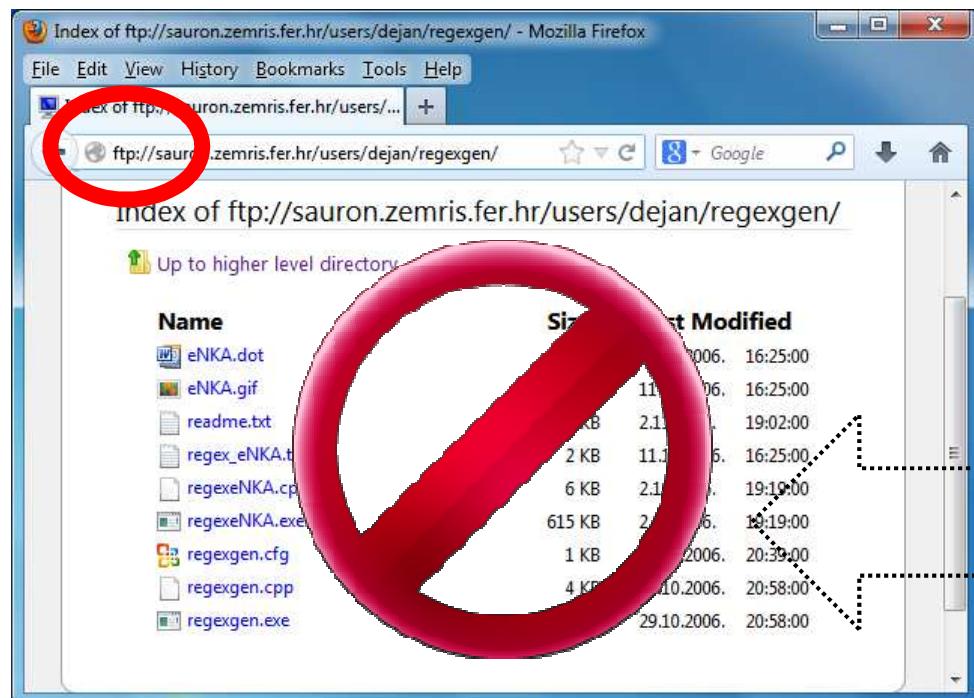
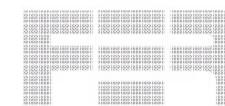
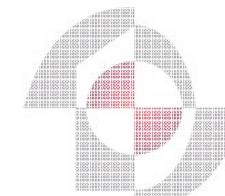
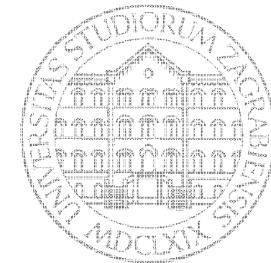
Internet vs. World Wide Web



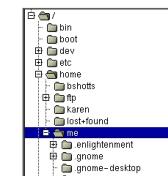
Internet vs. World Wide Web



Internet vs. World Wide Web



File system data
(directory structure,
file list,
file content)

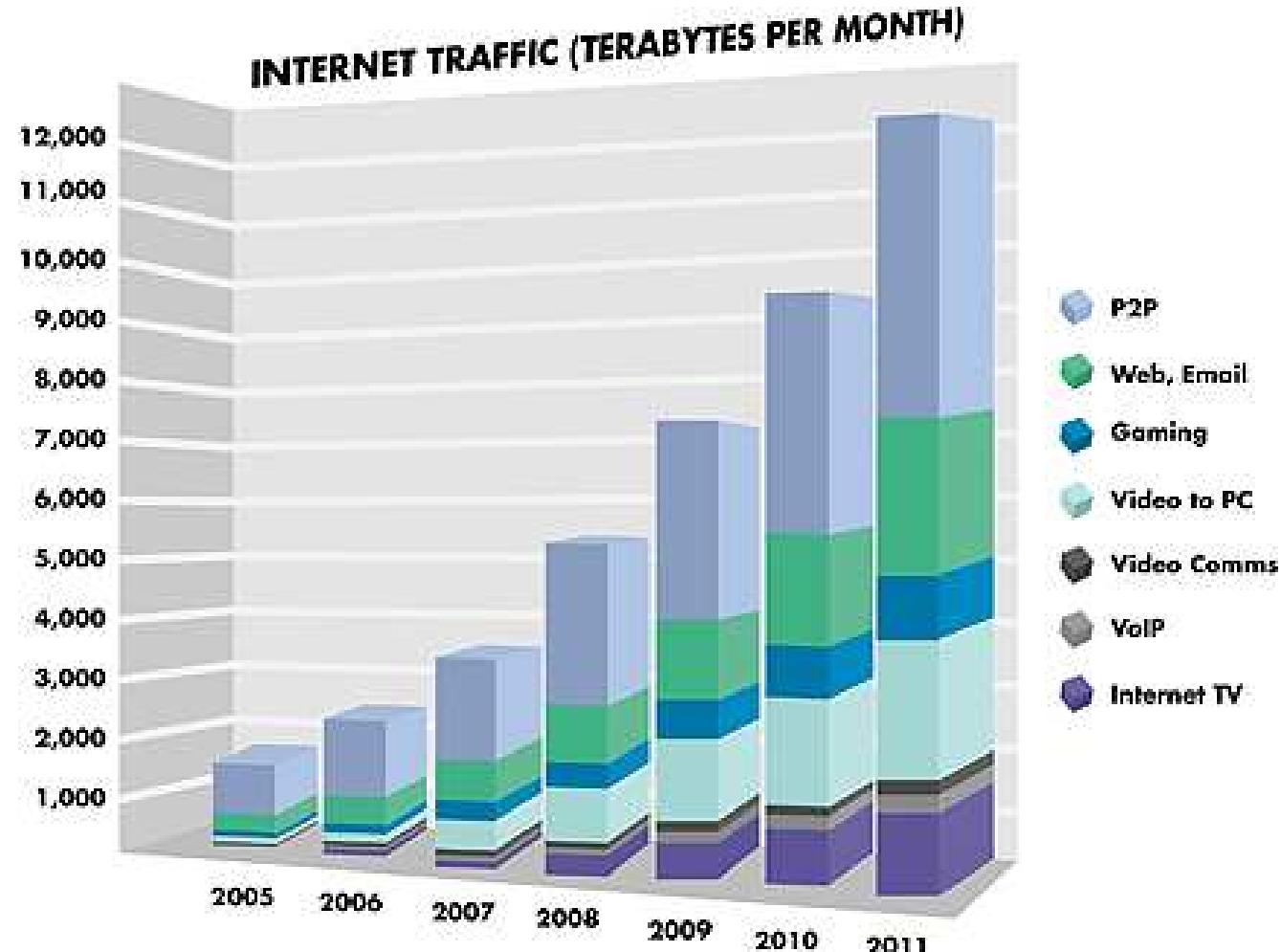
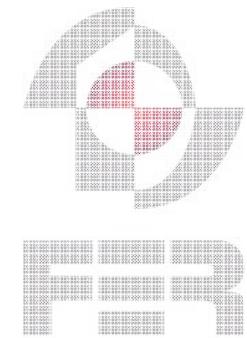
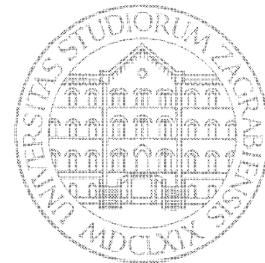


FTP
(File Transfer Protocol)

File server



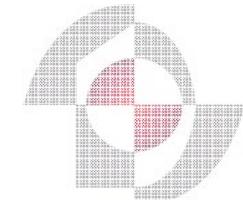
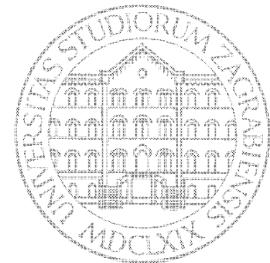
Why is Web Important for Us?



Source:

Cisco Systems, Inc: Global IP Traffic Forecast and Methodology, 2006-2011

Why is Web Important for Us?



FER

- Hypermedia

- Interactivity

- High degree of user's inclusion
 - Bidirectional flow of communication (data + commands)
 - Server-to-client
 - Client-to-server



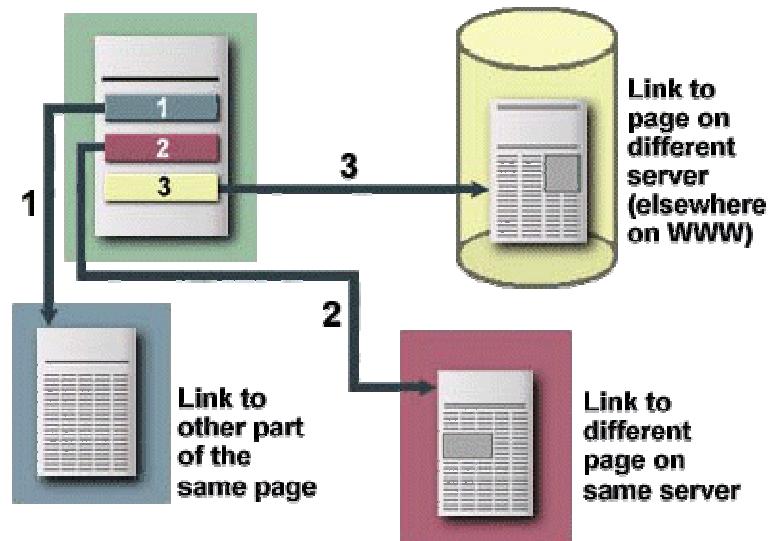
- Multimedia

- Text
 - Graphics
 - Sound
 - Video

- Connectedness

- Links (hyperlinks)
 - Non-linear traversal of the World Wide Web space

Hyperlinks (3 types)



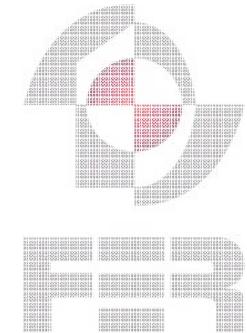
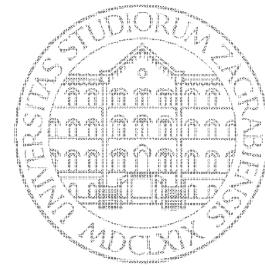
A Word or Two About History

Sir Timothy John Berners-Lee
(*Tim Berners-Lee*)

- Inventor of the World Wide Web



<http://www.cern.ch>

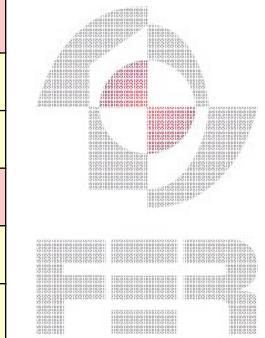
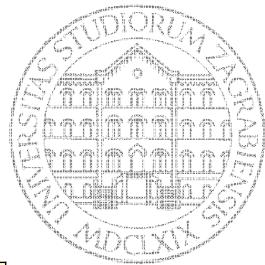


<http://www.w3.org>

Internet before the World Wide Web

- Early research and development

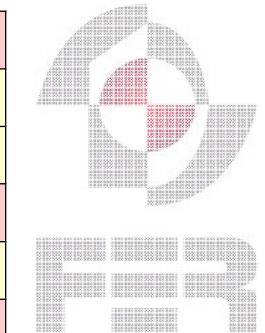
1961	First packet-switching papers
1963	Ted Nelson coins the term HyperText
1966	Merit Network founded
1966	ARPANET planning starts
1969	ARPANET carries its first packets between UCLA and Stanford
1970	Mark I network at NPL (UK)
1970	Network Information Center (NIC)
1971	Merit Network's packet-switched network operational
1971	Tymnet packet-switched network
1972	Internet Assigned Numbers Authority (IANA) established
1973	CYCLADES network demonstrated
1974	Telenet packet-switched network
1976	X.25 protocol approved
1980	USENET news using UUCP
1980	Ethernet standard introduced
1980	Tim Berners-Lee built ENQUIRE, personal document collection (remote access+links)
1981	BITNET established



Internet before the World Wide Web

- Merging the networks and creating the Internet
- Announcement of the World Wide Web

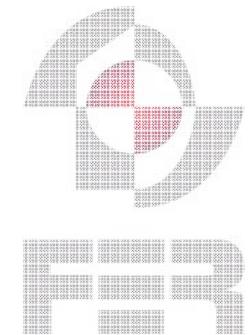
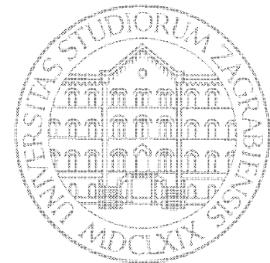
1982	TCP/IP protocol suite formalized
1982	Simple Mail Transfer Protocol (SMTP)
1983	Domain Name System (DNS)
1985	First .COM domain name registered (symbolics.com , Cambridge, MA, USA)
1986	NSFNET with 56 kbit/s links
1986	Internet Engineering Task Force (IETF)
1987	UUNET founded
1988	NSFNET upgraded to 1.5 Mbit/s (T1)
1988	OSI Reference Model released
1988	Morris worm
1990	ARPANET decommissioned
1991	World Wide Web (WWW) <i>Tim Berners Lee built first web server, web browser, and HTML editor</i> <i>First application: CERN phonebook</i>



Web History Timeline

- Early stage web browsers and markup languages
- Server-side technologies
- Standardization bodies

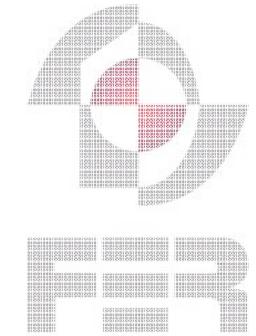
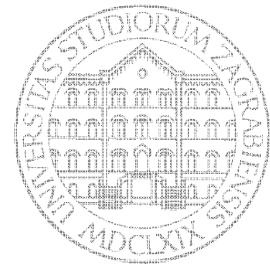
1991	HTTP 0.9 specified by Tim Berners Lee
1992	ViolaWWW, first popular web browser
1993	HTML, IETF first draft (Tim Berners-Lee and Dan Connolly)
1993	Mosaic web browser (later Netscape Navigator) Cello web browser released by Microsoft
1994	Python 1.0 (Guido van Rossum)
1994	Netscape Navigator 1.0 web browser
1994	Full text web search engines
1994	World Wide Web consortium founded (W3C) <i>Director: Tim Berners Lee</i>
1995	Opera 1.0 web browser
1995	PHP (Personal Home Page Tools – PHP Tools)
1995	Internet Explorer 1.0
1995	Javascript
1996	CSS level 1



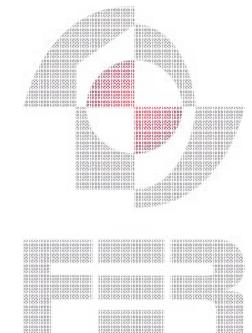
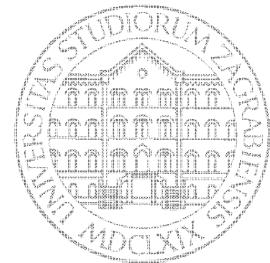
Web History Timeline

- Modern Web

1997	HTML 4.0
1998	XML 1.0
1998	Netscape went open source, Mozilla Foundation founded
2000	Dot-com bubble bursts
2000	REST defined by Roy T. Fielding, UCI
2001	Code Red I, Code Red II, and Nimda worms
2002	Web 2.0: blogs, wikis, RSS
2003	Safari 1.0 for Mac OS X
2004	Firefox 1.0
2005	Ajax
2005	Ruby on Rails 1.0
2006	jQuery JavaScript Framework 1.0
2007	iPhone announced
2008	Android 1.0 released
2008	Google Chrome
2011	Google+ social networking
2012	HTML 5.0

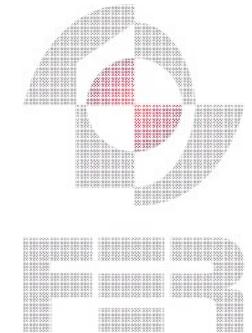
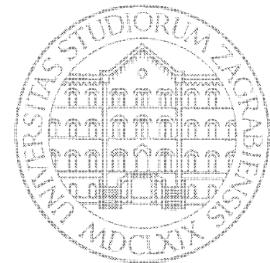


Popular Web Services



1990	IMDb Internet movie database
1995	Amazon.com online retailer
1995	eBay online auction and shopping
1995	Craigslist classified advertisements
1996	Hotmail free web-based e-mail
1997	Babel Fish automatic translation
1998	Google Search
1998	Yahoo! Clubs (now Yahoo! Groups)
1998	PayPal Internet payment system
1999	Napster peer-to-peer file sharing
2001	BitTorrent peer-to-peer file sharing
2001	Wikipedia, the free encyclopedia
2003	LinkedIn business networking
2003	Myspace social networking site
2003	Skype Internet voice calls
2003	iTunes Store
2003	4Chan Anonymous image-based bulletin board

Popular Web Services



2004	Facebook social networking site
2004	GMail
2004	Podcast media file series
2004	Flickr image hosting
2005	YouTube video sharing
2005	Google Earth virtual globe Google Maps Google Talk
2006	Twitter microblogging
2007	WikiLeaks anonymous news and information leaks
2007	Google Street View
2008	Amazon Elastic Compute Cloud (EC2)
2008	Dropbox cloud-based file hosting
2009	Bing search engine
2011	Google+ social networking

World Wide Web Today



2.4 billion users
634 million web sites
51 million websites added each year



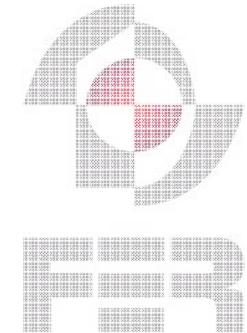
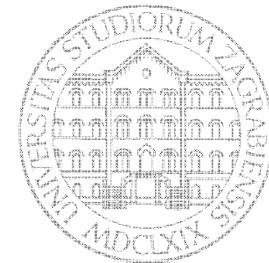
329 top-level domains
246 million registered domain names
100 million .com domains
14.1 million .net domains
9.7 million .org domains
77,000 .hr domains



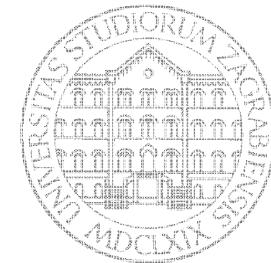
5 billion mobile phone users
1.1 billion smartphone users

Source:

<http://royal.pingdom.com/2013/01/16/internet-2012-in-numbers/>
<http://www.dns.hr/20godinadomene>



World Wide Web Today



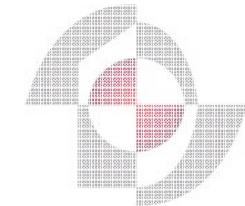
1.9 trillion searches on Google in 2012

620 million visitors/day to google.com

7.2 billion page views/day for google.com

19,800 employees

\$50 billion in revenue for 2012

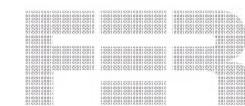


1 billion Facebook users

2.7 billion likes/day

7 petabytes of new photos uploaded/month

300 millions new photos uploaded/day



200 million users of Twitter

163 billion of tweets since Twitter started in 2006

175 million of tweets/day

123 heads of state have a Twitter account

Source:

<http://royal.pingdom.com/2013/01/16/internet-2012-in-numbers/>

<http://royal.pingdom.com/2010/02/24/google-facts-and-figures-massive-infographic/>

<http://www.statisticbrain.com/google-searches/>