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Information Technologies in Remote Experiments

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The presentation consist of three parts:

- » Introduction to the remote experiments
- » ICT and remote experiments
- » Remote experiment and teacher

Don't be afraid to ask me.



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- » Hands on Experiments
- » Simulated Experiments
- » **Real** Remote Experiments



- A remote experiment is a real experiment with real laboratory instruments and equipment that can be controlled by a computer through the Internet.
- One or more remote experiments are accessible in remote laboratory.

Wikipedia



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But how to imagine Remote Experiment ?

Remote experiment in one picture...

The better one..



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Information and Communication technologies behind Remote Experiments

- Internet and computer networks.
- Web browser.
- Web server.
- Web camera
- Internet search services.



Internet and computer networks

- Network interface
- Transmission medium
- Communication protocols





Internet and computer networks

- LAN – Local Area Network
- WAN – World/Wide Area Network
- Packet
- ISP – Internet Service Provider
- World Wide Web – web, web2



Internet and computer networks

- URL
 - five parts
 - protocol (<http://>)
 - login and password (marek:1234@)
 - name of the server (www.ukf.sk)
 - number of port (:88)
 - path to resource (</conference/manuscript.pdf>)
 - <https://ib.bank.sk/login.php>



Internet and computer networks

- IP address
 - like telephone number
 - IP address = network address + computer address, netmask
 - 193.87.59.115/24
 - public and private IP addresses
 - NAT – Network Address Translating



Internet and computer networks

- port
 - abstract number for addressing process
 - 0 – 65535
 - well-known (21, 25, 80,...)
 - privileged (<1023)
 - unprivileged (> 1023)



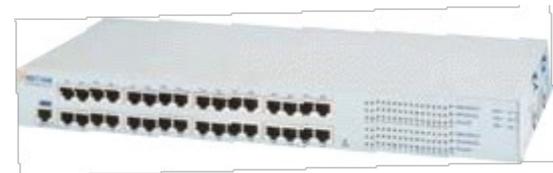
Internet and computer networks

- domain name
 - who can remember 239.186.247.241, 138.10.87.56, ...
 - www.ukf.sk, experiment1.university.edu, experiment.university.sk,...
 - TLD – Top Level Domain (.sk, .ua, .com, .edu...)



Internet and computer networks

- common network devices
 - switch
 - router (gateway)
 - firewall (hardware, software)
 - client
 - server





Internet and computer networks

- few important TCP/IP protocols:
 - Domain Name System - DNS (port 53/udp)
 - HyperText Transfer Protocol - HTTP (port 80/tcp)
 - Internet Control Message Protocol - ICMP



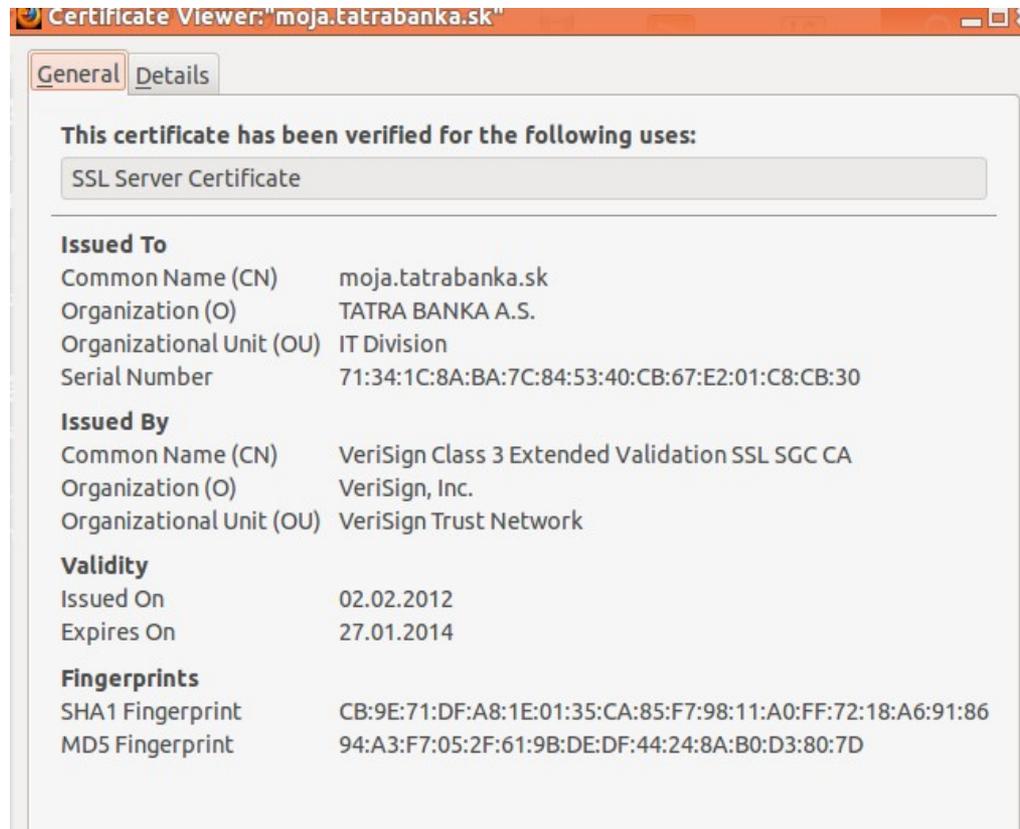
Internet and computer networks

- HTTPS
 - port 443/tcp
 - secure connection
 - SSL/TLS (TLSv1,2)





Internet and computer networks





Internet and computer networks

SelfSigned Certificate



This Connection is Untrusted

You have asked Firefox to connect securely to **ki.fpv.ucm.sk**, but we can't confirm that your connection is secure.

Normally, when you try to connect securely, sites will present trusted identification to prove that you are going to the right place. However, this site's identity can't be verified.

What Should I Do?

If you usually connect to this site without problems, this error could mean that someone is trying to impersonate the site, and you shouldn't continue.

Get me out of here!

- ▶ Technical Details
- ▶ I Understand the Risks

Certificate Viewer: "ki.fpv.ucm.sk"

General Details

Could not verify this certificate because the issuer is not trusted.

Issued To

Common Name (CN)	ki.fpv.ucm.sk
Organization (O)	FPV UCM
Organizational Unit (OU)	KAI
Serial Number	00:BF:FA:6D:BA:AA:5F:52:E3

Issued By

Common Name (CN)	ki.fpv.ucm.sk
Organization (O)	FPV UCM
Organizational Unit (OU)	KAI

Validity

Issued On	09/08/2008
Expires On	09/06/2018

Fingerprints

SHA1 Fingerprint	4B:F9:40:B0:98:AF:60:5A:FF:98:46:4A:7A:EB:91:D5:C2:EE:75:0B
MD5 Fingerprint	2F:E6:1A:F7:97:36:0A:C9:77:57:3E:E3:F2:DF:DF:80

Close



Web browser

- Google Chrome, MS IE, Firefox, Safari, Opera,.....
- Organize your remote experiments url's, use Bookmarks
- Open your computer to hackers, install plugin
- No plugin for your browser = no remote experiment



A plugin is needed to display this content.
[Install plugin...](#)

**sta 32-bit/Vista 64-bit/7 64-bit/Server
32-bit/Server 2008 R2 64-bit**

Plugin Finder Service

Completing the Plugin Finder Service

No suitable plugins were found.

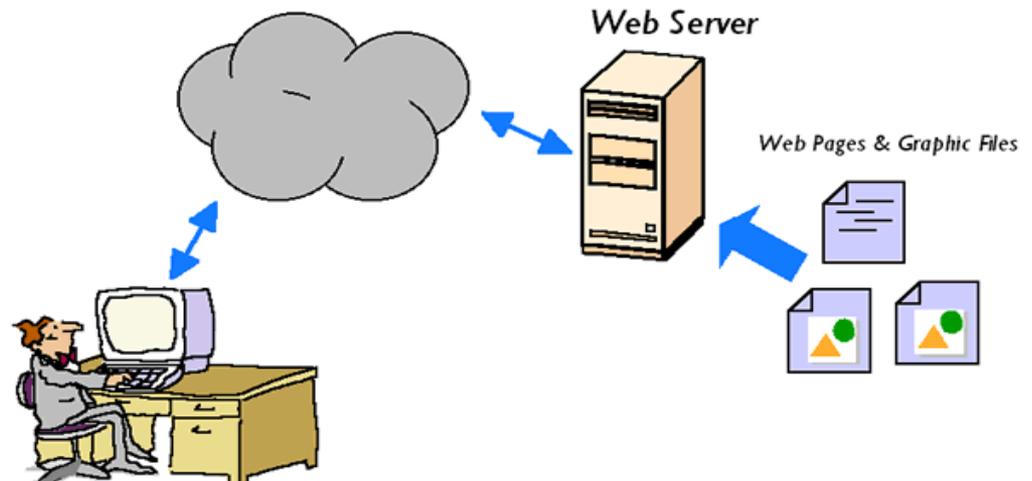
Unknown Plugin (application/binary)

[Manual Install](#)



Web server

- HTTP or HTTPS communication
- listen usually on port 80 or 443
- for RE often listen on nonstandard port (81, 88,..)





Web camera

- 80 percent of the sensory information the brain receives comes from our eyes
- reality of remote experiment
- visual quality:
 - resolution (pixels)
 - frame rate (fps)





Internet search services

- to search texts, photos, videos, actually anything..
- Google, Yahoo, Bing
- we are goods for sale
- Worry about privacy ? Use DuckDuckGo..



Google

Vyhľadavanie Približný počet výsledkov: 8 930 000

Web

- Solar Panel Experiment (Remote Trigger) (Theory) : Modern Physics ...**
amrita.vlab.co.in/?sub=1&brch=195&sim=360&cnt=1 - V pamäti
 Sunlight hits the **solar** cell - if the energy of the photon is high enough (\geq bandgap energy), it is absorbed on the P-side. This sends the.
- Solar Panel Experiment (Remote Trigger) (Procedure) : Modern ...**
amrita.vlab.co.in/?sub=1&brch=195&sim=360&cnt=2 - V pamäti
 Procedure. The **remote** trigger equipment will control the illumination and load voltage operating on the cell. By varying these parameters, the relevant graphs ...
- REMOTE EXPERIMENTS IN EXPERIMENTAL PHYSICS - Institut für ...**
www.ifkp.tu-berlin.de/fileadmin/i1/thomsen/publikationen/paper/372.pdf - V pamäti - Podobné
 undergraduate **experimental** physics to demonstrate the functionality and capability of **remote experiments**. In the first **experiment** the IV-characteristic of a **solar** ...
- IEEE Xplore - Remote triggered photovoltaic solar cell lab: Effective ...**
ieeexplore.ieee.org/xpl/articleDetails.jsp?reload=true&arnumber...
 A novel **remote** triggered photovoltaic **solar** cell **experiment** is presented here. This **experiment** enables the student to learn in a hands-on, practical way about ...
- Manual of Experiment - iSES - Internet School Experimental System ...**
www.ises.info/index.php/.../experiment/solar.../experimentManual - V pamäti
 Figure 1 The front www page of the **experiment Solar** energy conversion ... of the **remote experiment** laboratory in Prague; two resolutions and off of the camera ...

na webe

- Stránky v slovenčine
- Stránky z (zo) Slovenska

Kedykoľvek

- Posledná hodina
- Posledných 24 hodín
- Posledný týždeň
- Posledný mesiac
- Posledný rok

Všetky výsledky



Advanced Search

Find pages with...

all these words:

this exact word or phrase:

any of these words:

none of these words:

numbers ranging from:

to

Then narrow your results by...

language:

any language



region:

any region



last update:

anytime



site or domain:



Internet search services

- Googling
 - explicit phrase „remote experiment“
 - exclude words remote experiment -solar
 - search on site site:ukf.sk „remote experiment“
 - document type filetype:pdf „remote experiment“



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YAHOO!

remote experiment solar

Search



Options

765,000 results

WEB

IMAGES

VIDEO

SHOPPING

BLOGS

MORE

FILTER BY TIME

Anytime

Past day

Past week

Past month

[iSES - Internet School Experimental System: Remote Laboratory ...](#)

Solar energy conversion Manual of **Experiment** . The purpose of the **experiment** is to measure I - U characteristic of a photovoltaic cell in the dark and under the ...

www.ises.info/index.php/en/laboratory/experiment/solar...

[Solar TV Remote — DIY How-to from Make: Projects](#)

Make - **Solar TV Remote**: Juice your flipper with sunlight.

makeprojects.com/Project/Solar+TV+Remote/969/1 - [Cached](#)



Advanced Web Search

You can use the options on this page to create a very specific search. Just fill in the fields you need for your current search.

Yahoo! Search

Show results with

all of these words

the exact phrase

any of these words

none of these words

Tip: Use these options to look for an exact phrase or to exclude pages containing certain words. You can also limit your search to certain parts of pages.

Site/Domain

Any domain

Only .com domains Only .edu domains

Only .gov domains Only .org domains

only search in this domain/site:

Tip: You can search for results in a specific website (e.g. yahoo.com) or top-level domains (e.g. .com, .org, .gov).

File Format

Only find results that are:

SafeSearch Filter

Applies when I'm signed in:

Strict: filter out adult web, video and image search results - SafeSearch On

Moderate: filter out adult video and image search results only - SafeSearch On

Off: do not filter web results (results may include adult content) - SafeSearch Off

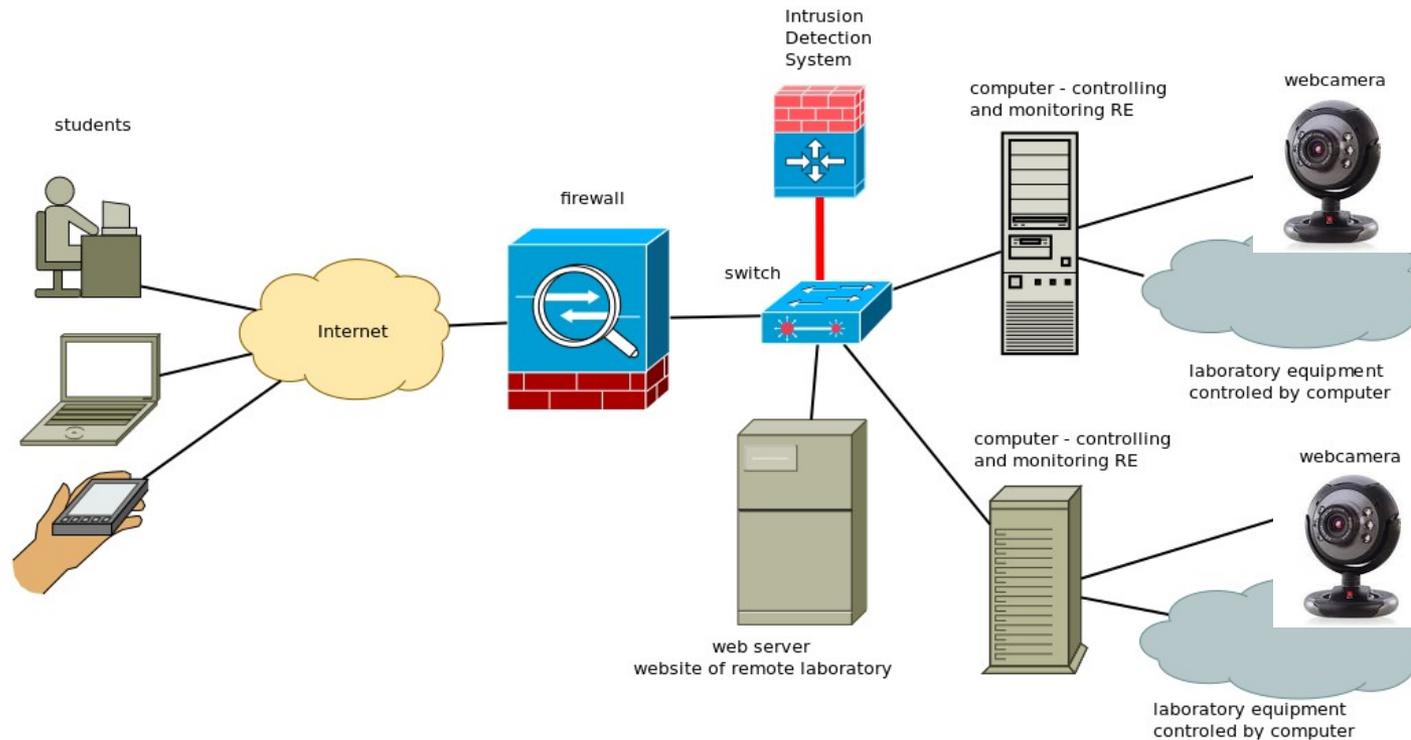


The screenshot shows a Bing search results page for the query "remote experiment solar". The search bar contains the text "remote experiment solar" and shows "1,130,000 RESULTS". The top navigation bar includes "WEB", "IMAGES", "VIDEOS", "NEWS", and "MORE". The search results are as follows:

- Remote Laboratory solar energy experiment - YouTube**
www.youtube.com/watch?v=snVw34Hd2IQ
By SIEW WEI Tho · 2 min · 43 views · Added 3/16/2014
Innovative use of IP camera: Let try out simple **remote**-controlled **experiment**, an example of scientific investigation that related to renewable energy and ...
- REMOTE EXPERIMENTS IN EXPERIMENTAL PHYSICS - ISPRS - ...**
www.isprs.org/proceedings/XXXVI/6-W30/Paper/eLearnWS_Potsdam2005... · PDF file
REMOTE EXPERIMENTS IN EXPERIMENTAL PHYSICS C. Thomsen, H. Scheel, and S. Morgner ... **Remote experiment: Solar Cell Current Source (ADVANTEST R 6243) Solar ...**
- Remote-Experiment: Solar Cell - LIVE STREAM**
remote.physik.tu-berlin.de/index.php?id=164&L=1
Remote Farm Institut für Festkörperphysik Prof. Dr. Christian Thomsen: Home. Registration. Installation. ... **Remote-Experiment: Solar Cell - LIVE STREAM ...**
- Remote Experiments | European Virtual Smart Grid Lab - EIT ...**
www.eitictlabs.eu/.../supporting-sub-projects/remote-experiments
Results. Results of the **Remote Experiments** sub-project regarding **remote control** of Imperial College's **Solar Array** and the co-simulation using the Market Garden ...



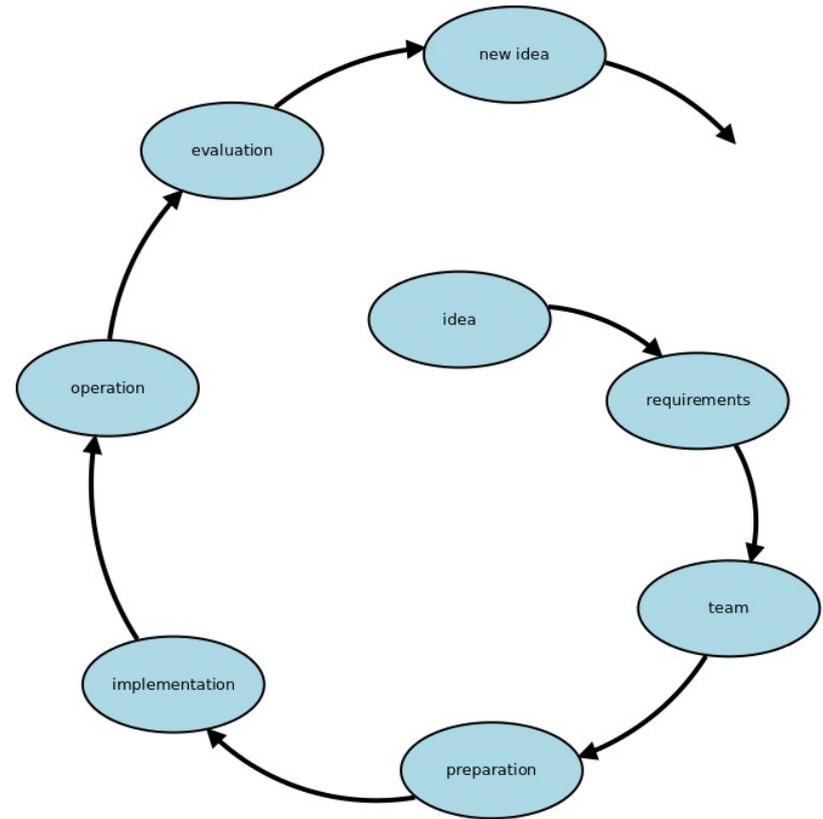
Principles and concepts of remote experiments





Remote experiments

- different areas, including technology, science and education
- the most numerous are RE in the field of electrical engineering
- operational sustainability of RE
- spiral life-cycle





There are several kind of RE

- freely available
 - first user win
 - short live on the Internet
 - Remotely Controlled Laboratories – RCLs project in Germany
- available after free registration
 - registration take some time...
 - usually more stable available
 - reservation
 - malicious activities of students
 - NetLab project in Australia



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- available only within educational institution
 - intensive use in education
 - well debugged and available 24/7
 - dedicated only for own students
 - you can try to request access, or join the RE project
 - LabShare project in Australia
- commercial, available for a fee
 - it's a business



Client-server architecture

- specialized client-server applications
 - industrial applications
 - the need to install specialized application on client side, is it permitted ?
 - compatibility, often only for windows platform
 - LabVIEW
 - unique HW and SW solutions, departments that have decided to go their own way



Client-server architecture

- standard Internet applications
 - common web browser with java or flash
 - sometimes occur problem with compatibility, proper version of java



Searching of remote experiments

- searching in articles
- searching on the Internet
 - remote experiment (laboratory)
 - remotely controlled experiment (laboratory)
 - remotely controlled laboratory -filetype:pdf -filetype:doc (exclude articles)
 - remote experiment oscillation -filetype:pdf
 - remote experiment vibration -filetype:pdf



Methodology of remote experiments.

- teacher carried out remote experiment within an hour as a demonstration
- student (or group of students) carried out remote experiment in the classroom as a shared experiment under the supervision of a teacher in a computer lab
- student carried out experiment outside of school as a flexible tool for self-learning



Methodology of remote experiments.

- RE can be used in all phase of the lesson (motivation, exposure, fixation, diagnostic)
- the researchers recommended to combine experiments in hands on and remote laboratories (and simulations)



Requirements for remote experiments.

- Reality,
 - all aspects of real experiment (including errors!)
- Availability,
 - any time, any where,
 - no special SW,
 - no special costs for using RE



The presentation of remote experiment.

- simply connect PC to data-projector and open RE
- SW for presentation (MS PowerPoint, LibreOffice Impress)
 - be careful with collors
 - inserting URLs
- LMS



The presentation of remote experiment.

- LMS and busy word e-learning
- Moodle is our favorite
- Theoretical background in moodle course
- Add an activity or resource and choose URL



Your questions – my questions..

- What is differences between LAN and WAN?
- Can you explain the relationship between the Internet and the ISP?
- Can you explain the relationship between the client and the server?
- What is a URL?
- What url you enter if you want to search for something on the Internet?



Your questions – my questions..

- What is remote experiment?
- Can you explain the relationship between the client, server and devices of remote laboratory experiment?
- Why is quality of web-camera so important?
- Try to describe types of remote experiments.
- What key words would you use for searching remote experiments using an Internet search engine?



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Thank you for your attention.