Engineering Education Challenges and VISIR

Virtual Instrument Systems In Reality

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Outline

- Engineering educations challenges
- BTH actions
- Conclusions and a future scenario

Why More Experiments in Engineering Education?

- A sustainable society needs engineers who are able to design high quality goods and services complying with the principles of nature
- Universities should deliver engineers with a *documented* solid laboratory experience
- More experiments may encourage young people to opt for engineering

Experimenting is a sort of conversation with nature

- You perform a physical experiment and nature answers
- The delicate activity is formulating a good question and is interpreting the answer
- Students need to practise a lot to be fluent in this language i.e. to train laboratory work

Three Challenges

- Implement learning objectives of instructional laboratories
- Evaluate laboratory work individually
- Provide free access to laboratory resources without rising the cost

Examples of learning objectives

- Devise an experimental approach, specify appropriate equipment and procedures
- Apply appropriate sensors, instrumentation to measure physical quantities etc.
- Demonstrate the ability to collect, analyze, and interpret data, and to perform and support conclusions
- Identify the strengths and limitations of theoretical models as predictors of real-world behaviors

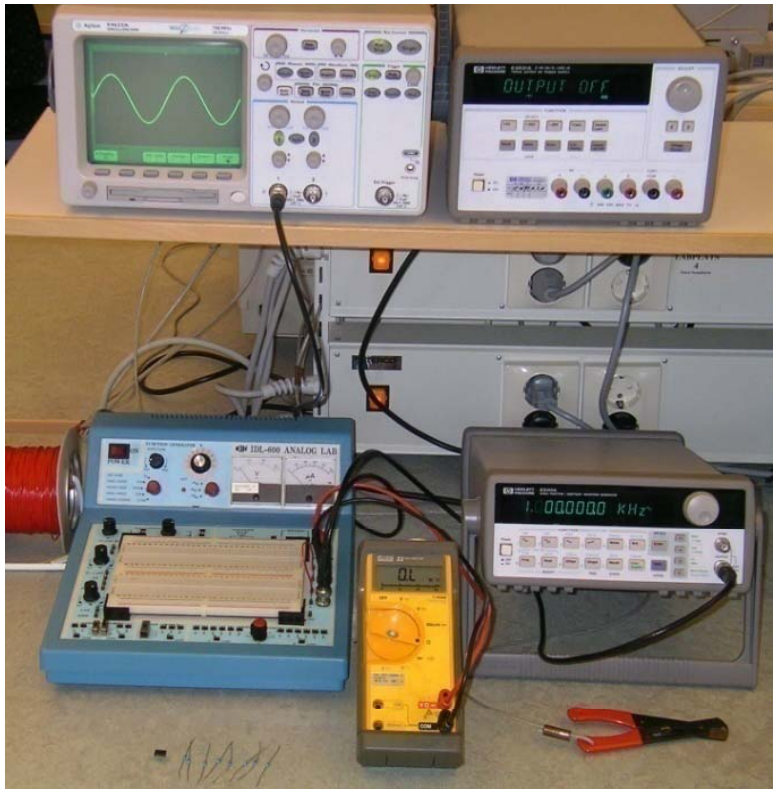
Three Ideas

- Translate the objectives into a large collection of experiments
- Include practical exams in the courses
- Offer a possibility for students to perform experiments at any time

University activities

- Create an infrastructure of collaborative laboratories and of other learning material
- Define practical exams
- Involve industrial partners

Workbench for electrical experiments

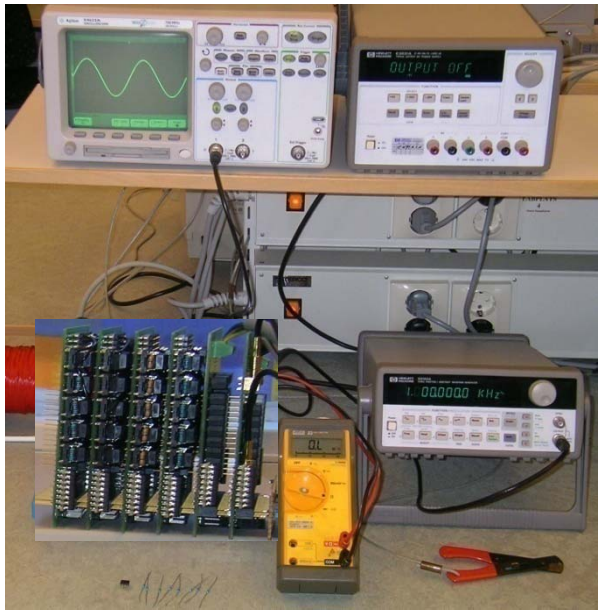


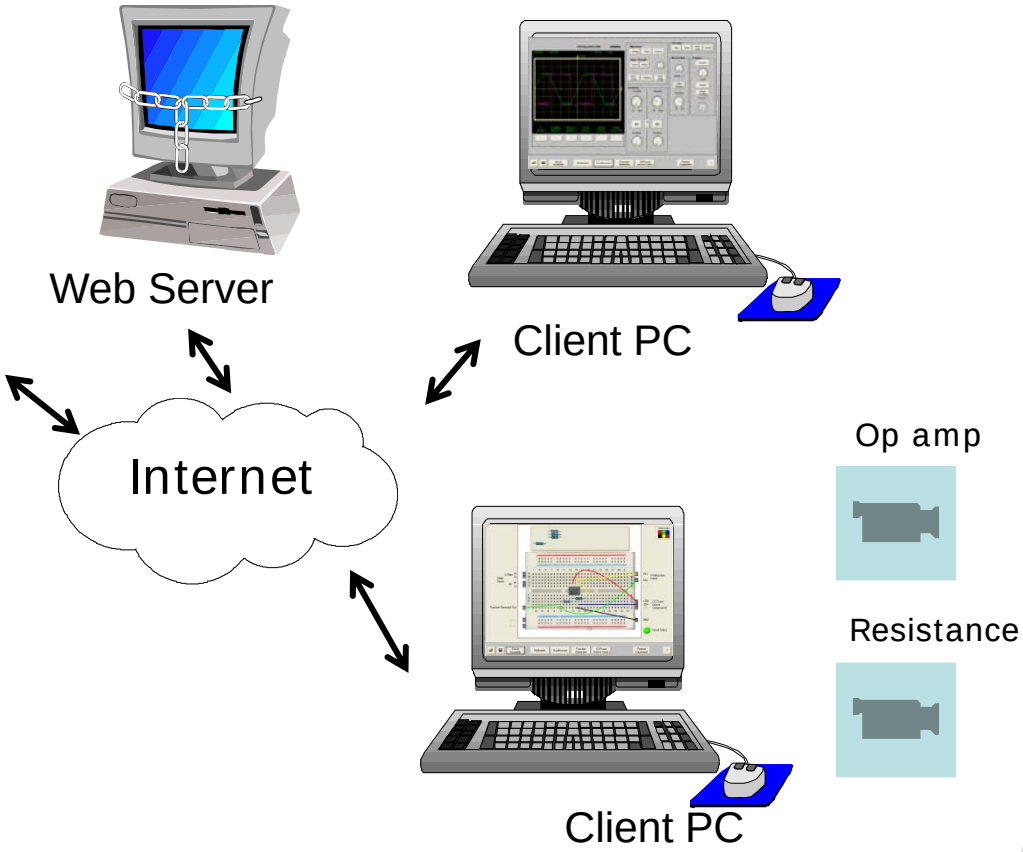
- There are many such workbenches worldwide
- Teachers and students are familiar with them
- They are a de facto standard
- They are used by majors in electrical engineering as well as non majors

History

- In 1999 a remote laboratory project was started
- Today laboratories in electronics, security, radio and signal processing are online
- At the end of 2006 a disseminating project, VISIR, was started
- IAOE started VISIR SIG spring 2009

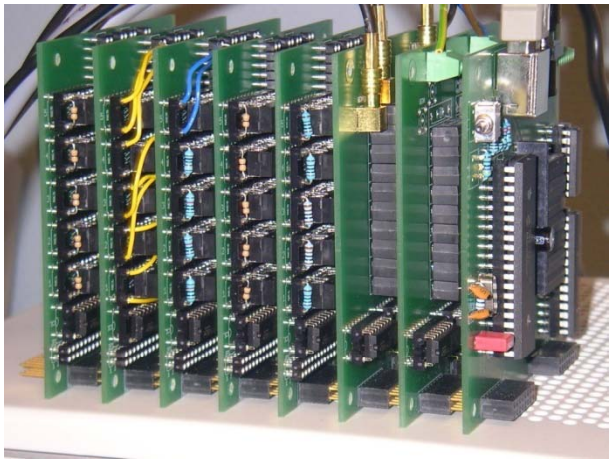
Open Laboratory Organization and Demo





Characteristics of the workbench for electrical experiments

- available for experimenting 24/7
- supports laboratory work training
- supports low-cost practical exams

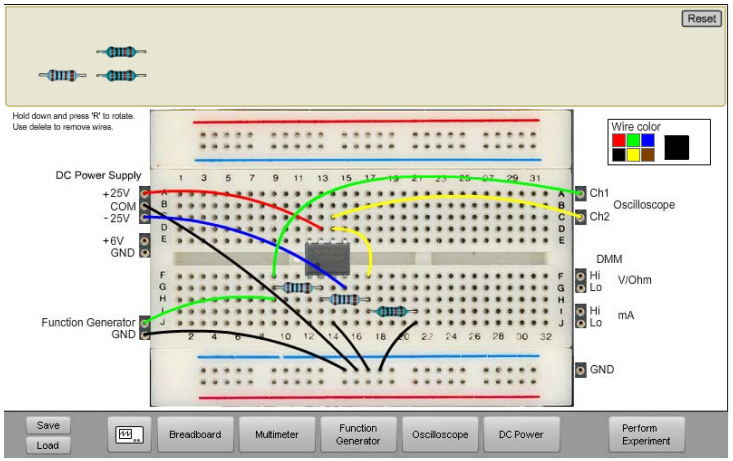


VISIR laboratory administration

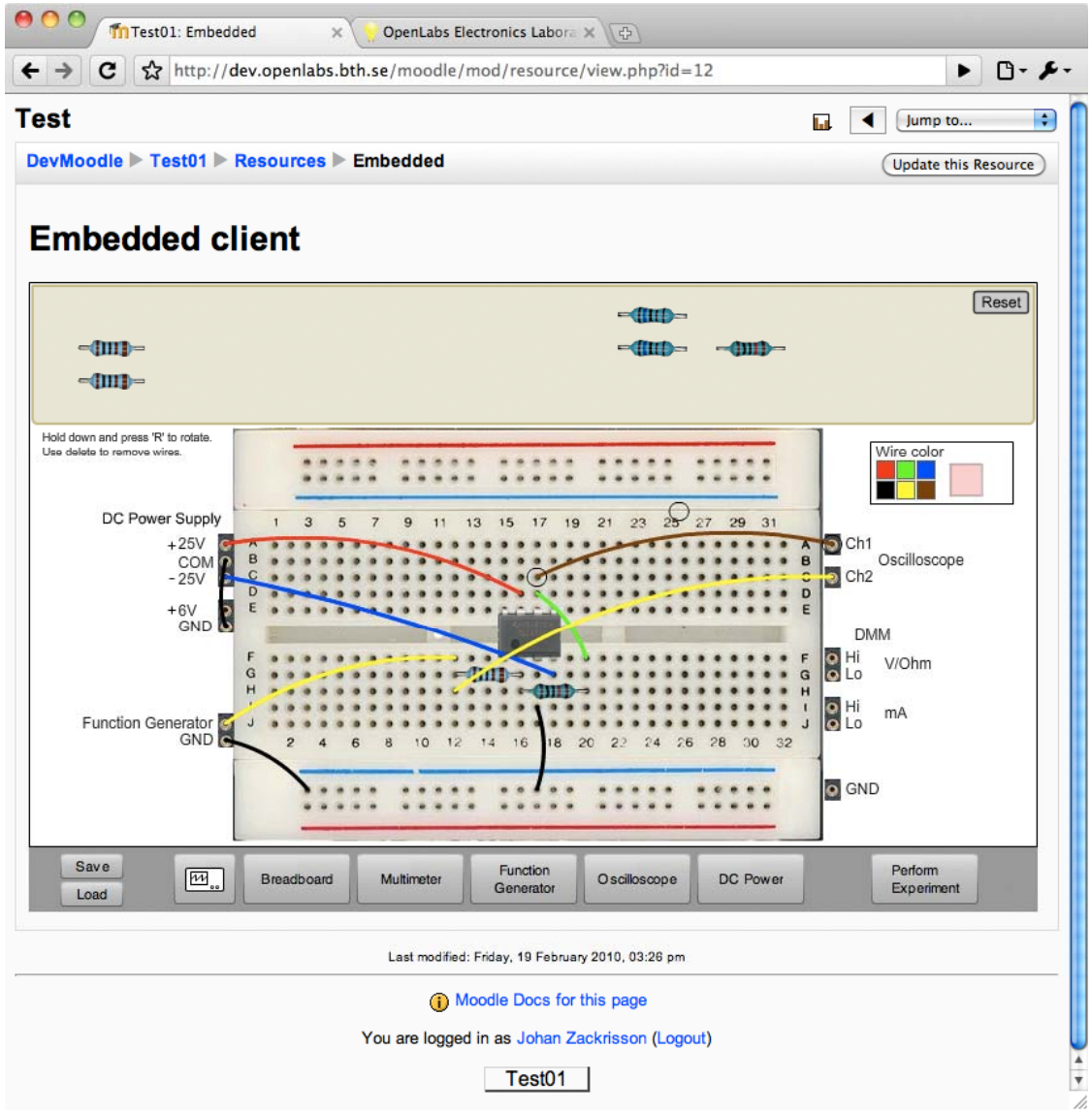
- The VISIR web interface is used to introduce courses, lab sessions, personal accounts etc.
- Different roles such as administrator, teacher and student are defined and they have different access rights
- Time reservation for laboratory classes as well as for students are provided

Integrating with Other Systems

- LMS (HTML embedding)
- iLabs



Moodle Interface



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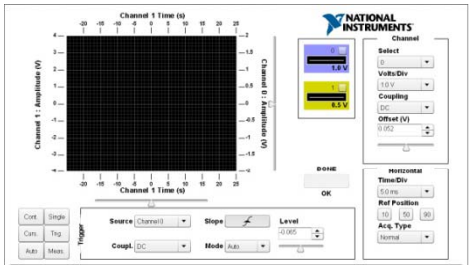
Online Workbench for electrical experiments

Distributed Resources

Client computer side

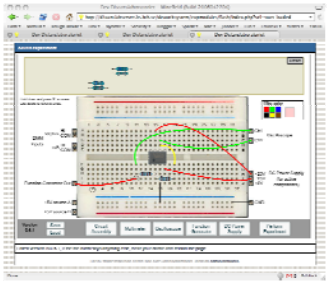
Equipment Server side



XML, TCP/IP

Virtual front panel

Source/instrument board



XML, TCP/IP

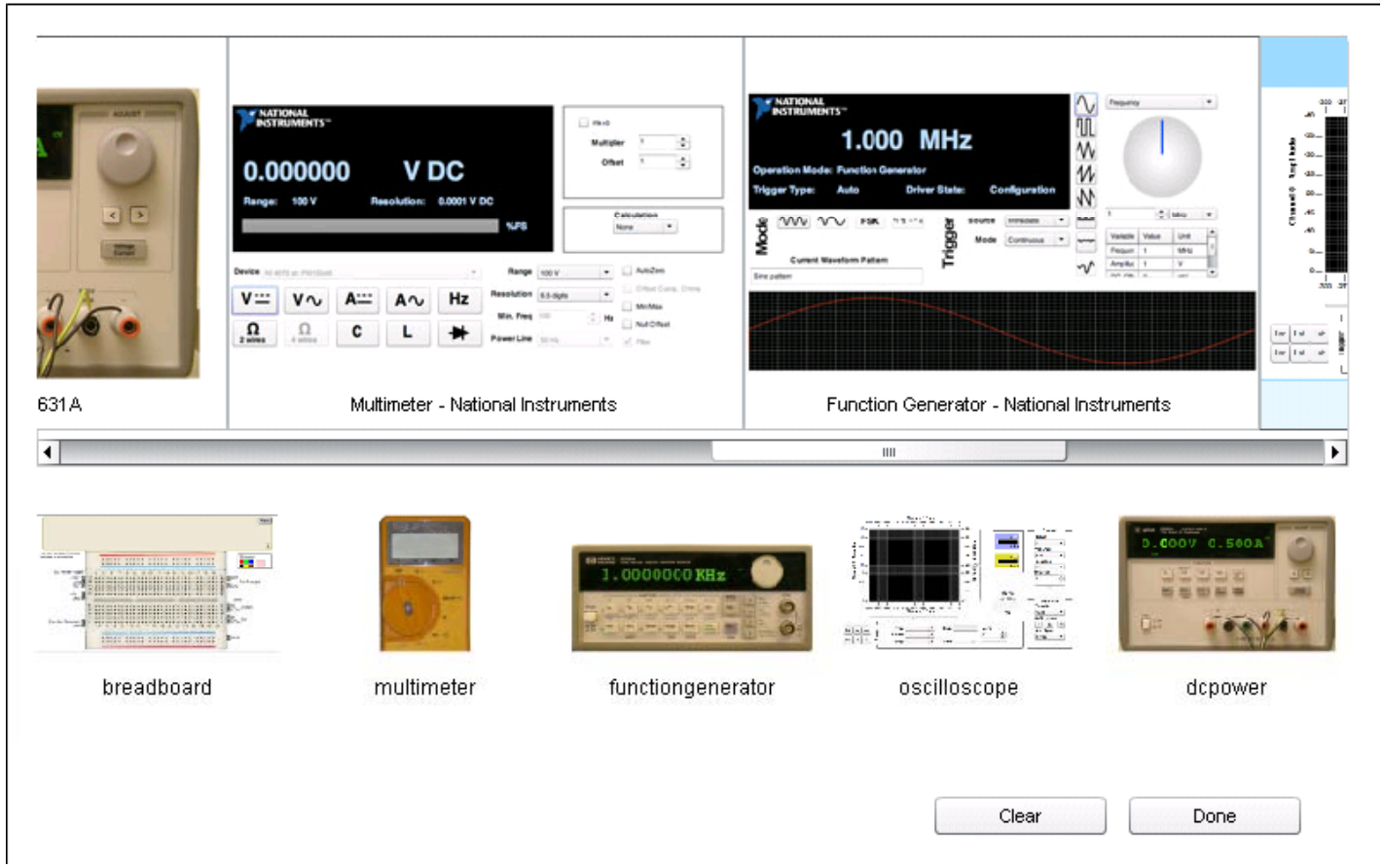
Virtual breadboard

Switching matrix

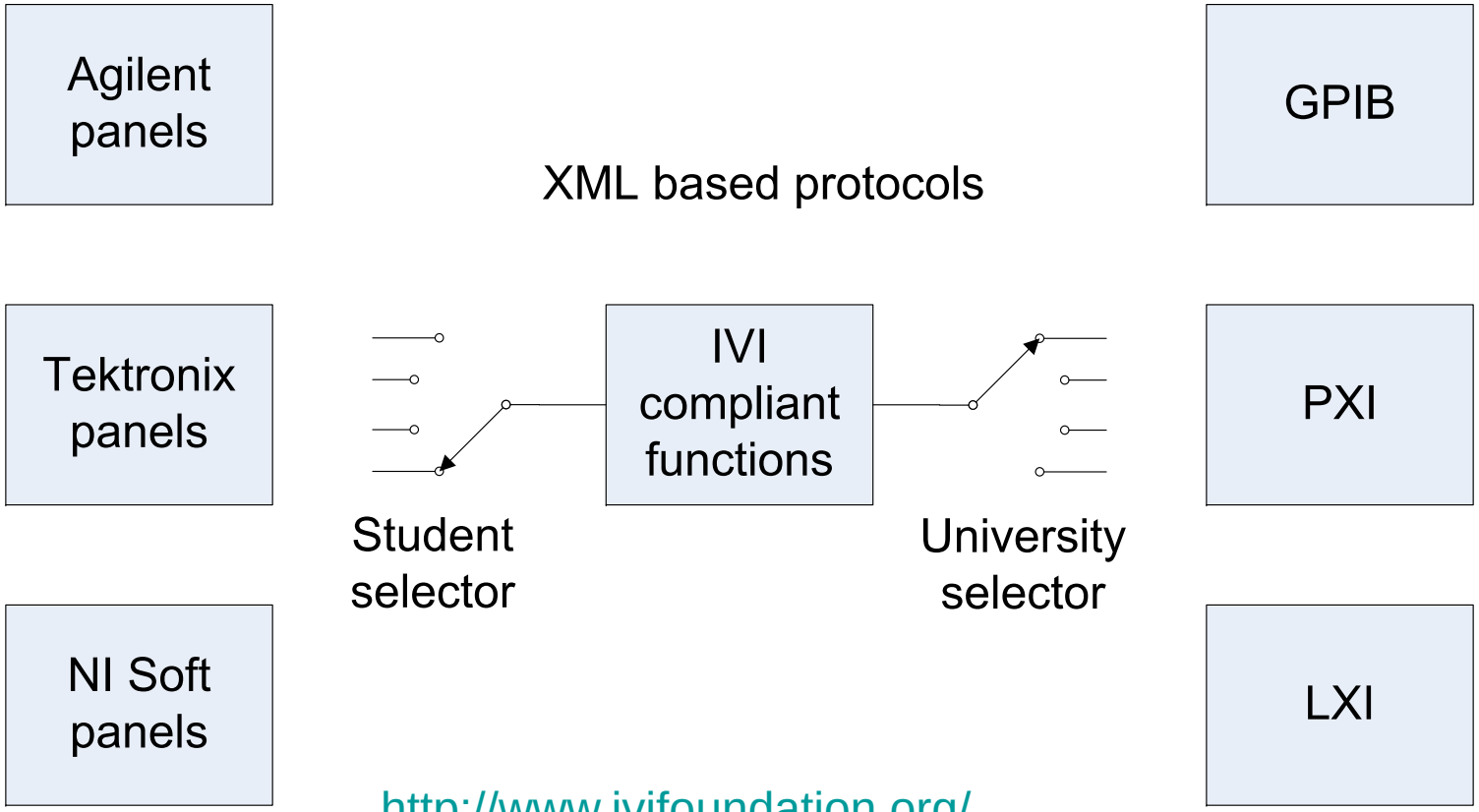
Virtual Instrument Shelf

- Other universities use other models in their local laboratories
- It should be possible for students to select the instrument models they are used to

Example of Virtual Instrument shelf



VISIR Standards



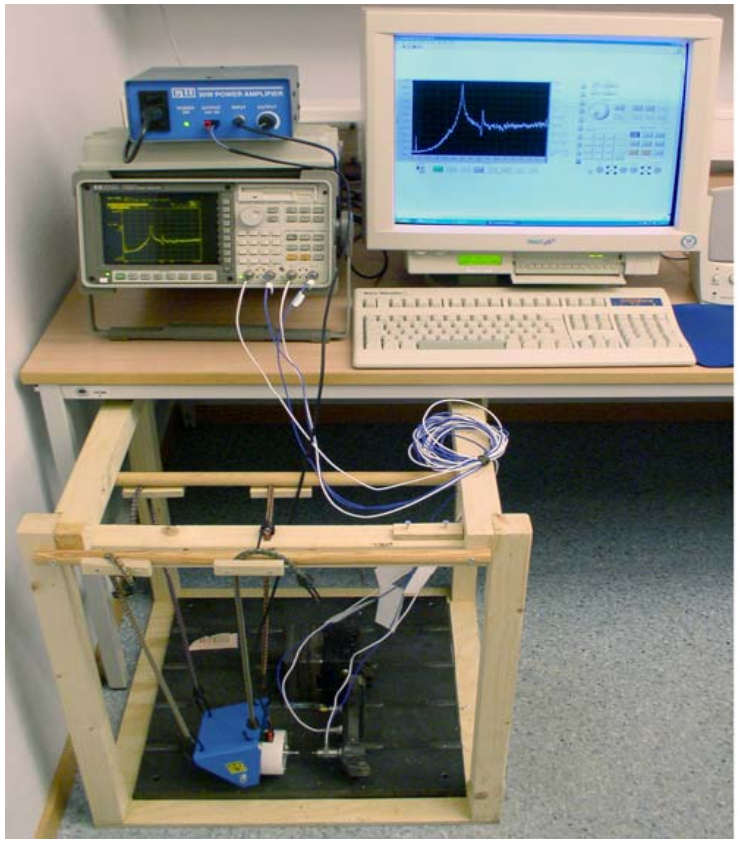
http://www.ivifoundation.org/

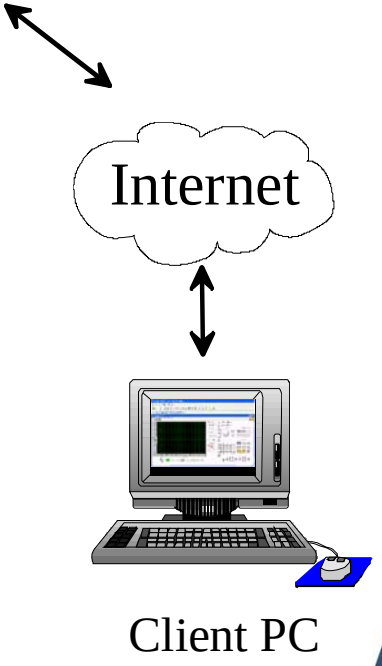
Instrument Drivers

- VISIR recommends IVI drivers
- The VISA Standard is accepted too but the instrument functions should be those defined by the IVI Standard

Signal processing laboratory

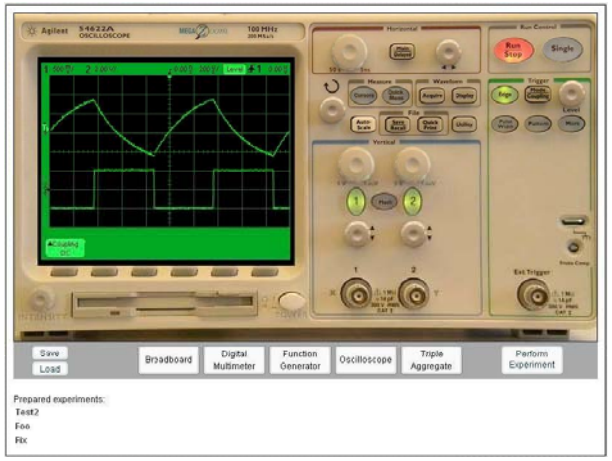
- Setup for vibration experiments





The Aim of the VISIR Project

- Is establishing a large VISIR Community of collaborating universities/organizations
- Is distributed standardized laboratories



Existing VISIR Laboratories

- University of Deusto, Spain
- FH Campus Wien University of Applied Sciences, Austria
- Blekinge Institute of Technology, Sweden
- Carinthia University of Applied Sciences (CUAS), Austria

New VISIR Laboratories

- Instituto Superior de Engenharia do Porto, Portugal
- National University for Distance Education, Spain
- Indian Institute of Technology Madras, India

The VISIR Open Laboratory Platform Software Distribution

- A public subversion repository with all software modules are available (http://svn.openlabs.bth.se/trac/)
- Members of the VISIR Community will be granted write access to branches in the repository
- Write to the trunk is limited and will require code review

How to Join the VISIR Community

- Join The International Association of Online Engineering (IAOE) http://www.online-engineering.org/
- Sign up for SIG VISIR (a Special Interest Group within IAOE) and its Mailing List

How to Set up An Online VISIR Workbench for Electrical experiments

- Download the software and instructions published at http://svn.openlabs.bth.se/trac
- Buy a standard PC and LabVIEW and the PXI hardware from National Instruments
- The switching matrix is commercially available

Competences Required to Implement a VISIR Online Workbench

- Experience of analog electronics, PXI, and LabVIEW
- IT experience (Web, PHP, MySQL, XML, C++, FLASH etc.)

Conclusions

- Start from traditional laboratory education and continue using new means
- Adapt to the Bologna Process
- Collaboration

A Future Scenario

- Collaborative remote laboratories organized in an infrastructure similar to university libraries
- Ubiquitous resources for physical experiments existing in the real world as well as in the virtual one

THANK YOU FOR YOUR ATTENTION