

SCREENS PROJECT



Improving efficiency in conference rooms and in computer classroom training

(EU funded development project, research for SMEs, former
CRAFT)

Five European SMEs involved in designing and manufacturing multimedia switching networks (video, keyboard & mouse and audio) and three RTD performers decided to join efforts to innovate and develop the next generation digital multimedia switching network for computer classrooms and for conference rooms.

SCREENS is an innovative multimedia switching network for computer classrooms, language labs, meeting rooms and other demanding audiovisual applications. The system is controlled by an easy-to-use and stylish LCD panel containing programmable and localised soft keys and a keyboard. It enables digital video transfer and switching up to 20 meters and remote control of USB keyboard and mouse

Multimedia switching network is an efficient tool for training in a computer classroom. Its most important function is to transfer computer images from the instructor's screen to the students' screens so that students can follow the lesson on their own screen. The advantage of the video switching network compared to data projector is that students are able to see all the small details of the instructed software in day light in all places in a large room.



Picture 1: Turku city government meeting room equipped with a Video Switching Network

Technological changes

Flat panel displays have replaced CRT (Cathode Ray Tube) monitors due to their dramatic price reduction and smaller space requirement. A new digital display connector (DVI) for flat panel displays is taking place of the analogue display (VGA) connector, which has dominated in the market since 1987. This technological change has made the current equipment obsolete and has caused technological challenges for European SMEs in the educational network business.

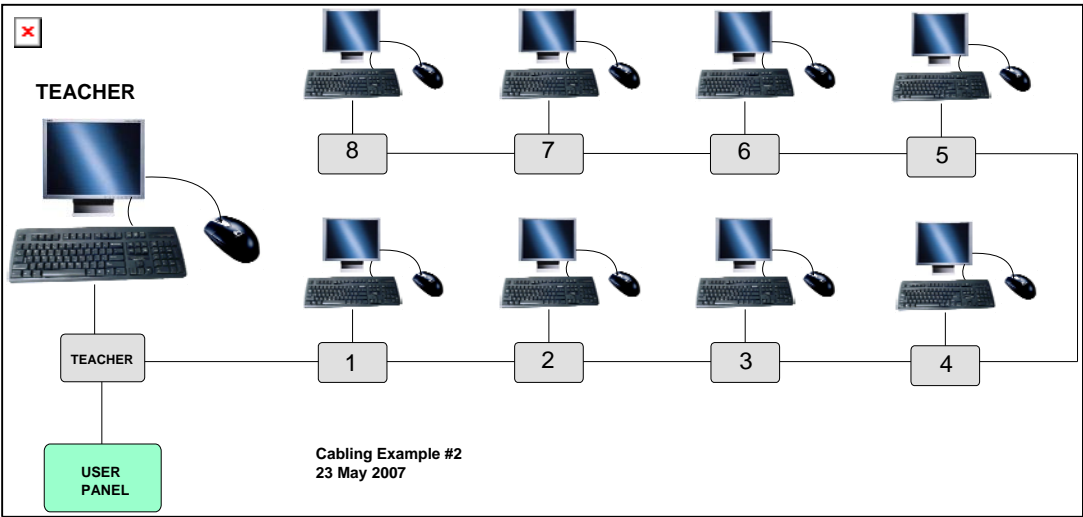
In the DVI standard the transfer distance is specified to max. 5 meters, which is not enough in a typical classroom environment. One goal of the project was to increase the transfer distance of digital video signal up to 20 meters. The DVI standard enables content to remain in the lossless digital domain from creation to consumption. It also enables better picture quality on flat panel displays. A

new generation educational network system supports resolutions up to 1600 x 1200 pixels and 1920 x 1080 (HDTV) resolution. It also supports the next generation HDTV level digital training material formats like HD-DVD and Blu-Ray discs.

The classroom of the future

Technological changes in e-learning and audiovisual technologies require European SMEs in these fields to innovate and develop their products accordingly in order to stay competitive. With this in mind, a public-private partnership of five European SMEs and three research organisations was initiated to develop a new audiovisual system. The **SCREENS** consortium combines new generation flat panel screens, USB connectivity, intuitive user interfacing, and high frequency digital video transmission. One of the main applications of this technology is the educational network, as a cutting-edge training tool in a computer classroom. Another important application area well equipped meeting rooms.

SCREENS system consist of Video Switch Units, Video Hubs and User Interface panel and student's table unit. Video Switch Unit can be equipped with an optional USB board, which supports mouse and keyboard remote control. Video Hubs are installed on crossroads of digital video cables. The system is controlled by a separate User Interface Panel or software.



Picture 2: Typical cable configuration

Basic functions of the Screen system

Screen transfer

The most important function of the **SCREENS** system is to transfer the teacher's screen image to the students' screens. This function needs only one push of button. But it is also possible to transfer any screen to any single workstation, group of workstations or the entire class. The advantage of this system over a data projector is that the students can see all the details of the instructed software in daylight, from anywhere in the classroom. The system also allows the instructor to follow students' progress from their own displays. To this end, the new digital standard for flat panel displays (DVI) provides a significantly improved image resolution and quality over the analogue display connector (VGA), which is becoming obsolete.

Scan

The teacher can scan student screens one by one or automatically in his/her own monitor. This helps the teacher better to follow student's progress during the lesson.

Remote control/Blackboard

Another useful function is that the instructor can take control over the USB-keyboard and the USB-mouse of the computer he/she has selected. This feature enables the instructor at his/her own computer to guide a student when it is needed. Blackboard feature makes it possible that all other students can follow the quiding. Remote control also enables a teacher to prepare software and files for all computers at the same time remotely before the lesson on his/her own computer.

Blank screens

The teacher can blank student screens if the teacher want to have attention preventing students to work in their own workstations.

Info Screen/Call

The teacher can transfer his/her or anybody else's screen "for information". The student has so possibility by the table unit switch between his/her own screen and the screen sent "for information". The table unit gives also possibility to send a help call to the teacher.

Groups

The teacher can divide the class into groups as he/she wants and show each group the operation selected.

Data projector on/off

By one push of button in the User Panel, the teacher can switch the data projector on or off.

Digital video switching network development

Flat panel displays have replaced CRT (Cathode Ray Tube) monitors due to their dramatic price reduction and smaller space requirement. A new digital display connector (DVI) for flat panel displays is taking the place of the analogue display (VGA) connector, which has dominated in the market since 1987. This technological change makes the current equipment obsolete and has caused technological challenges for European SMEs in the multimedia switching network business.



Picture 3:

DVI Connector

VGA Connector

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A next generation multimedia switching network consist of Video Switch Units, Video Hubs and User Interface panel. Video Switch Unit can be equipped with an optional USB board, which supports mouse and keyboard switching. Video Hubs are installed on crossroads of digital video cables. Also separate audio modules can be connected to the network. The multimedia switching network is controlled by a separate User Interface Panel. The products are manufactured and assembled in Electro-Hill Estonia factory.



Picture 4: Video Switch Unit

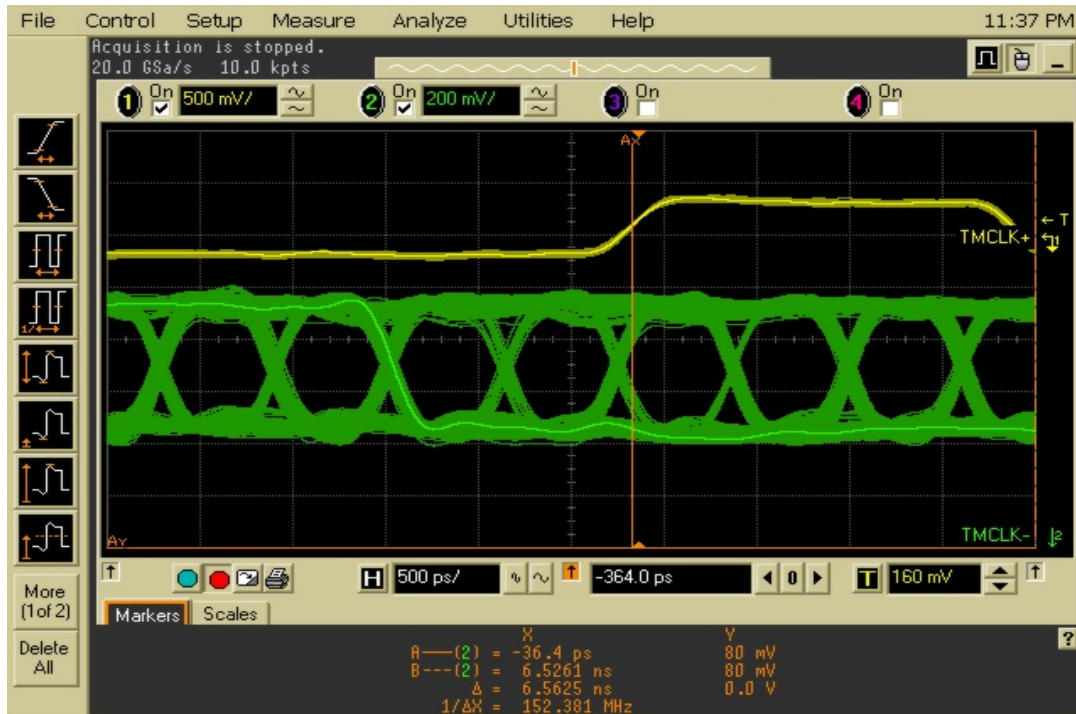
Digital video transfer research

The major research of high frequency video transmission was made by VTT. The DVI standard is based on very fast differential, serial channels for red, green, blue and clock signals. The bit speed can be even 1.6 Gbit/s.

When a signal propagates in a cable, it suffers from transmission losses, specially losses of high-frequency content in long cables. Techniques to compensate high-frequency signal attenuation in a cable was examined including signal equaliser techniques, which are used in a Gigabit level signal transmission. Adaptive signal equaliser techniques seems to be the most appropriate to this application.

Several cable types were tested. The most appropriate cables were high quality DVI cables, which have controlled propagation delays in a each pair keeping the jitter minimal.

Using high quality DVI cables and adaptive equaliser techniques the required 20 meters cable length was achieved. The most important measures have been so called eye-diagram measures (see picture 4), which shows typical attenuation as well as the jitter of the high frequency signal. For detailed signal waveform measurements an 20 GSamples/second scope was used.

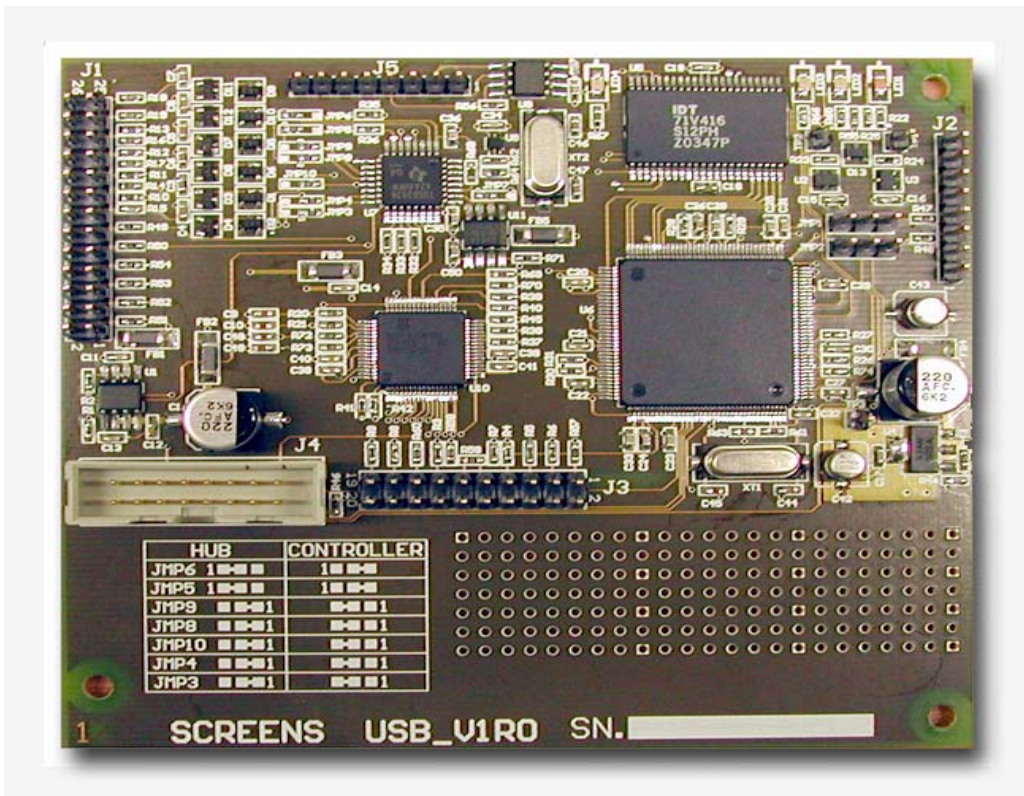


Picture 5: Eye diagram of the DVI transmitter circuit
Keyboard & mouse switching development

Another useful function of the multimedia switching network is that the instructor can take control over the keyboard and the mouse of the computer he/she has selected. This feature enables the instructor at his/her own computer to guide a student when it is needed. This feature also enables a teacher to prepare software and files for all computers remotely before the lesson on his/her own computer.

USB (Universal Serial Bus) connector is replacing old keyboard and mouse connectors in personal computers. USB brings ease of use, reduced system cost and true Plug and Play convenience to PC users but at the same time it is challenge for developers due to its complexity.

The main components of the USB board are USB controller and ARM7 microcontroller. The software of the USB module consists of USB host and device drivers as well as command interpreter. The main development work of the USB board and the User Panel was done by Consorzio Roma Ricerche.



Picture 6: USB board

User interface panel development

The third objective was to develop an easy-to-use user interface panel, which controls the multimedia switching network. A rapid development and price reduction of small-size colour LCD displays has made their use favourable for many European SMEs in user interfaces. A graphical display equipped with soft keys supports easily different European languages and the language can be changed even during the lesson.

The main requirements for the user panel have been easy way to set up different languages, a graphics display and soft keys. Open source code operating system with Linux platform has been selected to shorten time-to-market, to reduce development costs and to minimise runtime royalties.



Picture 7: User Interface panel

Project basic information

Project Short Name: SCREENS

Project Title: New method of video transfer and control functions for training in computer classroom and for audiovisual applications

Duration: 24 months

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Picture 8: 2nd Project Meeting in Rome Nov 24-25, 2005

