eng. Adrian TARTA – NUMERIS COM

" TELEMEDICINE READY " CONCEPT

Remote diagnosis using ultrasound imaging has received considerable attention in recent years. Until now, because of the limitation of technical resources it has been difficult to improve the diagnostic accuracy to higher percentages. But this limitation is ready now to be broken due to technology progress.

Two important steps were made in this direction and these steps refer to the main features that support a telemedicine ultrasound system:

1. Communication networks – now a wide range of fast connections for data transfer is available (Internet high speed connections, LAN, mobile communications), which can assure support for ultrasound imaging transfer.

2. Ultrasound devices – quality of ultrasound scanners has considerably increased in last years and systems for archiving and transfer ultrasound images to distance were developed.

Most usual configuration for ultrasound telemedicine consists of ultrasound scanner with video output, PC with video capture board, communication network, remote PC for remote ultrasound imaging display.

video signal → PC & video capture board → comm. network → Remote PC
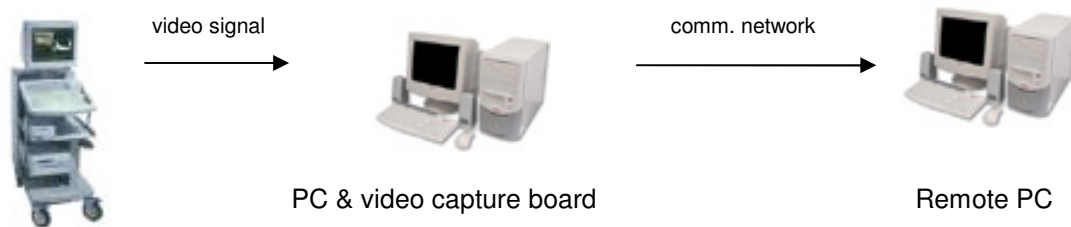
Ultrasound Scanner
with video output.

In order to simplify this complicate chain, Telemed company found technical solutions developing new PC based ultrasound scanner Echo Blaster 128 which offers high image quality and "Telemedicine ready" concept.

Echo Blaster 128 is based on the latest digital technology and provides high performance ultrasound imaging combined with advantages of a PC. Using Telemed equipment we can obtain next simplified telemedicine system:

comm. network →
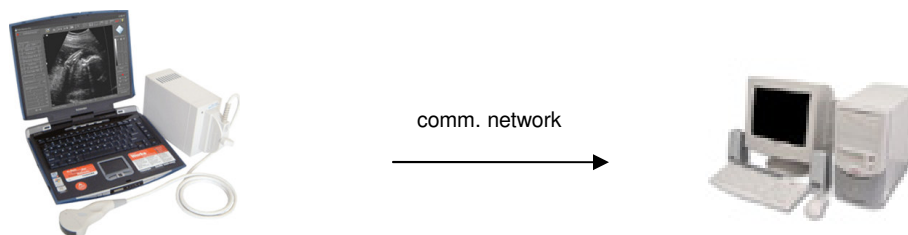
Echo Blaster 128 - PC based ultrasound scanner   Remote PC

Let's get into details...

Telemed historically used Overlay technology for displaying ultrasound images on PC based ultrasound scanners, since this method does not require much computational resources. But Overlay has one serious drawback - since echo

data is sent to a special memory area of the video adapter, resulting image is not accessible for other applications. Therefore at first models of Telemed scanners video capture board were needed at telemedicine applications. Anyway no additional PC was required.

To overcome this and other minor problems related to Overlay technique, Telemed has moved to GDI technology (Graphics Device Interface). In this case ultrasound image is sent to main memory area of video adapter, becoming very easy to be processed. This led us to infinite solutions of acquire, process and transmit ultrasound images.

According to type of remote connection we can order these solutions in next categories:

1. LAN – Connection between ultrasound scanner and remote PC is made using a Local Area Network. In this case we are not limited by connection speed and this allows us to develop best solutions for telemedicine. There is a drawback related to area covered by LAN.

2. Internet – Area covered by internet is "world wide", but the main problem remains speed connection between two points of image transfer.

3. E-mail –Transmitted image is not made in real time and requires archiving and sending. But this presents a real advantage - it can be realized even by internet low speed connection.
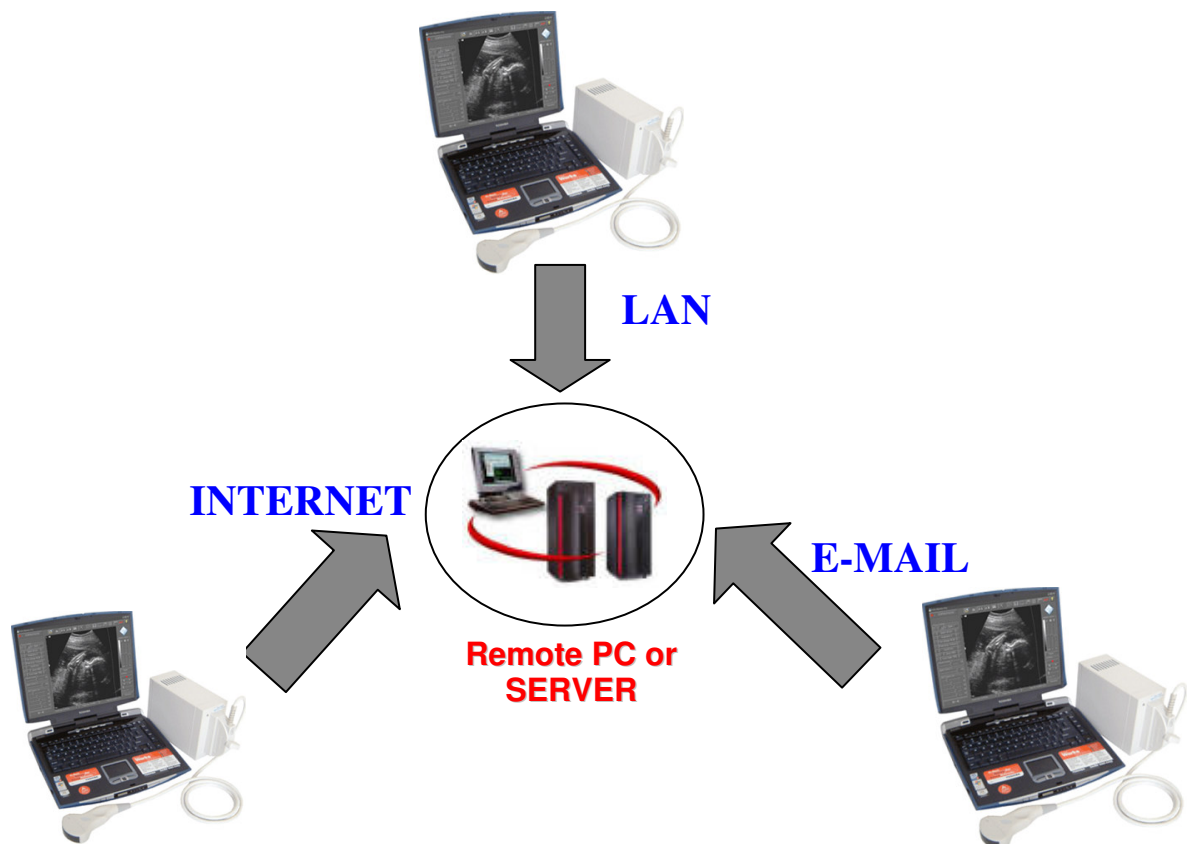
Some of these solutions were presented by Numeris company at MedIT - Workshop on information and communication technologies advances in medical

education – 28-31 October 2004, Cluj-Napoca, Romania. Here we succeeded to transfer real time ultrasound images from Medical Clinic III to Informatics Department of University of Medicine and Pharmacy Cluj Napoca.

The presentation was made by prof. Radu BADEA – Medical Clinic 3, University of Medicine and Pharmacy Cluj-Napoca. We quote: ” The ultrasound investigation constitutes an extremely spread exploration technique due to good accuracy, reduced cost and portable feature of the equipment, as well as due to the right of good practice for all the medical fields. The aspect limiting the performance of this method is related to the "user dependent" feature. A second ultrasound scanning is often required, which eventually increases the exploration costs and puts off the final decision, both diagnostically and therapeutically speaking.

There are numerous development directions regarding telemedicine. Two of them refer to ultrasound imaging:
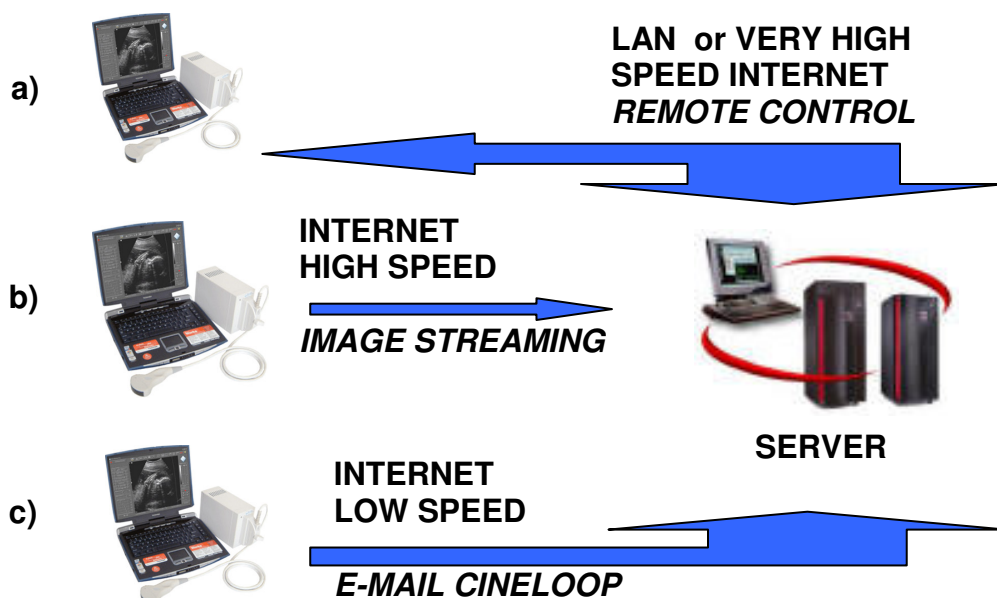
1. Transfer of images from the family doctor's office to a department that supervises the diagnostic result. The benefit will be the short time and high-quality diagnosis, leading to fast decision-making and prompt treatment application in pre-hospitalising circumstances.

2. Image transfer form the accident site if emergency units are present (car accidents, catastrophes, mountain accidents, etc). The technical particularities are related to the necessity of small-sized equipment, as well as fast transfer techniques via mobile communication.

As a conclusion, telemedicine using long distance image transfer represents a concept that imminently should be put into practice. The results will be noticed soon: fast, accurate diagnosis, efficient and prompt treatment, low costs, no patient transport required. “

NUMERIS COM successfully tested a few solutions and we present it related to speed connection:

SOLUTIONS

a) **LAN or VERY HIGH SPEED INTERNET** *REMOTE CONTROL*

b) **INTERNET HIGH SPEED** *IMAGE STREAMING*

SERVER

c) **INTERNET LOW SPEED** *E-MAIL CINELOOP*

a) LAN or VERY HIGH SPEED INTERNET (over 2 Mbps) – in this case, using a remote desktop control software we can send images in real time to remote server. This connection type is making possible remote control of ultrasound device, like having scanner keyboard at server's site. We installed RealVNC software in order to establish communication between Echo Blaster 128 scanner and remote PC (server) and we obtained images in real time with possibility of freeze, measure and set adjustments of scanner from remote PC. The only disadvantage of this solution is a small loss of frame, so it can not be implemented in diagnosis of dynamic organs.

b) HIGH SPEED INTERNET (over 256 Kbps) – we implemented for this situation a solution that is easy to configure in relation to speed connection. In this case, ultrasound image is compressed using an encoder, send remotely via internet, decompressed and displayed on remote PC. This means the higher internet speed, the lower image loss. The main disadvantages of this solution are that scanner can not be controlled remotely and a delay is noticed in displaying ultrasound image at remote PC due to compression and decompression of live images.

c) LOW SPEED INTERNET (over 33 Kbps) – This refers to dial-up connections. Due to low transfer rate the solution consists in compressing a cineloop avi file of ultrasound investigation which can be sent via e-mail to remote PC. This image transfer is not made in real time, but offers a possibility to send ultrasound images in a short period of time (1-2 minutes) to a remote PC even with a low speed connection. This feature is already integrated in Echo Blaster 128 software.

These solutions can be easily implemented in hospitals and clinics for image transfer between departments, in different geographic areas to cover rural health, between a district general hospital and a subspecialty referral centre. Depending on particularity of each application, communication and archiving software can be easily developed.

We presented only a few of the possible solutions for remote ultrasound images transfer in order to enhance the unlimited options that are available for users of PC based ultrasound scanners and show that in the modern world of communication technology Telemed ultrasound systems are "telemedicine ready".