

Enabling Off-hour Teleconsultation from Home, Including Fast 3D Visualization Using AquariusNET

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Introduction

In our radiology department, the demand for teleconsultation has grown rapidly in past months. The increased demand corresponds with the growing interest in the radiology literature for remote viewing and reporting, while still maintaining minimal functionality of conventional radiological workstations (Figure 1). However, the question was how to enable this new capability with the focus on cost-effectiveness and security. Therefore, we decided to investigate the possibilities using already available technology.

Our radiologists wanted to have basic functionality to allow them to supervise their residents during off-hours. This meant that they had to have access both to our Electronic Patient Record (EPR) to retrieve clinical information and to an image viewer to obtain images from the Picture Archiving and Communications System (PACS).

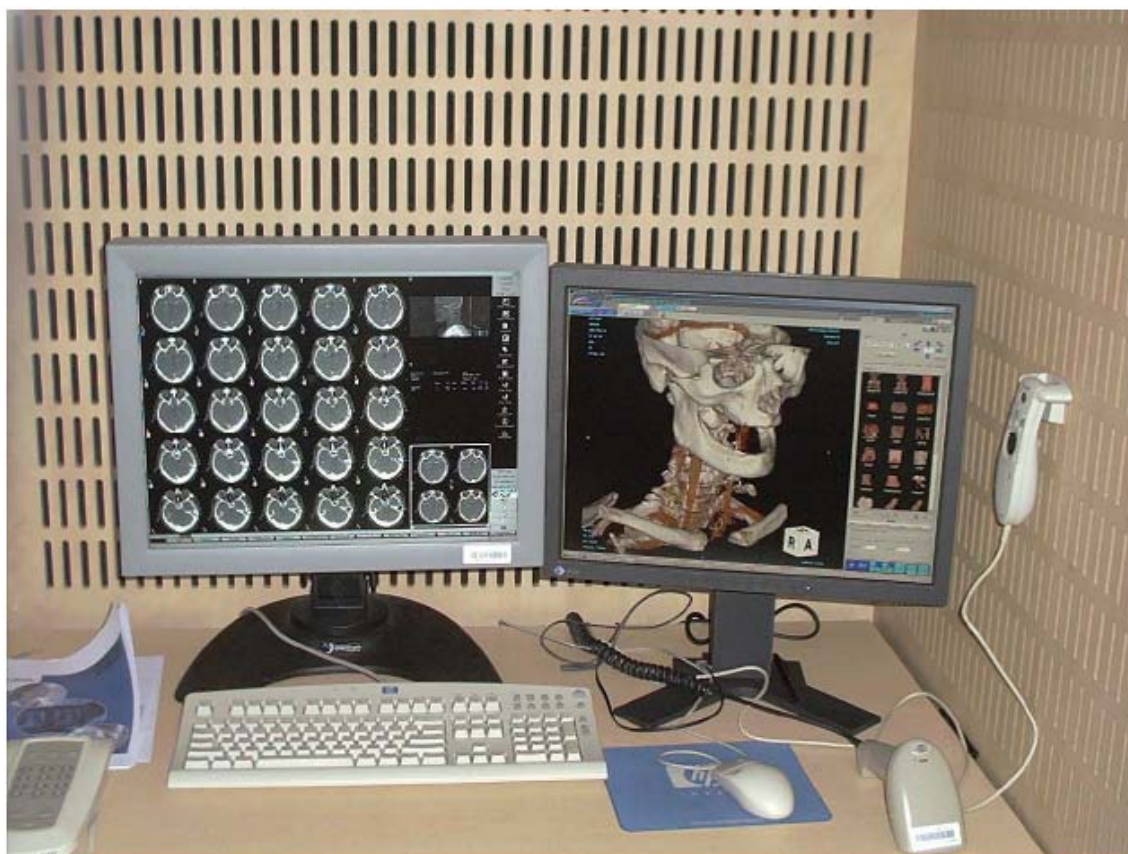


Figure 1: In-house radiological workstation with standard PACS viewer (left screen) and 3D AquariusNET viewer (right screen)

Our Setup

VPN Key

A Virtual Private Network (VPN) connection was acquired for staff radiologists in our hospital that needed to supervise during off-hours. A Digipass 300 (VASCO Data Security International, Oakbrook Terrace, IL and Zurich, Switzerland) is used for authentication of the user to the VPN network (Figure 2). As described at the vendor website (www.vasco.com):

The handheld Digipass 300 provides financial institutions and companies with a secure means of customer or employee identification and authentication for remote access to their computer systems and networks. The Digipass 300 is ideally suited for large public banking applications such as telebanking, home banking, PC banking, phone banking and Internet banking where authentication and e-signatures are key requirements.

The user interface has been conceived to work in an intuitive way, requiring a minimum number of keystrokes, so that the user can start using the Digipass 300 almost without referring to a user guide. Thanks to the optical interface, the user can even read challenges directly from the computer screen. The Digipass 300 benefits from all existing programming and authentication software that already supports the other Digipass family members.



Figure 2: VASCO Digipass Pro300

Internet connection

The Internet connections from the radiologists using the AquariusNET solution are either by cable or by ADSL. The upload and download speeds vary from 256 kbps to 768 kbps for upload and from 1200 kbps to 4000 kbps for download. Since the AquariusNET thin-client mainly relies on a fast download and only requires the upload communication to send commands, the usually large difference between up- and download speed with most providers is not a problem.

The Universal Mobile Telecommunications System (UMTS) was also tested for AquariusNET, but the data connection speeds available for UMTS are too low at this time to provide a properly working system.

Workstation requirements

No real requirements were set for the workstation itself. A basic personal computer or laptop already allows the use of both the EPR and AquariusNET since they are both server-client applications (Figure 3). In practice, radiologists using the available facility are minimally in possession of Pentium 4 2.8 GHz CPUs with at least 512 MB of internal memory.

On the hardware side, the quality of the computer screen has the potential to affect diagnostic ability. We therefore decided to provide every radiologist holding a VPN account with an Eizo Flexscan S1910-K computer screen (Eizo Nanao Corporation, Hakusan, Japan). These are not fully medically certified for radiological review, but allow for a sufficient display of DICOM imaging using specific presets, which is adequate for the supervision purpose of our setup.

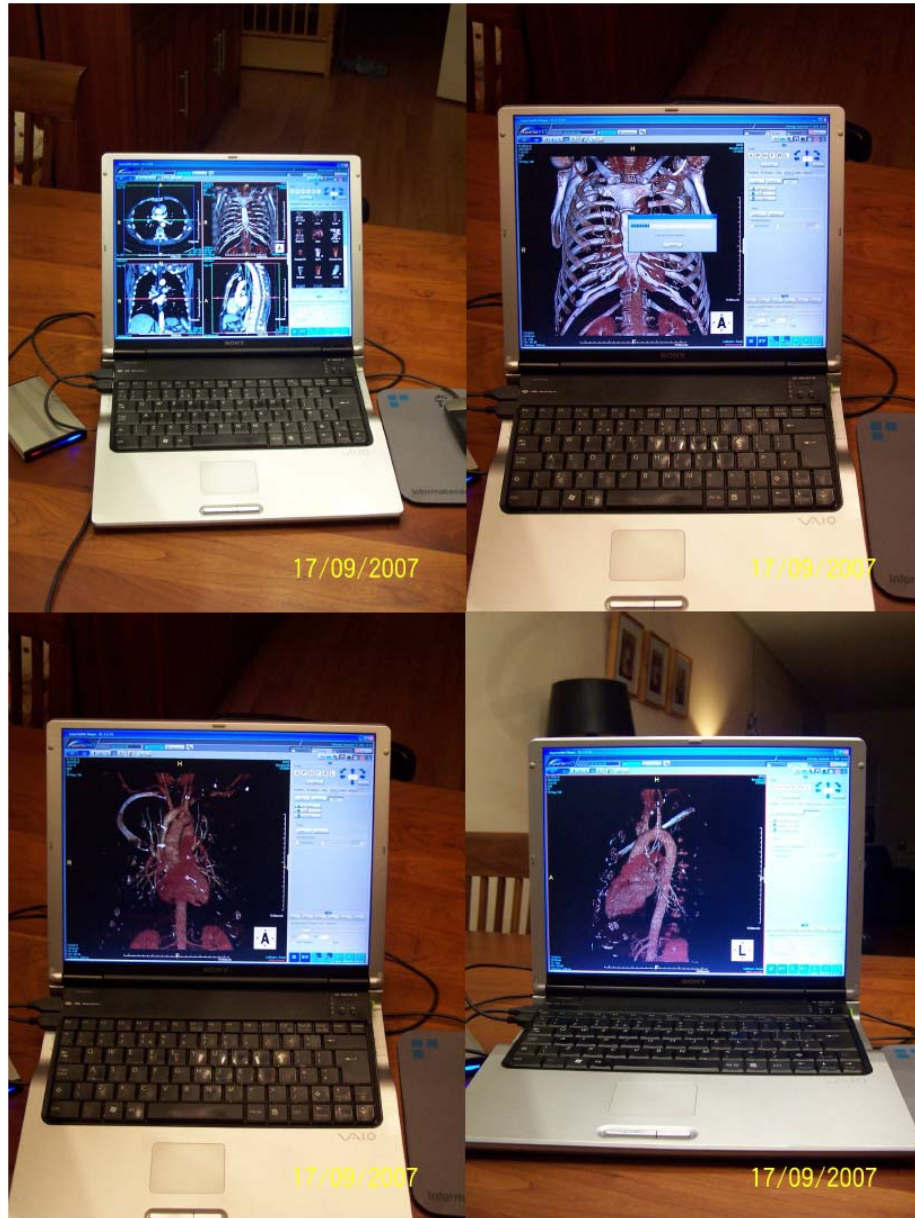


Figure 3: Example of running AquariusNET from home using a laptop. Even large CT datasets can be viewed easily, and even more advanced capabilities, such as automatic bone removal, are available from home.

Software requirements

Software requirements were simple. To access AquariusNET for the first time, Microsoft Internet Explorer (Microsoft Corporation, www.microsoft.com) is necessary. After installing the AquariusNET client application from the server, which was rated as simple by the radiologists, AquariusNET can be executed without any other requirements.

To access the EPR, Microsoft Internet Explorer 6.0 and Java Runtime Environment, version 1.4.2_05 are required. Both are available on most personal computers; if Java is missing, it can easily be downloaded from the Internet.

Compression ratios

In general, compression is required to work properly at lower download speeds. The compression image quality percentage settings varied from 50% to 70% for different radiologists. According to their feedback, these compression settings still allowed significant diagnostic quality for remote supervision purposes. [Editor's note: The latest AquariusNET software version supports automatic lossy compression while manipulating the image, followed by a lossless image which is automatically rendered once manipulation stops.]

Results

Figure 4 shows the recorded usage of AquariusNET from home as registered in the audit trail of the server. The usage was determined by counting the number of log-ins made per user per month. It is clear that most of the remote access from home is performed by a small number of users. The graph also demonstrates that after the initial excitement waned, a steadier level of use was reached in August and September of 2007 of about 30-35 total log-ins per month. The radiologists have remarked that the ability to access AquariusNET from home saves them visits to the hospital, but also makes residents more willing to ask for supervision.

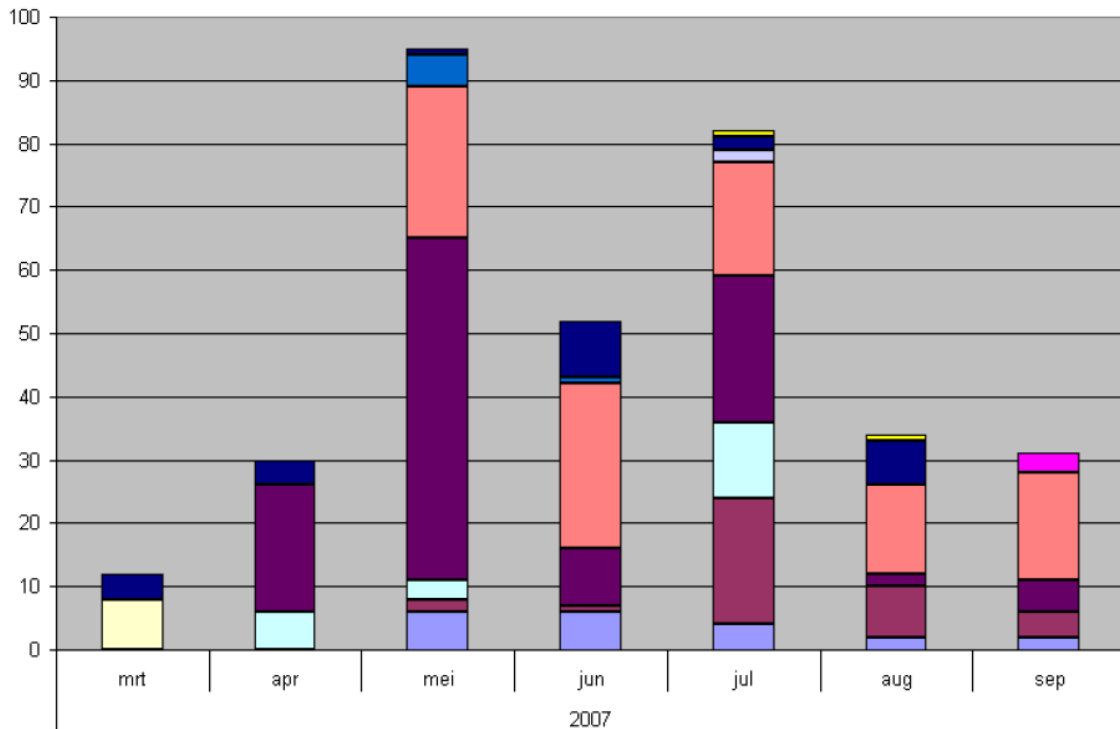


Figure 4: Recorded usage of people accessing the AquariusNET application from home with their private login. Each color represents one radiologist.

Conclusion

Current commercially available techniques can be used easily to set up off-hour teleconsulting from home. The application of AquariusNET in this arrangement provides a simple installation and update with low maintenance requirements. Furthermore, AquariusNET is a tool which is used by our radiologists on a day-to-day basis already. It thus provides them with a familiar interface, while additionally allowing them to perform enhanced three-dimensional evaluations from home. Our current setup is very effective and meets the requirements with a minimal investment and minimal effort from the radiologists.