Quality of Life and Management of Living Resources

European Human Frozen Tumour Tissue Bank

TUBAFROST

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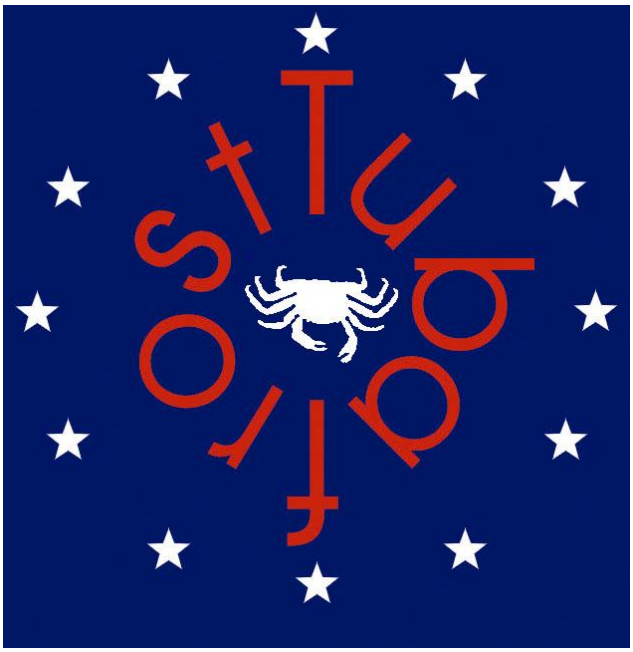
Deliverable D 5.2



This report concerns virtual microscopy and how it will be integrated into the workflow of tissue banks. It is part of Work Package 5: "Virtual microscopy in Tissue Banks".

What is Virtual Microscopy

Virtual Microcopy is the technique of digitizing an entire glass microscope slide at the highest resolution to produce a digital virtual microscope slide with diagnostic image quality. It would then be possible to use image processing software tools to view, manipulate, position, and specify the magnification of the image on screen as if using a regular microscope to view the original glass slide. By making this glass slide into a virtual glass slide, it allows many possibilities for use of these images for archival, replication, transferring over networks, remote consultation, integration with other media types for educational use on the web or DVD, integration into laboratory information systems and image analysis.

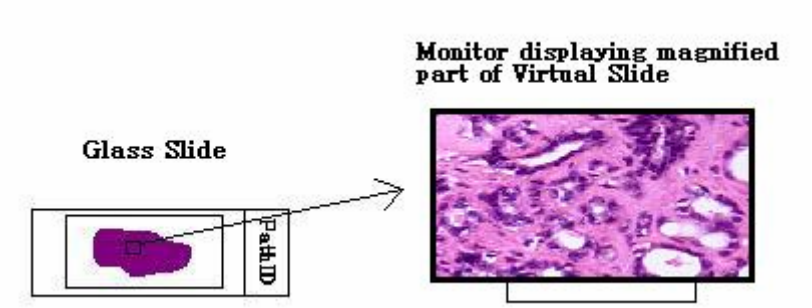


Figure 1 - Virtual microscopy involves the digitization of an entire glass microscope slide to produce a digital virtual microscope slide with diagnostic image quality

Traditional histopathology diagnosis uses the standard microscope to observe prepared tissue slides on glass slides. If second opinion is required for the original diagnosis, the glass slides would have to be sent by post to another pathologist to analyze these slides under his/her microscope and then the slides would have to be returned to the original pathologist. This method takes time and money for posting.
Classroom viewing of microscope slides in an educational environment would require an optical microscope with a projector operated by an instructor (and not the students themselves) and would require the students to be physically present in the same classroom at the same time.

However because of Virtual Microscopy technology and development of broadband internet connection it is now possible for these microscope slide images to be digitized, placed on an image server and made available online via a (secure) website. Note: The whole virtual slide image is not sent to the user over the Internet. The image server will on request calculate, from the large picture stored on disk, a simple image of sufficient quality, of the requested magnification and area in the tissue slide and will send it to the user over the Internet. This calculation is performed every time the user requests another location or magnification. This means that all the pathologists, involved in reviewing a case, would be able to log into this website, access these images and be able to decide on their histopathological diagnosis of the case due to the diagnostic image quality of the virtual slide image (see figure 2).
Students would also be able to access these images online and by using their computer can independently look at any image from a database containing thousands of slides. The viewing technology that is available with virtual microscopy technology allows the user to zoom to variable magnifications and use UP/DOWN/LEFT/RIGHT arrow buttons to move the center of field of view.

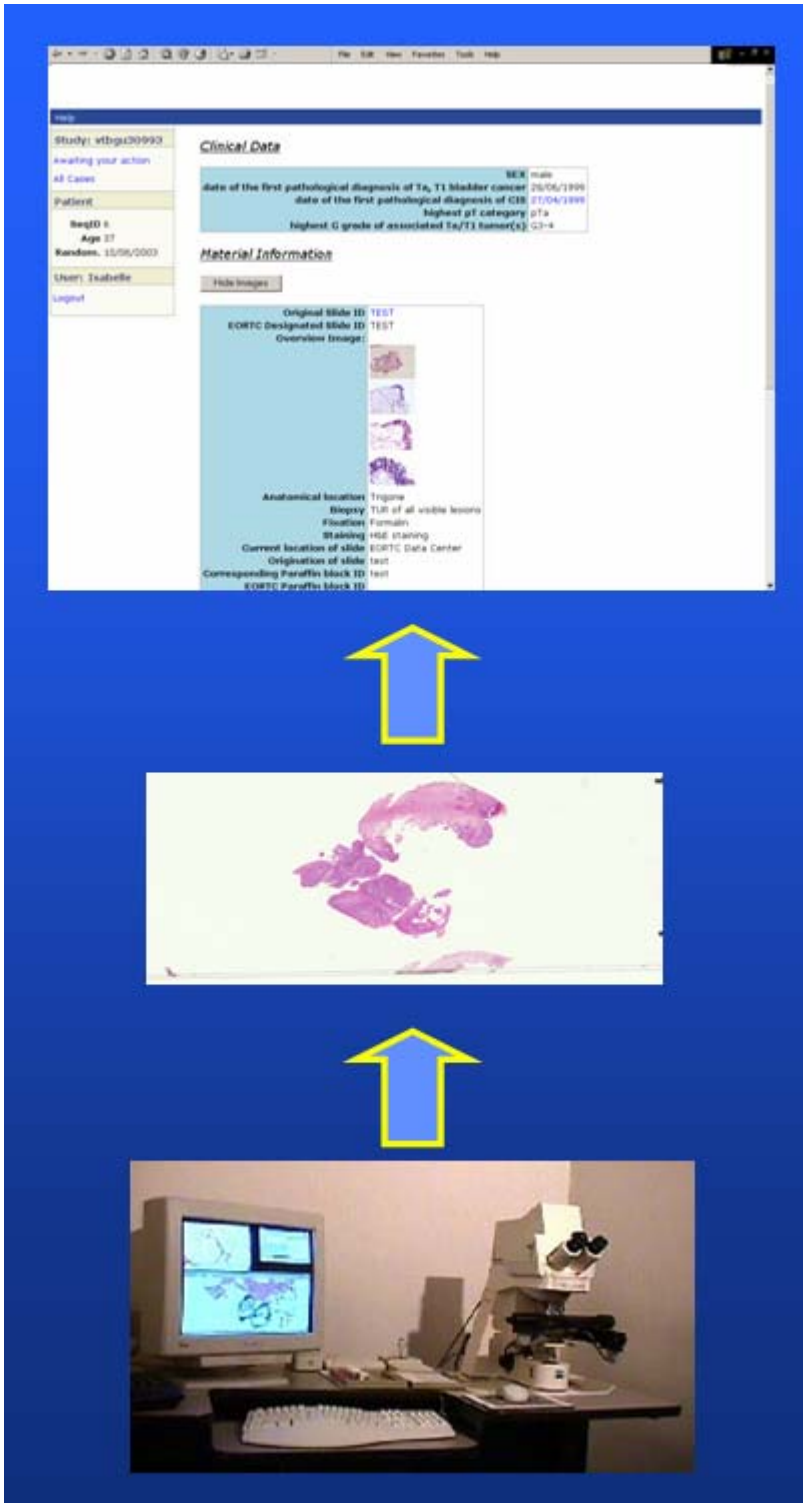


Figure 2 - Virtual Slide Image taken using the Virtual microscope system can be accessed using a website interface.

Virtual Microscope Technology

Figure 3 portrays a general setup for a virtual microscope and telepathology system. The glass slide is placed on the microscope stage and the digital camera (3-chip 24 bit) takes high quality 'field of view' single images (usually at 20X objective but 40X is possible) as the motorized stage moves the glass slide left-to-right and up and down. Eventually, a collection of 'field of view images' are taken representing the entire glass slide. These images are saved to the PC that is connected to the digital camera and the image acquisition software installed on the PC will 'stitch' together these field of view images to create an entire virtual slide image (between 300-600MB in file size using jpeg image compression).
This virtual slide image can then be placed on image file server and the server file address can be stored in a database under the tissue record. Client viewer software is installed on the web server so that when a user logs into the website and selects a tissue record, he/she can click on the low-objective slide image (taken, for instance, at 1/2X objective) which will load the client viewer software so that the user and view and navigate the matching virtual slide image that is stored on the image server (Figures 2 and 4). The request is made to the image server, where the requested image is calculated and sent to the user as described in the chapter “What is a Virtual Microscope”.

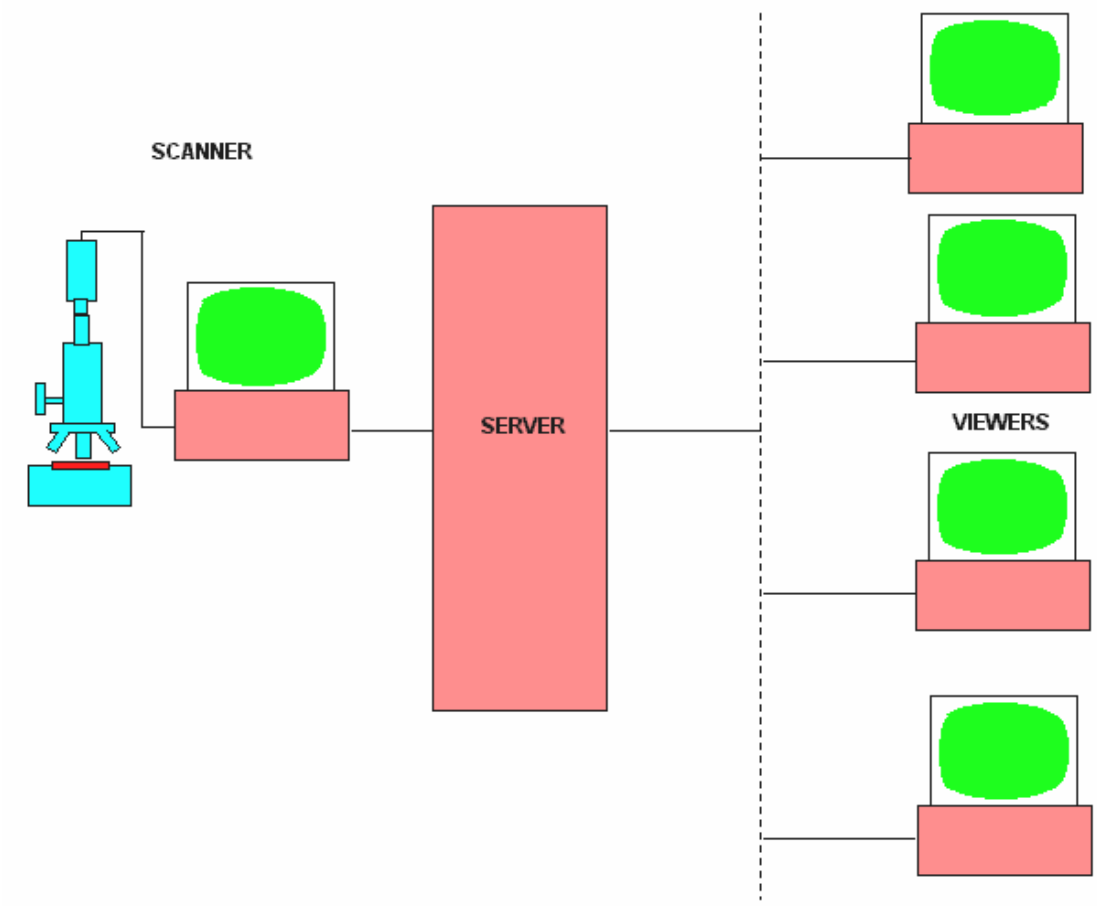


Figure 3 - System setup for a virtual microscope and telepathology system.

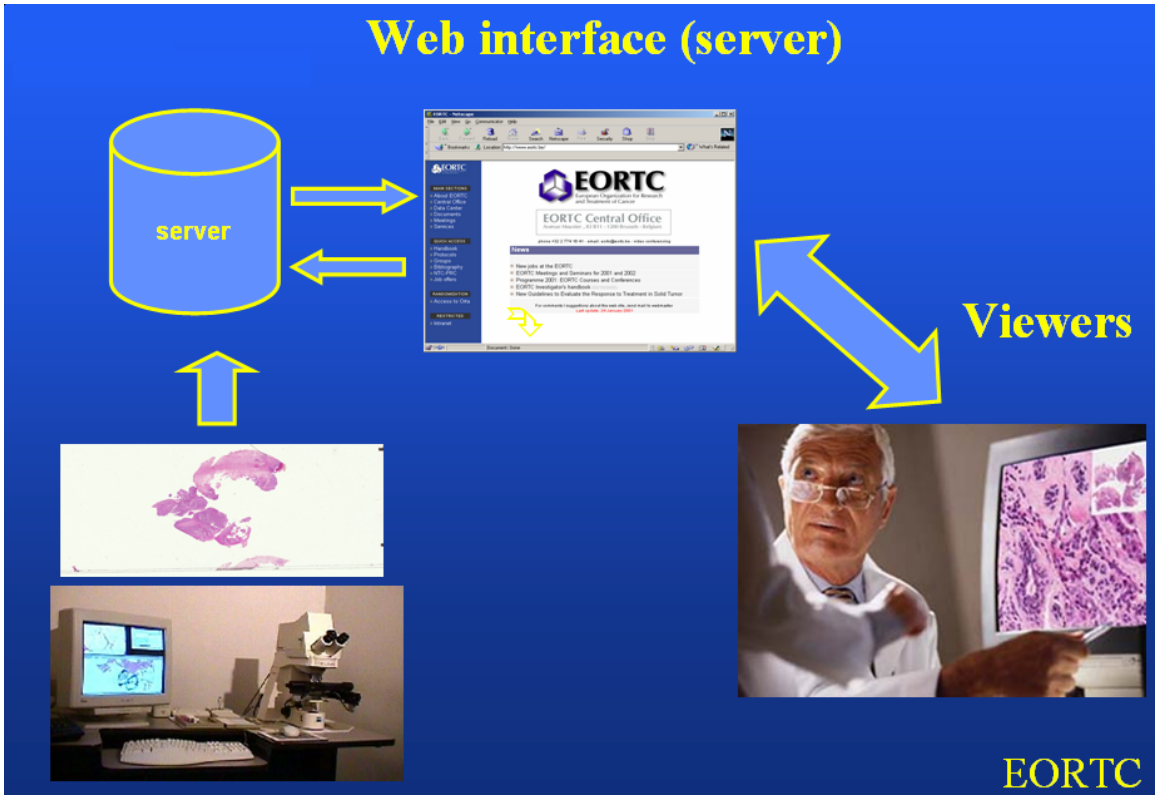


Figure 4 - Once the virtual slide image is stored on the image server and catalogued in the tissue database, users can access these images from the online tissue record and discuss the slide image with colleagues.

Investigation of commercial virtual microscope systems

In 2003 a questionnaire was sent out to twenty companies involved in virtual microscopy (VM) around Europe. The questions included: scan times, scan speeds, objective range, output file sizes, cost of complete systems, component lists etc. (See questionnaire template in appendix A).
17 responses were received and 13 companies were selected from these responses (see Results of Virtual Microscopy Questionnaire in Appendix B) that had systems that represented a true VM and telepathology system (i.e. a system that produced a complete virtual slide image of the slide navigable at various magnifications remotely via the internet).

The criteria for a good VM system are:

1. Good quality images (good resolution, focus and sharpness)
2. Adequate range of objectives/magnification
3. Accurate focusing
4. Fast Scan speeds/low scan times
5. Best compression rates and low image sizes (but maintaining good quality images - e.g. JPEG loss less and Jpeg2000)
6. Easy integration into already existing software, databases and computer systems
7. Affordable system
8. Reliable.

The components of a typical Virtual Microscope system are:

1. Microscope (standard or research) with XYZ motorized stage and controller (attached to PC). Includes focusing system.
2. 3-chip digital camera attached to a high performance PC with high resolution monitor
3. High resolution flat-screen monitor attached directly to digital camera (for displaying current field of view)
4. Image acquisition software installed on PC that, through the motorized stage controller, allow the microscope to move across slide and collects frames of 'field of views' and then stitches these field of view images together to make a complete virtual slide image of the complete glass slide.
5. Image file server to hold these compressed virtual slide images
6. Web server to hold the web site files (ASP and html) to provide an interface to the images and tissue information
7. Pathology-Tissue database system that holds the image server-file location for each virtual image within the tissue record.
8. Remote client viewing software installed on web server that works together with the tissue record database to allow pathologists and scientists to remotely access and navigate these virtual images.

Conclusion

By the end of 2003 there were 5 main systems that had most of the requirements and criteria stated above:
1. Aperio US (Dakocytomation Europe)
2. Syncroscopy UK (Leica and Van Hopplynus Instruments SA Europe)
3. Olympus Europe (Omnilabo NV)
4. Fairfield Imaging UK/ Biomedical Solutions Plc (IBM Biosciences)
5. Nikon Europe

Testing was done with the Nikon Coolscope system. However the quality of the images, very slow scan speeds and large image file sizes meant that the system was not adequate.
In February 2004 Aperio and Dakocytomation broke their partnership meaning that there was no longer was any European supplier for the Aperio Scanscope system.
In February 2004, a visit was made to Syncroscopy in Cambridge and although they are a very good image acquisition system they did not have any remote client viewing software. They are in the process of developing this tool now as a result of this meeting however they could not give any kind of deadline for completion of this development.
Olympus also had a VM system in development but it would not have been ready until the end of 2004.
In May 2004, a visit was also made to Fairfield Imaging/ Medical Solutions Plc. They had image acquisition software and remote viewing tool. Due to the fact that the hardware and software components of the Fairfield Imaging system meet the requirements of the work package, Fairfield Imaging/ Medical Solutions Plc's VM system has been chosen for the project.

Proposed workflow within TuBaFrost Tissue Bank network

The TuBaFrost Central Database system is being developed in order for it to work with the Virtual Microscope system that will be purchased.
Some tumor samples will have the standard (0.2-1.0MB) images produced during histology review by pathologists who have telepathology equipment (i.e. digital camera attached to microscope). These standard images can be uploaded to tissue records via the TuBaFrost Central Database system.
An large image server (at least 1TB [=1,000,000MB]) will come with the VM system however since each image will be between 300-600MB in file size it means storage capacity will be a limiting factor and the consortium will have to decide on which types of tumor samples will have virtual slides images produced for them. On the other hand not all tumor samples need to be supported with virtual slide images. Support is only needed for those samples having a diagnosis, which is difficult for pathologists to determine. In these cases, a local pathologist, involved in the project can, by judging the virtual Images, determine the choice of the samples. Less difficult cases can be supported by a normal representative image (0.2-1.0 MB), whereas the easy diagnosis needs no support at all.
In order to decide on what tumor types will have virtual slides, a questionnaire has been sent out to the consortium. The consortium members, who are pathologists, will then indicate which tumor types need virtual slide images, standard images and no images at all. It was already agreed during the Oxford meeting in May 2004 that no images would be stored for very common, easy to diagnose types of cancer, however, virtual slide images should be created and stored for rare tumor types, where diagnosis is uncertain. The results of this questionnaire will be posted on the TuBaFrost Project website.

For tumor types chosen for virtual slides to be created and stored, the collector institute will send the glass slides to the Tumor Bank office at the EORTC in Brussels for digitization. The virtual slide images will be stored on an image server under directories linking it to records within the TuBaFrost Central database (i.e. TuBaFrost Collector Institute ID and TuBaFrost Tissue Record ID). The server address will be entered into a field within the tissue record (among the minimal and facultative dataset) in the TuBaFrost Central database.
After digitization is completed, the glass slides will be returned to the collector institute.
A user (e.g. requestor) can now perform a search using the TuBaFrost Central database and get access to a tissue record of interest to his research project which will contain the minimal and facultative data set. If a virtual slide image is attached to this record, a low-magnification overview image will be show on the webpage, which the user can click on. This will load up the remote image viewing software (installed on the web server along with the html and asp web files) to allow the user to navigate the virtual slide image as described on page 1 of this document (i.e. What is Virtual Microscopy).

Appendix A - Questionnaire Template

Questionnaire for Virtual Microscopy and Telepathology

European Organization for Research and Treatment of Cancer (EORTC) Tumor Bank:

The European Organization for the Research and Treatment of Cancer (EORTC) (website: http://www.eortc.be/) is an international cancer research organization, based in Brussels, Belgium.
The aims of the EORTC are to conduct, develop, co-ordinate, and stimulate research in Europe on the experimental and clinical bases of treatment of cancer and related problems.
The ultimate goal of the EORTC is to improve the standard of cancer treatment in Europe, through development of new drugs and other innovative approaches, and to test more effective therapeutic strategies, using these anti-cancer drugs, and/or surgery or radiotherapy. Research is accomplished mainly through the execution of large, prospective, randomized, multicenter, cancer clinical trials.

The EORTC Tumor Bank is a department within the EORTC. The EORTC Tumor Bank's activities are to collect and centrally store glass slides and paraffin blocks from patients who are registered into EORTC clinical trials. The relevant material can be sent (via EORTC) to other pathologists to review the material and so provide a 'second opinion' on a patient's diagnosis. Translational researchers also have the opportunity to request material from the EORTC for their research projects providing that is adequate ethical/scientific requirements are fulfilled.

In 2001, we set up a system to tie the information contained in the EORTC databases (in-house built database for EORTC clinical trials) to Internet tools so pathologists can view (anonymized) patient data on a secure website and also submit their diagnoses of the patient case online. To enable this we also allowed the original and reviewing pathologists to submit their representative digital images (1-2MB file size) directly into the patient case (within the database) online. Therefore the cases contain patient clinical data, diagnoses and digital images. However this relies on the pathologists doing their own digitization of the glass slides.

Now (2003) we are interested in acquiring a Virtual Microscope and the (Telepathology) software to allow us to create virtual slide images to allow review pathologists to view these slides in detail at various magnifications via the Internet and allow them to make confident pathological diagnoses.

Since all the clinical, image and diagnostic data is tied together everything needs to be stored in the systems at the EORTC in Brussels. EORTC have developed its own database software to hold the clinical data, diagnoses and image data.

What we require from a company is the virtual microscope and software that can be integrated with the databases and Internet tools already developed here. Essentially this means tools to create the virtual slide and store the compressed jpeg file on the image server. We then need tools to work together with the website which has been developed to allow a large and varying group of users to access and view the virtual slide (reasonably quickly, easily and at various magnifications). The pathologist can then provide comments and his/her diagnosis of the case and upload these to the patient case.

To help us better understand the system you have available for Virtual Microscopy and Telepathology, I ask you to please complete the below questions as best you can and send back to me as soon as you can (via e-mail or fax preferably).

Thanks in advance

Yours Sincerely,

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Questions:

1. Scan Speed (sec/image)

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2. Scan objective (maximum magnification)

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3. Scan Time (for 25x50mm coverslip with x20 objective)

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4. Frame Size (pixels)

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5. (Geometric/Spatial) Resolution (mu/pixel at x40 objective)

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6. Color Resolution

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7. Cost (€) of Scanner (scanning microscope, computer, etc..)

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8. Cost (€) of Image/File Server

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9. Cost (€) of Server Software (i.e. software used to create digitized images)

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10. Is the viewer software free of charge? (Yes/No)

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If not, please outline the procedure how the license costs for the viewer are charged.

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11. System requirements (i.e. type of computer, type of operating system, modem/internet connection, screen size, type of browser, image server size requirement, hard drive space requirement etc...)

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12. File sizes of images produced (raw (uncompressed) image size and compressed image size) at a magnification of 20x and 40x (if present)

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13. Image compression type and compression ratio (e.g. JPEG2000)

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14. Image format types and possibilities for image/document exporting (e.g. html etc...)

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15. Websites/software for demonstration (information/free software to view sample images)

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16. Flexibility of installation of system (i.e. how easy would it be to install the software and hardware in an already existing database system and existing website system). Does your company provide software so that we can use the same server-client system with our own databases and servers?

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17. Contact details for company representative for possible further discussion/information

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18. Comments (further details of how the system works, different components of the system, diagram flowchart, screen shots etc...)

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Appendix B - Results of Virtual Microscopy Questionnaire

Question 1: Scan Speed	
3DHistech	For Carl Zeiss Axio Cam MR: 3 images/second; For Sony DFW-X700: 5 images/second
Aperio	5-6 minutes at 20 X magnification (15mm x 15mm section)
Histkom	Ca 1sec/image
InterscopeTech	2 square cm tissue area: +/- 4 minutes (inc. slide loading and focus setup)
Leica (Van Hopplynus Instruments)	20 fields/sec
Olympus	Depends on stages used and which repositioning accuracy is needed (in the most simples machines = 2-3 images)
Nikon	In most time consuming conditions: 5 seconds per frame
Samba	2 sec/image with a Xeon 2,8 Ghz (dependent on power of scanning PC)
Syncroscopy	Varies from 7,5 to 30 frames/second depending on type of resolution
Trestlecorp (Illumea)	100 ms/image (2.5GB/minute)
ZEISS	Up to 0.7 sec / image
ZEM	500 MB per minute or 40 mm2/minute at 20 X or 10 mm2/minute at 40X
Fairfield	15 minutes at 20X magnification (15mm x 15mm section)

Question 2: Scan objective (maximum magnification)	
3DHistech	40X
Aperio	40X (20X is optimal)
Histkom	40X
InterscopeTech	Base system uses 20X
Leica (Van Hopplynus Instruments)	40X
Olympus	any (2X-100X)
Nikon	any
Samba	X40 (63X is optional, 4X, 10X, 20X also possible)
Syncroscopy	100X oil (maximum)

Trestlecorp (Illumea)	40X
ZEISS	63X dry (image size limited to 12MB)
ZEM	40X (20X also possible)
Fairfield	Dependent on type of microscope (usually 2.5X, 10X, 20X, 40X)

Question 3: Scan time (for 25 x 50 mm coverslip with x20 objective)

3DHistech	Microscope's capability can be configured in a wide range according to the customer's requests
Aperio	ca. 31 minutes (max scan area = 23 mm X 50 mm)
Histkom	ca. 12000 fields of view
InterscopeTech	Entire slide = 11 minutes
Leica (Van Hopplynus Instruments)	ca. 4.34 sec
Olympus	Depends on the stages used and which accuracy is needed
Nikon	12.5 hours when refocusing on every frame. When using the focus stability of E600N: 4 hours
Samba	Max 162 minutes (for whole slide area: dependent on area effectively occupied by sample)
Syncroscopy	Less than 5 minutes
Trestlecorp (Illumea)	Approx. 16 minutes
ZEISS	30 minutes
ZEM	31 min 15 sec (when entire slide is covered by tissue)
Fairfield	15-20 minutes

Question 4: Frame size (pixels)

3DHistech	AxioCam MR: 1300 x 1300 pixels Sony DFW-X700: 1024 x 768 pixels
Aperio	Sections scanned in stripes. At 20X one stripe is typically 200 Mpixels in uncompressed form
Histkom	576 x 768 for field of view image

InterscopeTech	Depends on field of view or region of interest.
Leica (Van Hopplynus Instruments)	?16 000 x 16 000 pixels? (From Acquis Pro doc: 768 x 576 or 1536 x 1152 using resolution doubling)
Olympus	Variety of choises are available (real-time images usually below 0.8 Mpixels, however captured images use higher resolutions - 3.34 Mpixels)
Nikon	Nikon DXM1200F: 1.3 million-pixel per frame resolution (also 12 million-pixel modes possible)
Samba	1600 x 1200
Syncroscopy	Depends on resolution type
Trestlecorp (Illumea)	1380 x 1024
ZEISS	752 x 582
ZEM	No framesize because frames not used. Creation of one contiguous image
Fairfield	Dependent on type of camera. AxioCam MR: 1300 x 1300 pixels

Question 5: (Geometric/spatial) resolution (µm/pixel at x40 objective)

3DHistech	Microscope's capability can be configured in a wide range according to the customer's requests
Aperio	0.23 µm/pixel at 40 X
Histkom	Ca. 0.25 µm/pixel
InterscopeTech	0.33 µm/pixel with our base system of 20X
Leica (Van Hopplynus Instruments)	0.77µm/pixel
Olympus	Depends on optics and CCD (see question 4)
Nikon	0,45 µm/pixel
Samba	0.18 µm/pixel at X40
Syncroscopy	Depends on resolution type but typically 0.1 µm/pixel or better
Trestlecorp (Illumea)	0.16 µm/pixel
ZEISS	0.90 µm/pixel
ZEM	0.23 µm/pixel
Fairfield	2.5X = 0.075 10X=0.3 20X=0.50 40X=0.75

Question 6: Color resolution

3DHistech	24 bit red green blue
Aperio	24 bit
Histkom	24 red green blue
InterscopeTech	24 bit color for JPEG compression
Leica (Van Hopplynus Instruments)	24 bit true color (from Acquis Pro doc)
Olympus	Depends on optics and depth of the camera used (see question 5)
Nikon	NikonDXM1200F: 24 bit color resolution
Samba	24 bit
Syncroscopy	24 bit
Trestlecorp (Illumea)	30-bit capture, 24-bit save
ZEISS	24 bit
ZEM	24 bit
Fairfield	24 bit

Question 11: System Requirements (i.e. type of computer, type of operating system, modem/internet connection, screen size, type of browser, image server size requirement, hard drive space requirement, etc.

3DHistech	• Intel P4 Processor • 256 MB Ram • 17 " monitor, true color, 1024 x 768 resolution • Windows NT platform
Aperio	• 2.4 GHz • Windows 2000 server software • system drive: 40 GB • Other drives: 1CD-ROM/DVD drive • Memory: 2GB Ram • Network interface: 2 Gigabit NICs • Monitor: 17" or 20"
Histkom	The HISTKOM-equipment includes the complete microscope station with remotely operable microscope, 3CCD-Chip camera, macro

	viewer, scanning table equipment, 2 computer monitors, PC-equipment (Pentium III), telecommunication entium t. The remote display station includes PC-equipment (Pentium III), 2 computer monitors, telecommunication equipment. HTML inspection equipment consists of a standard PC with browser and internet connection, 1 monitor.
InterscopeTech	• Image Capture Station (slide scanner): Windows 2000 PC • Image File Server: typically Windows 2000 file server (depends on user requirements) • Remote viewing: requires Internet Explorer 5.0 or higher (Netscape can be utilized if they conform to IE5.0 standards)
Leica (Van Hopplynus Instruments)	From Acquis Pro doc: • Top Pentium PC • With digital camera interface • cd writer • 16MB + graphics card • 128 MB + RAM • 19" or larger display • 5+ GB hard drive • Windows 98/NT (or later) • Acquis software • TWAIN input support for other capture devices such as scanners
Olympus	Depending on configuration
Nikon	• Windows 2000 • 8MB ADSL connection
Samba	Central Unit (server): • P4, dual processor 2,6 Ghz • 512 Kb cache memory • 512 Mo RAM, DD 80 Mb • CD-ROM, CD-RW • 64 Mb graphic board

	• 10/100 MHz Ethernet board • 20" flat screen monitor Viewing Unit: • Pentium 3 • 256 MB RAM • 8MB Graphic Board • 40 MB Hard disk • 17" monitor • Windows 9x, NT4.0, 2000 and XP
Syncroscopy	• Pentium PC, 2.8 Ghz processor • 1GB RAM • 21" monitor • Windows XP professional • 60 GB + hard disc with tape back up • CD-RW • DVD-RW • Internet browser
Trestlecorp (Illumea)	Image server requirements: • Pentium 4 • 2.8 GHz • 1GB Ram Viewer PC minimum requirements: • Pentium 3, 500 MHz • Screen resolution: 1024 x 768 • Minimum bandwidth 128Kbps, connection to image server
ZEISS	• 512 kBRAM • Windows 2000 • Matrox Meteor II for server

	• Connections from 112kB to 2MB
ZEM	Standard Intel P4 (For server): • 2.6 Ghz • 19" monitor or bigger • Windows 2000 or XP (professional) • 128Kb minimum internet connection • Screen resolution: 1280 x 1024 • Browser: Internet explorer version 5 or higher
Fairfield	PC for microscope control and image acquisition: • Intel P4 2.8Ghz processor; 512 MB RAM; 40GB Hard disk; Fast Ethernet; DVD/CD reader/writer; Two flat-screen LCD monitors. Sony 17" Image server: • HP PROLIANT ML310 Y01 P4 36 MB, 256 MB. 36 GB HARD DRIVE 768 MB SDRAM with 3.7TB RAID (15 x 250GB SATA drives). Backup (optional) for 6TB image data: • NAS data backup o PC, monitor for backup control o NAS backup hardware and software o Cables, power supplies o 20 x data cartridges (300GB each) o 10 x cleaning cartridges

Question 12: File sizes of images produced (raw (uncompressed) image size and compressed image size) at a magnification of 20x and 40 x (if present)

3DHistech	A single field of view using AxioCam MR is 3.83 MB uncompressed or 0.77 MB using a 1:5 compression. A single field of view using Sony DFW-X700 = 2.25 MB uncompressed or 0.45 MB using a 1:5 compression

Aperio	File size of 15 x 15 mm section at 20X: • Uncompressed: ca. 3GB • Compressed: ca. 150 MB File size of 15 x 15 mm section at 40 X: • Uncompressed: ca. 12GB • Compressed: ca. 600 MB
Histkom	• Uncompressed: 1.3 MB (field of view image), 3MB (overview image) • Compressed: 50 kB-400kB depending on image content
InterscopeTech	Average compressed image size: 280 MB for the 0.33 µm system at 20X objective
Leica (Van Hopplynus Instruments)	-
Olympus	Depends on camera (resolution and bit depth) and compression of file (jpeg, jpeg2000, tiff)
Nikon	A single full color image of DXM1200F acquired in 1.3 quick mode is about 3.5 MB. Further compression results in the following file sizes: • Loss less: 1.785 MB • Low: 1.233 MB • Lowest: 535 kB • Medium: 210 kB • High: 86 kB • Highest: 55 kB
Samba	Raw uncompressed size of a 1600*1200 image = 5.5 MB. The average compression rate for Histological sections is 10. The average compression rate for cytological samples is 25. (Total size depends on area effectively occupied by tissue)
Syncroscopy	Typical size image uncompressed: 1GB but dependent on selected image area)
Trestlecorp (Illumea)	For 15mm x 15mm tissue size, approximately: • 20 X: 6.3 GB (uncompressed) / 314 MB (compressed) • 40 X: 25.2 GB (uncompressed) / 1.2 GB (compressed)

ZEISS	• Single image: 1.3 MB raw • Entire slide: max 12 MB
ZEM	Assuming a scanned area of 15 x 15 mm: • at 20X the uncompressed image size will be 2.8 GB / at 20:1 compression this will be 140 MB • at 40 X the uncompressed image size will be 11.25 GB/ at 20:1 compression this will be 560 MB
Fairfield	• 20X: 500-700MB compressed with jpeg compression

Question 13: Image compression type and compression ratio (e.g. JPEG2000)

3DHistech	• JPEG, configurable. Recommended: 1:5)
Aperio	• JPEG2000 (compression ratio 20:1)
Histkom	• JPEG-compression. loss less for visual inspection
InterscopeTech	• Standard: JPEG (typical compression ratio 17:1)
Leica (Van Hopplynus Instruments)	• you can choose
Olympus	• JPEG • JPEG2000 • TIF
Nikon	• Default: JPEG2000 • various compression ratios are available
Samba	• TIFF (no compression) • BMP (no compression) • JPEG loss less • JPEG • JPEG2000

	• JPEG2000 loss less • (compression rate and formats are user-selectable)
Syncroscopy	Compression is user-selectable. • JPEG • RLE • JPEG2000 is optional
Trestlecorp (Illumea)	• JPEG with user-configurable compression ratio • JPEG2000 with user-configurable compression ratio
ZEISS	• JPEG adjustable
ZEM	• JPEG2000 with user-selectable compression ratio
Fairfield	• JPEG, configurable. Recommended: 1:5)

Question 14: Image format types and possibilities for image/document exporting (e.g. html etc.)

3Dhistech	• HTML with JPEG images from VI-Scope • RTF from Patho-Scope
Aperio	• JPEG2000 (jp2) • HTML via Web Browser Viewing software • Uncompressed TIFF files (raw stripes)
Histkom	An investigation results in 2 archive documents: • 1) HISTKOM folder (2 monitor format) • 2) HTML folder to be inspected with a standard browser and PC-equipment

InterscopeTech	The image file format is based on a standard tiled TIFF or paged TIFF format. Several of our applications have the ability to extract an image for alternative use (best stored as standard JPEG, other options are available but compression artifacts can occur is compressed using a second compression metholodogy) Also possible to generate reports with bookmark images.
Leica (Van Hopplynus Instruments)	• (Acquis Pro doc:) • Numerous file formats supported • Link text, images, numbers and data stored in other application files such as Word or Excel
Olympus	• JPEG • JPEG2000 • TIFF • compatible with Word/Excel • …
Nikon	A range of other image formats is available in the EclipseNET software, like BMP, TIF and JPEG. Images can be exported VSL image structure, single JPEG2000 or a range of different image formats
Samba	• TIFF (no compression) • BMP (no compression) • JPEG loss less • JPEG • JPEG2000 • JPEG2000 loss less • (compression rate and formats are user-selectable)
Syncroscopy	Windows metafiles, bitmap, jpg, also copy and paste regions
Trestlecorp (Illumea)	• TIFF • JPEG • JPEG2000 • Viewable over standard HTML pages

ZEISS	• Windows Bitmap (BMP) • JPEG compressed images (JPG) • Truevision Targa (TGA) • Zsoft Paintbrush (PCX) • TIFF • HTML
ZEM	All usual image formats such as TIFF, BMP, JPEG, GIF, TRG, etc.
Fairfield	• JPEG

Question 15: Websites, software for demonstration (information/free software to view sample images)

3DHistech	• www.3dhistech.com
Aperio	• www.dakocytomation.com • www.scanscope.com
Histkom	On request for a limited period, access to HISTKOM HTML archive may be provided
InterscopeTech	• www.interscopetech.com
Leica (Van Hopplynus Instruments)	• www.leica-microsystems.com • www.syncroscopy.com
Olympus	No detailed information available on the current web sites of Olympus, Olympus biosystems and SIS
Nikon	• www.nikon-instruments.com • www.eclipsenet.info • www.lim.cz
Samba	A CD-Rom can be sent containing virtual slides and viewer software. System can be demonstrated in the Strasbourg Academic Hospital
Syncroscopy	Syncropscopy by arrangement, using desktop streaming
Trestlecorp (Illumea)	• http://www.digitalslide.trestlecorp.com/?u=demo

ZEISS	Full version free for 4 weeks on Product CD. Testperiod up to three months
ZEM	• www.Scanscope.com
Fairfield	• http://www.fairimag.co.uk/

Question 16: Flexibility of the installation of the system

3DHistech	Our client software can be installed on any existing Win2000/XP workstation. Our server side components can be installed on an existing Windows based server.
Aperio	Adaptation should be possible, but depends on configuration of the current system. We recommend sourcing most part from DakoCytomation for seamless workflow.
Histkom	The session folder is archived automatically in the HISTKOM files. In parallel a second folder in HTML format is generated which may be exported to customer archives.
InterscopeTech	Our system consists of three components: • Image Capture Station (slide scanner) • Image File Server • Viewing Application All three can be purchased as individual items.
Leica (Van Hopplynus Instruments)	-
Olympus	Easy
Nikon	
Samba	Easy to install. The virtual slide is a single file containing image data and viewing applet. Two options exist for database and no installation is required on the client side. Option 1: Database stores image file, file is downloaded to client, unzipped and viewed using java applet, images are consulted from PC Option 2: Database stores image file, file is unzipped on server and viewed on java applet, but images are sent to PC only when required by applet.
Syncroscopy	Far too complex a question to answer without a detailed discussion of

	requirements and expectations.
Trestlecorp (Illumea)	MedScan provides an image database for organizing digital slides. Image data may be stored anywhere on a network and accessed by both existing database and website systems. MedScan stored images are accessible from existing client-server databases and servers.
ZEISS	No flexibility, no database software.
ZEM	Our scanscope system is extremely easy to operate and install. On site training and installation is included in the price of the system. Our viewer software may be a limitation for integration into your current computer system. However, given the fact that the output of our system is a single file (JPEG2000) you will be able to easily import these images into your database.
Fairfield	Adaptation should be possible, but depends on configuration of the current system.