Digital pathology: the UMC Utrecht experience

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Digital pathology UMCU 2015

• Scanners written off
• Tape archive full and written off
• No cytology
• No fluorescence
• Hardly telerevision/teleconsultation
• Not all MDMs done digitally
• Still slide searching, which could be in the scanner!
• No quality controls of scans, error rate 2-4%

→ Time for the next step!!!!!!!!!!!!!
The next step

- new bulk storage (EMC, hospital wide, incremental)
- new faster scanners (Hamamatsu)
  - fluorescence
  - big slides
  - $z$-stacks for cytology
  - quality control of scans, automatic rescan
- upfront scanning in the lab
  - all slides digitally available
  - all MDMs digital
  - no more slide searching
  - allows digital diagnostics
- workflow platform (Sectra)
- implement image analysis (Sectra/Visiopharm)
Digital pathology: the UMC Utrecht 2015 solution

scanning

database

storage

LIS

VNX Image/data server

macro imager

order form scanner

HIS

SECTRA PATHOLOGY

U-DPS

SECTRA RADIOLOGY

pathology users

clinical users
140 slides per hour during peak production

~1400 slides per day

cytology
big slides
fluorescence
frozen sections/priority
Sectra is watching you.....
Sectra is watching you....

Uptime > 99.9%
Implementation process

- Hardware
- Software
- Lab issues
- Workspace
- Change management
Implementation: hardware

- VNX server cluster hosting the workflow
  - Stand alone
  - Integration with Radiology later

- Network connections and switches

- Computers
  - Graphics cards
  - CPU speed
  - Big screens

- Climate control
  - Temperature, noise, ozon

- 2-D barcodes
Implementation: software

• Connections
  – Integration with PALGA
  – Integration with G2 speech recognition
  – Integration with LMS
  – Integration with bulk storage
  – Integration with Radiology PACS
System design

PALGA

Saltro

VPN

ChipSoft HiX and Cloverleaf

U-DPS

PACS worklist and desktop sync with UDPS

URL launch

Broadcast?

Image notification XML or HL7

Pat info XML

Pat info QRY

Pat info ORU

ORM status update

ORM exam info and status updates

Image import request ID, block & stain

Slide metadata XML

Scanning profile

Image notification

Launch from viewer

Image analysis

Launch from viewer

Sectra Core

Image Server/fs

EMC iSilon

ILM Rules

Image Server/s

NAS/SAN

Import Service(SPIS)

Aperio Archive

Slide Scanners

Aperio

Saltro

PACS worklist and desktop sync with UDPS

Technician prepares and stores results for pathologist

ChipSoft HiX and Cloverleaf

VPN

PALGA

Saltro

VPN

ChipSoft HiX and Cloverleaf

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Aperio Archive

Slide Scanners

Aperio
System design: connections

- **Sectra Core**
- **ImageServer/fs**
- **EMC iSilon**
- **LIMS**
- **Finalist**
- **PALGA**
- **U-DPS**
- **VPN**
- **PACS worklist**
- **Slides**
- **Image analysis**
- **Analysis performed and show result?**
- **Technician prepares and stores results for pathologist**
- **Slide Scanners**
- **ORM status update**
- **ORM exam info and status updates**
- **Image import request ID, block & stain**
- **Slide metadata XML**
- **Scanning profile**
- **Image notification**
- **Launch from viewer**
- **Import Service(SPIS)**
- **ImageServer/s**
- **ILM Rules**
- **ImageServer/fs**
- **EMC iSilon**
- **Saltro**
- **U-DPS**
- **VPN**
- **PACS worklist and desktop sync with UDPS**
- **URL launch**
- **Image notification XML or HL7**
- **Pat info XML**
- **Pat info QRY**
- **ORU**
- **LIMS Finalist**
- **Sectra Core**
- **ChipSoft HiX and Cloverleaf**
- **PALGA**
- **VPN**
- **PACS worklist and desktop sync with UDPS**
- **URL launch**
- **Image notification XML or HL7**
- **Pat info XML**
- **Pat info QRY**
- **ORU**
- **LIMS Finalist**
System design: connections

Launch from viewer

PACS worklist and desktop sync with UDPS

URL launch

Broadcast?

Image notification XML or HL7

Pat info XML

PACS worklist

Image import request ID, block & stain

Slide metadata XML

Slide Scanners

ORM status update

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ImageServer/fs

EMC iSilon

ILM Rules

ImageServer/s

NAS/SAN

Import Service(SPIS)

Aperio Archive

Sectra Core

Image import analysis

Slide archive

ChipSoft HiX and Cloverleaf

PALGA

Saltro

VPN

SLIMS

Finalist

U-DPS

Analysis performed and show result?

Technician prepares and stores results for pathologist

Launch analysis

System design: connections
System design: connections

- PALGA
- Saltro
- VPN
- U-DPS
- LIMS
- Slide Scanners
- ImageServer/fs
- EMC iSilon
- ImageServer/s
- NAS/SAN
- ILM Rules
- ImageServer/Import Service (SPIS)
- Aperio Archive
- ORU
- Pat info
- QRY
- ORM status update
- ORM exam info and status updates
- Analysis performed and show result?
- Technician prepares and stores results for pathologist
- Launch from viewer
- Image metadata XML
- Scanning profile
- Image notification
- Image import request ID, block & stain
- Slide import notification XML or HL7
- Broadcast?

Pathology reporting

Launch PACS worklist and desktop sync with UDPS

Technician prepares and stores results for pathologist

System design: connections

Pathology reporting

Launch from viewer

Image analysis

Analysis performed and show result?

Technician prepares and stores results for pathologist

Slide import notification XML or HL7

Broadcast?
System design: connections

- PALGA
- Saltro
- VPN
- ChipSoft HiX and Cloverleaf
- ORU
- Pat info
- QRY
- U-DPS
- Image import request ID, block & stain
- ORM status update
- ORM exam info and status updates
- Launch from viewer
- Analysis performed and show result?
- Technician prepares and stores results for pathologist
- Image import
- Slide Scanners
- ImageServer/fs
- EMC iSilon
- ILM Rules
- ImageServer/s
- NAS/SAN
- Import Service(SPIS)
- Aperio Archive
- Aperio
- Saltro
- LIMS
- Finalist
- Lab management system
- Image analysis
- ImageServer/s
- ImageServer/fs
- ILM Rules
System design: connections

PACS worklist and desktop sync with UDPS
URL launch

PACS worklist
Image notification XML or HL7
ORM status update
Slide metadata XML, block & stain
Analysis performed and show result?
Launch from viewer

Technician prepares and stores results for pathologist

Sectra Core
EMC iSilon
ILM Rules
ImageServer/s
NAS/SAN
ORM status update

ImageServer/fs
ImageServer/spis
ImageScanners
Import Service (SPIS)

Aperio Archive

Scanners
System design: connections

- PALGA
- Saltro
- VPN
- ChipSoft HiX and Cloverleaf
- U-DPS
- ORU
- Pol info
- QRY
- U-DPS
- LIMS Finalist
- ORM status update
- ORM exam info and status updates
- Analysis performed and show result?
- Technician prepares and stores results for pathologist
- Image analysis
- Launch from viewer
- Broadcast?
- URL launch
- PACS worklist and desktop sync with UDPS
- ImageServer/fs
- EMC iSilon
- ILM Rules
- ImageServer/s
- NAS/SAN
- Import Service(SPIS)
- ImageServer/fs
- ImageServer/s
- Aperio Archive
- Slide Scanners
- Slide metadata XML
- Scanning profile
- Image notification
- Image import request ID, block & stain
- Aperio Archive
- System design: connections
- hospital information system
- Image import request ID, block & stain
System design: connections

- PALGA
- PALGA
- VPN
- ChipSoft HiX and Cloverleaf
- ImageServer/fs
- EMC iSilon
- LIMS
- Finalist
- Slide Scanners
- U-DPS
- Image notification XML or HL7
- POR
- ORU
- QRY
- Pat info
- ORM status update
- ORM exam info and status updates
- Image import request ID, block & stain
- Slide metadata, profile
- Image notification
- Launch from viewer
- Technician prepares and stores results for pathologist
- Analysis performed and show result?
- PACS worklist
- Desktop sync with UDPS
- U-DPS
- URL launch
- Broadcast?
Implementation: software

• Smart storage
  – 40x → 20x

• Conversion of old Aperio images to DICOM
Implementation: lab issues

• Slide production
  – Perfect central mounting
  – Restrictive mounting
  – No glue remnants (Neoclear → xylene)
  – Quick slide drying

• Workflow
  – Slide cleaning
  – Quality control & rescan
  – Development scanning protocols
    • single layer vs Z-stacks
    • HE vs. special stains/IHC/defatted
    • big slides
    • fluorescence
Implementation: lab issues

• Case assembly and release
  – Filling folders
  – Incomplete cases

• Double workflow (temporary)

• Adapt LMS
  – “Wanna see the slides” button
  – “Rescan slide” button
Implementation: workspace

- Screens
- Gizmos
Storage

• Short term storage on the scanner

• Mid-term storage on the image server

• Long term storage
  – UMCU: EMC Isilon solution (hard disk based, backup)
  – 800 TB of image data
  – seven years archive
  – scalable
  – permanent
Change management

• Clear mission and vision
  – Explain the why
• Regular plenary meeting and email updates
• Dealing with dinos
  – Big bang vs. smooth transition
  – Convince yourself
  – Incentives
  – Residents
• Training
  – Pathologists
  – Residents
  – Technicians
  – Secretaries
• Working groups
  – involvement!
  – influence
Project management structure

Steering committee
- End responsibility project
- Allocation resources
- Final decisions
- Escalation channel

Project group
- Control Project organization
- Monitoring planning and deliverables
- Decisions
- Planning, coordination, communication
- Safeguard issues and risks
- Rapport to steering committee

Working group quality
- Create training plan
- Define acceptance criteria
- Create test plans
- Coordination SOPs
- Coordination acceptance tests

Working group workflow
- Processes
- Rearrange lab to house scanners
- Perform acceptation tests
- Define acceptance criteria
- Emergency procedures

Working group image analyse
- Test image analysis software
- Advise on changes
- Integration LMS
- Perform acceptation tests
- Define acceptance criteria

Working group digital workspace
- Ergonomics workstation
- Workspace design
- PACS Workflow, worklist, viewer
- Storage
- Roll out clients
- Perform acceptance tests

Working group technology
- Architecture and integration
- Hardware
- Storage (archive)
- Installation PACS & Scanners
- 2D Barcodes
- Roll out clients, install workspace
- Backup, Recovery & Monitoring
- Migration Aperio images
- Perform acceptance tests
- Functional PACS maintenance

Project management structure
- Coordination, planning, communication
- Decisions, planning, coordination, communication
- Safeguard issues and risks
- Rapport to steering committee

Working group quality
- Create training plan
- Define acceptance criteria
- Create test plans
- Coordination SOPs
- Coordination acceptance tests

Working group workflow
- Processes
- Rearrange lab to house scanners
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- Emergency procedures

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- Architecture and integration
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- Perform acceptance tests
- Functional PACS maintenance
Our new workflow
Annotations and measurements
Annotations and measurements
Changing slides
Viewing slides side by side
Integration of image analysis

Wish list

- Mitoses
- Nuclear area
- Metastases finder
- Immune infiltrate quantification
- Tumor vs. stroma quantification
- IHC membrane scoring
- IHC % positive nuclei scoring
- etc
Advantages of digital pathology

- no more case assembly in the lab
- quicker diagnostics
- easy and more accurate measurements and counting
- better overview of tissue present
- flagging missing slides
- tracking viewing
- automatic linking of images/reporting/LMS
- MDM: quicker preparation, anywhere, show images
- easier making annotations
- easier taking snapshots
- no more slide searching
- no more archive digging
- multiple observer viewing
- quicker and easier consultation
- quicker revision
- integration of image analysis
- remote digital diagnostics (including consultation)
- integration with radiology
- integration of images in EPF
- allows working paperless
- better ergonomics
- teaching is easier and better appreciated
Issues to solve

- cytology implementation
- (birefringence)
- optimize viewer (tracking viewing)
- teaching new residents to use the microscope
- keeping storage affordable

- nationwide consultation and revision
- full integration of image analysis
- integration with radiology
- remote digital diagnostics business
Optimal, future proof platform for safe exchange of digital images between Dutch pathology labs

→ Rapid, low threshold revision, consultation, panels
→ Increase quality of diagnostics
Consultations, revisions: PIE

Lab A

message

images

Lab B

Log in

SECTRA
Pathology Image Exchange

Lab A

message

images

Lab B

Log in
Forget about the business case!

JUST DO IT.