Att arbeta med Standarder

Arbeta gratis
eller få andra att arbeta gratis
med din organisations utmaningar?

Standardisering Digital Patologi

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Standardiseringsansvarig VGR

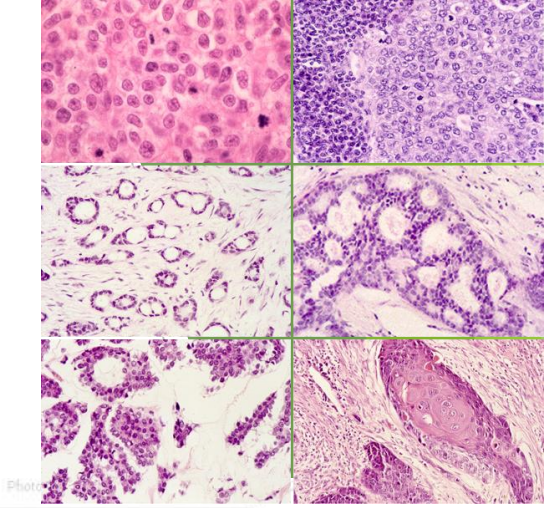
Ordförande DICOM WG26 Digital Pathology

Chair HL7 Sweden

Tk334 deltagare

ISO TC-215 Expert

Agenda



- Bakgrund
- Varför arbetar vi med standarder och vilka
- DICOM
  - Suppl 145
  - Suppl 122
- HL7
- Målbild
- AI
- Summering

Bakgrund

- 2005 beslutade DICOM (Digital Imaging and Communication in Medicine) att tas sig an Patologiområdet. Radiologidomänen hade börjat bli självgående vad gäller acceptans av DICOM som standard.
- Det etableras en arbetsgrupp som namnges WG26

- Utmaningarna är många då det redan finns en tröskel bland användarsidan, där tror man att det bara är att göra en Copy/Paste på radiologin och så är även patologin digitaliserad.
- Utmaningarna består av dels bilduppbyggnad men också att själva processen skiljer sig markant.
- Sedan 2012 har jag varit ordförande i DICOM WG26

Varför arbetar vi med standarder och vilka (inom Patologidomänen)

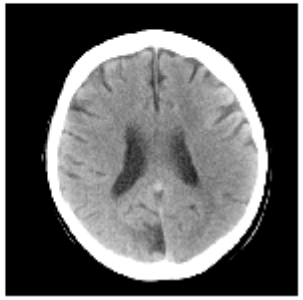
- Vad är en standard
  - En **standard** är en norm som gäller för alla aspekter av en sak (Wiki)
  - standard, (fastställd) norm; i tekniska m.fl. sammanhang dels standardiseringsresultat i form av beskrivningar, regler (normer) och rekommendationer för allmängiltig och upprepad användning, dels dokument innehållande sådana resultat (NE)
- Vi är många som står inför samma utmaningar och tillsammans hjälps vi åt och delar kunskap för att ta oss an utmaningarna (1+1=3)
- Vi arbetar främst med DICOM och HL7 sedan sätter vi samman dessa två utifrån användarscenarior och då bildas det IHE profiler

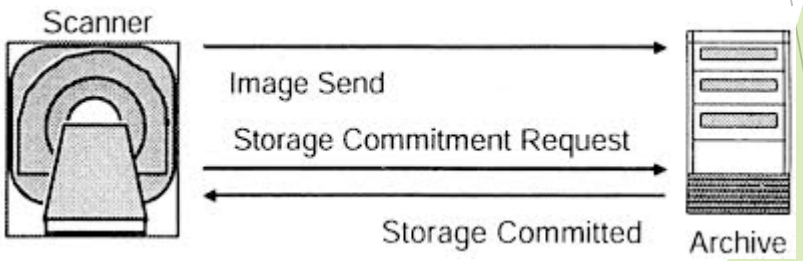
Vad är då DICOM

Basic DICOM

Patient Name:	James Kirk
Patient ID:	1701
Study Date:	22550401
StudyInstanceUID:	1.3.12.2.1.2000
SeriesInstanceUID:	1.3.12.2.1.2010
InstanceNumber:	11

PixelData:





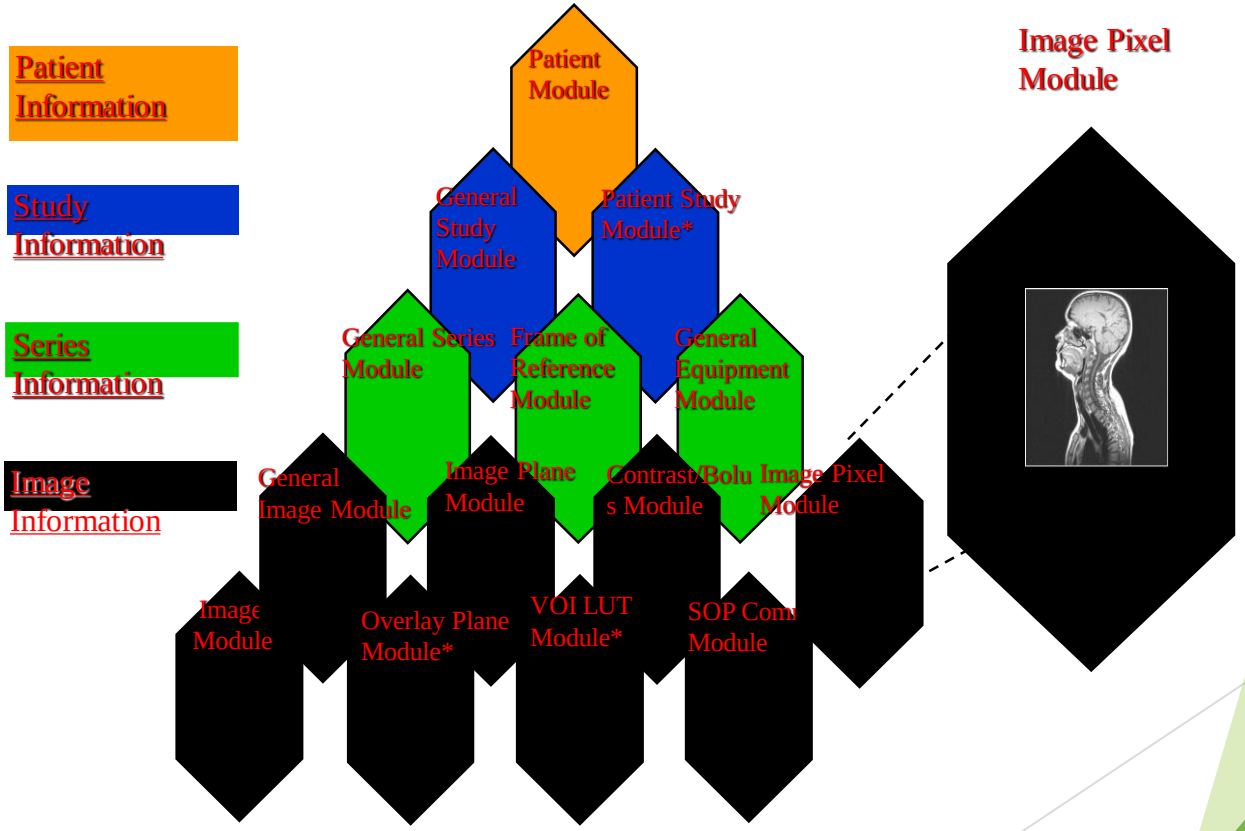
DICOM Image object .dcm

Header/ metadata →

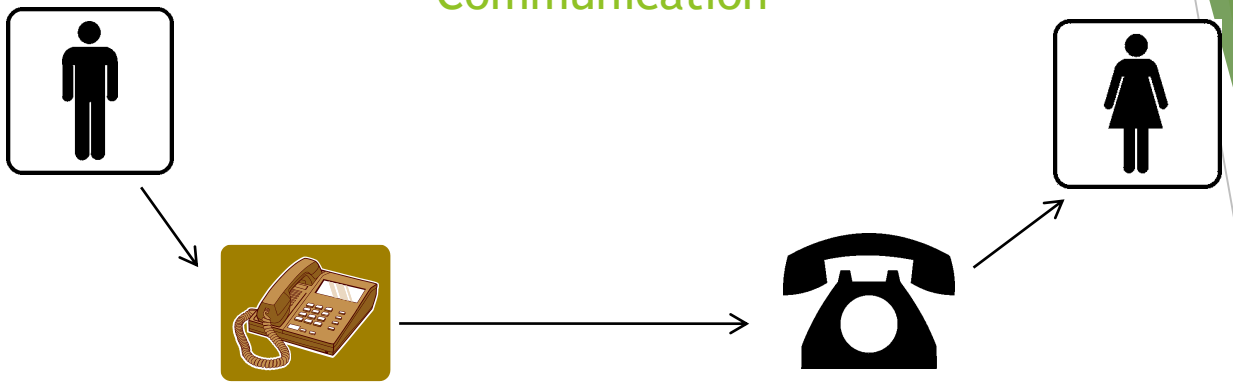
(0010,0010) Patient's Name PN 1, (0010,0020) Patient ID LO 1
(0010,0021) Issuer of Patient ID LO 1,
(0010,0030) Patient's Birth Date DA 1
(0010,0032) Patient's Birth Time TM 1,
(0010,0040) Patient's Sex CS 1

Image format .jpg etc →

The DICOM composite instance IOD information model.



Communication



User/Provider
Transfer Syntax
Application Context

Dial 0-12-34-56789 ---- > Pick Up
←----------Guten Morgen
Hi, how are you? ---------- ?!?
←-------Good Morning
Is this the shopping Mall?------
→
←-----------Yes, it is

Function:
Role
Language

Subject

nmunication

DICOM → DICOM

AE 2

DICOM Term
Abstract Syntax Association, open Exchange DIMSE´s/IOD´s

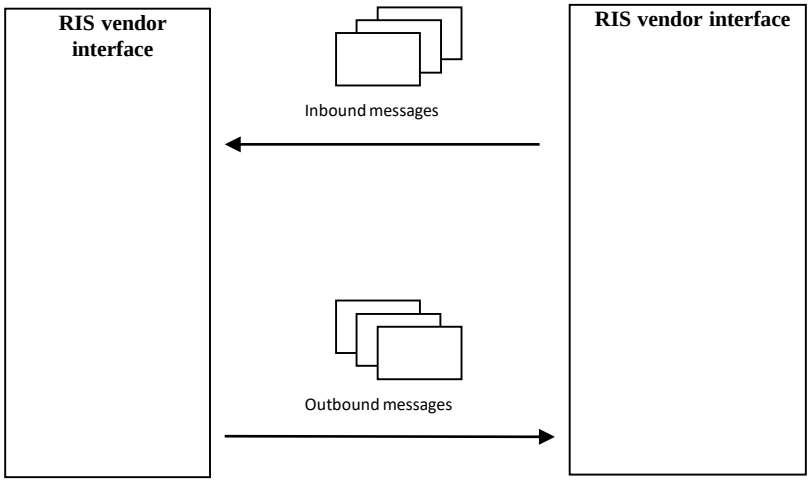
SOP Class UID (CT_Store, CR_Store….)
Exchange Objects using DIMSE services (CT_Store Mrs Jones…)

Function : Specifics
Call establised
Subject

HL7
Vad är detta

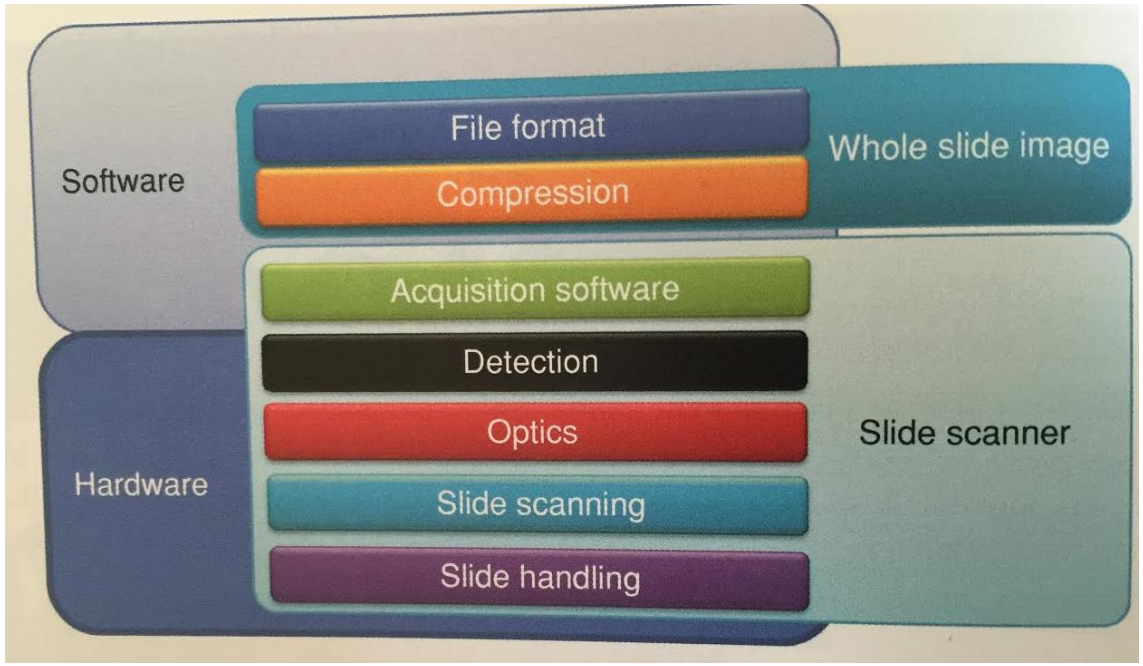
Health Level 7 refererar till Health Level Seven, Inc, en icke vinstinriktad organisation som driver standardarbete inom hälso- och sjukvård. HL7 används även för att hänvisa till de standarder som skapats av organisationen, exempelvis HL7 v 2.x HL7 v 3.0 HL7 RIM.

Standarder HL7 ver 2.x är en meddelandestandard

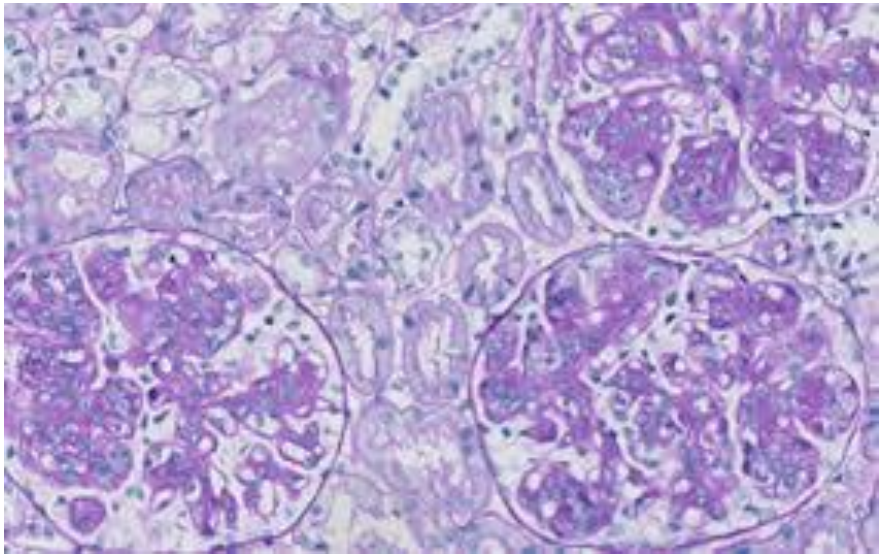


Digital Patologi

Under huven på EN av alla leverantörers skanners



”En standard många tolkningar”



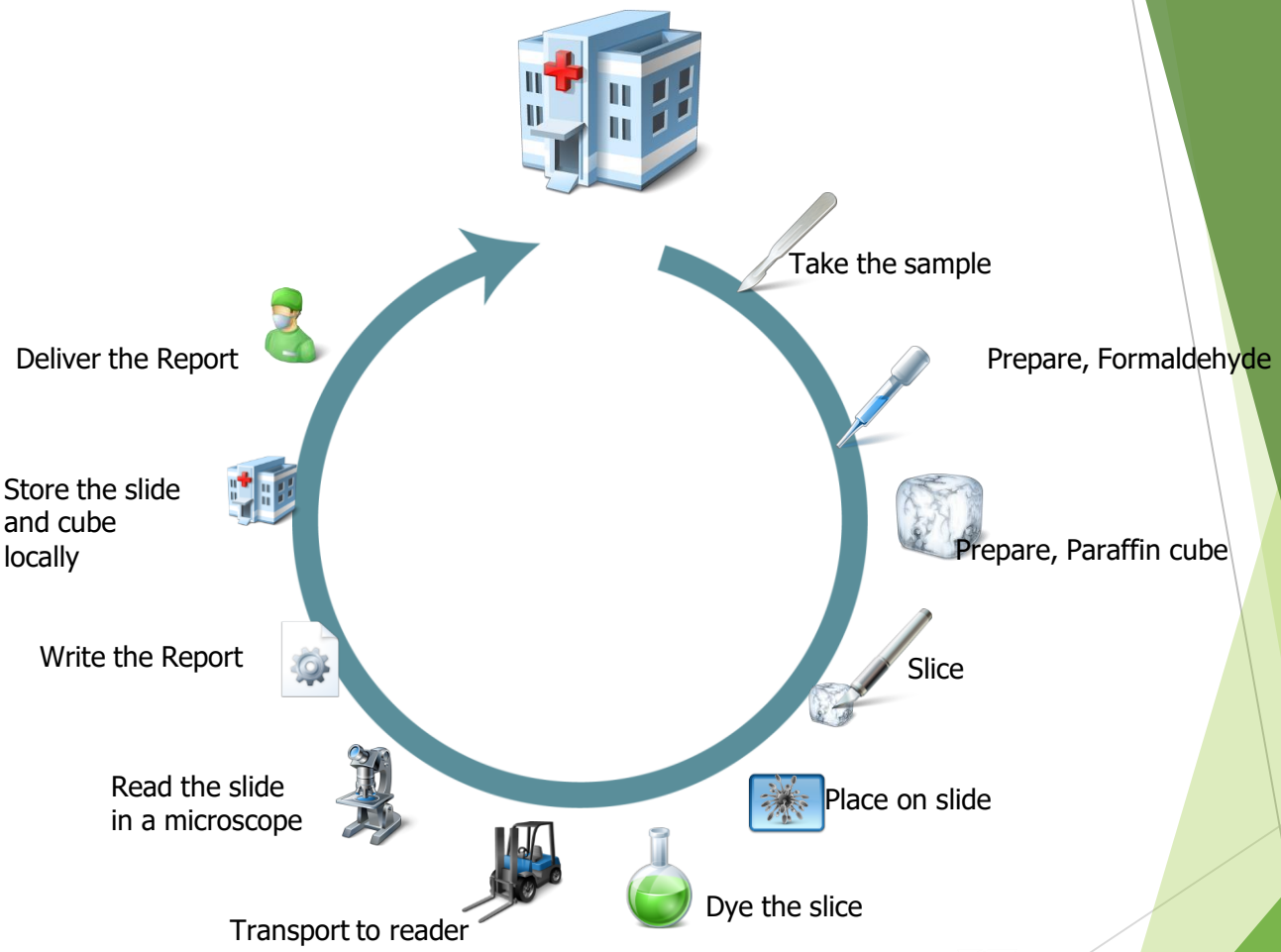
Översikt av 9 olika skanners

1	2	3	4	5	6	7	8	9	10
OME-tiff.	.svs	.bif	.ndpi	.mrxs	.vsi, .ets	.czi	.zvi	Compression	
Image planes stored within one multi-page TIFF-file.	Single file TIFF-format. Always tiled	Single file BigTIFF format	Single file TIFF format. Unlike other TIFF don´t uses the TIFF´s tile format. Every directory contains a jpeg image, stripped.Max img 65536x65536. Over this .ndpi sets the width and height to zero.	Multi file JPEG format with propriertary metadata and indexes. JPEG images are packed into small # of data files.	Based on wll known TIFF image file format. Contains a chain of custom metadata.	Designed to be so close to Open Microscopy envirement OME specification.	Standard OLE compund file containging storage named image fot the cointainer image and commonly used information.	JPEG (libjpeg), JPEG, JPEG 2000, CMW (wavelet), Lossless. BMP, PNG, LZW etc	
Complete OME-XML metadata block	Tile size 240x240 Second image Thumbnail, 1024x768 pix, stored in strips	First directory label image. Directory definies XMP tag 700 stores valid metadata	Restarts marker are placed inside tje JPEG stream to support random access reading		.vis can contain multiple regions within the same psysical slide	The XML schema definition XSD was defined to exhibit maximun compability with the OME tiff and XML data formats	The image data (pixel array) items are contained in substorages named items		
	Always compressed	BIF images contain overlapping tiles. Need approproate algorithm to correctly render them							
	Optional slide label image	Rendering algorithm calculates global coordinates for every tile.							

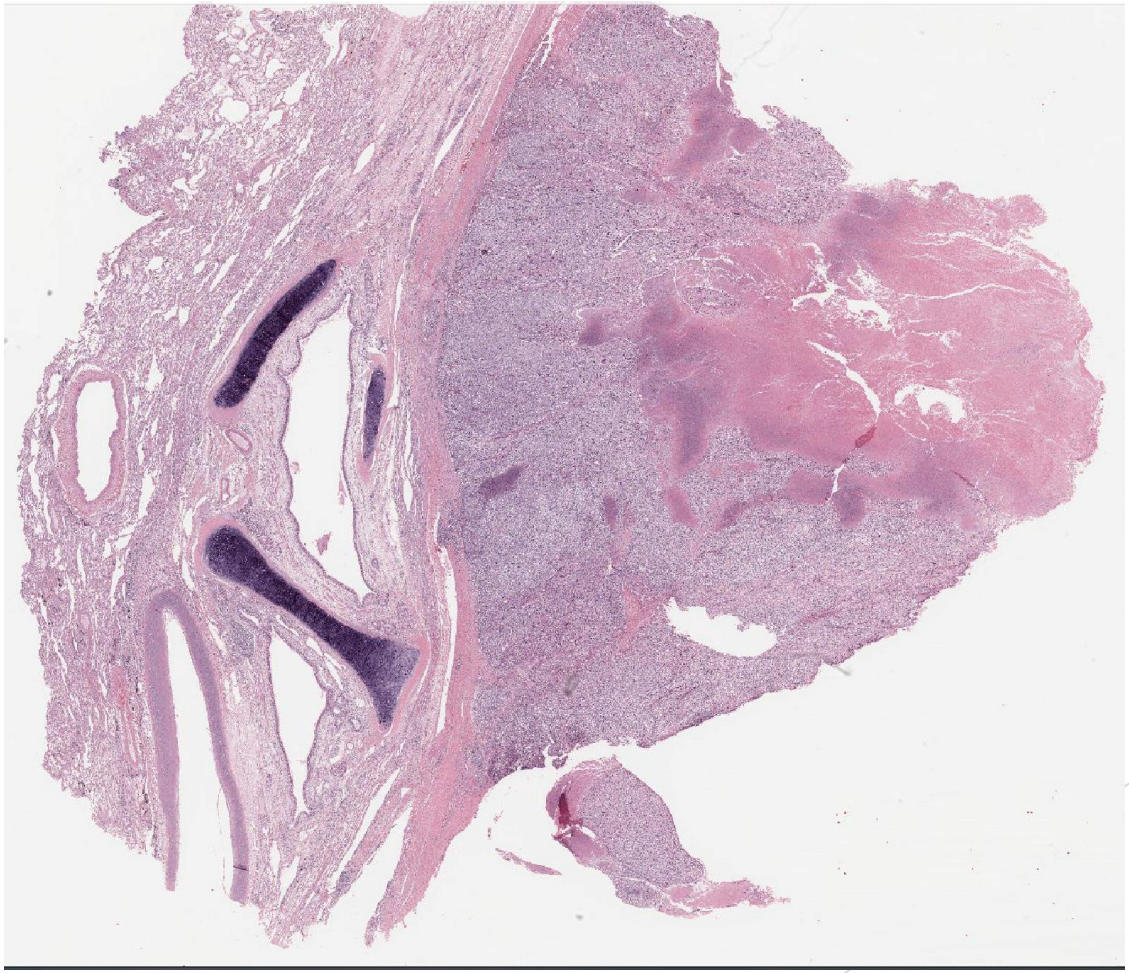
Utmaningar

- Då skannade glas kan bli väldigt stora datamängder önskar man kunna komprimera data och hur skall man göra det så att alla leverantörer vet hur man skall ”dekomprimera” för att kunna läsa data?
- Lossy vs lossless
- Lossy, dataförlust och du kan inte återskapa orginaldata
- Lossless, förlorar ingen information när du dekomprimerar

Arbetsflöde



Tillämpning av DICOM inom Patologi



Två huvuddelar i DICOM gällande Patologi

Two supplements

- 1) Supplement 122: Specimen Module and Revised Pathology SOP Classes

- 2) Supplement 145: Whole Slide Microscopic Image IOD and SOP Classes

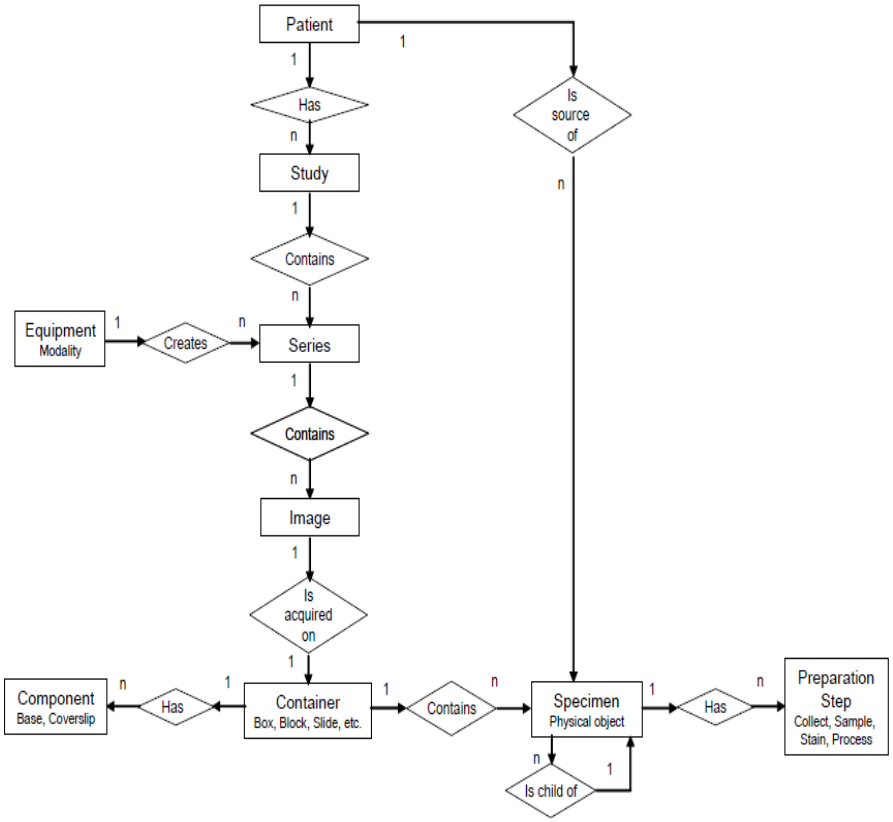
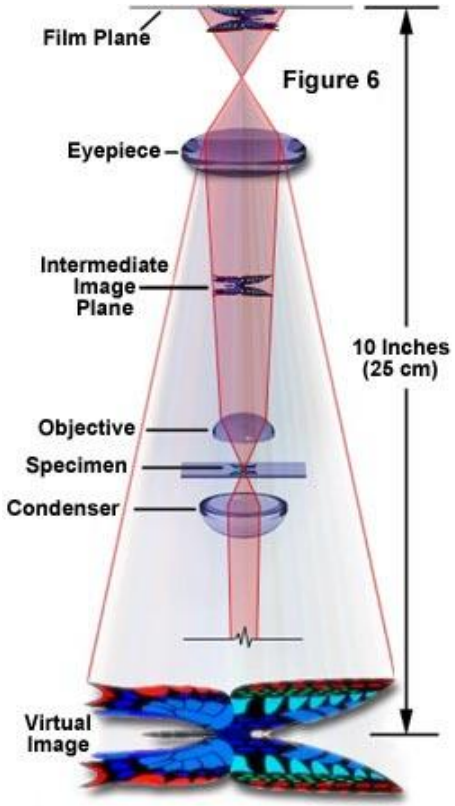


Figure SS.3-1 Extension of DICOM E-R Model for Specimens

…conventionel microscopy…

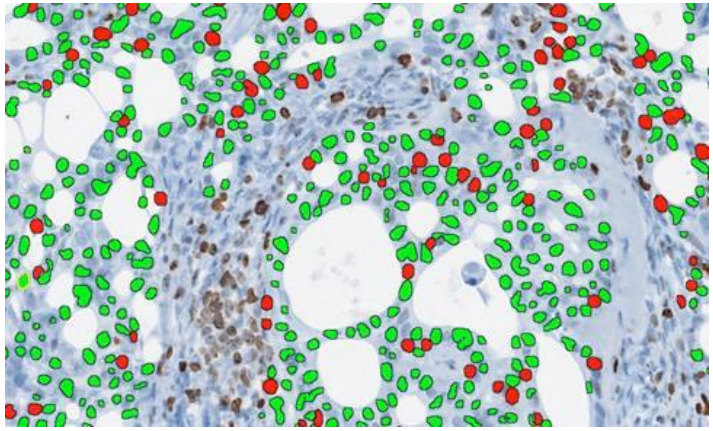


- **Light:**
- Reflected shinethrough
- **3 lenses:**
- Magnification
- Reduce artefacts
- **Staining:**
- Need contrast

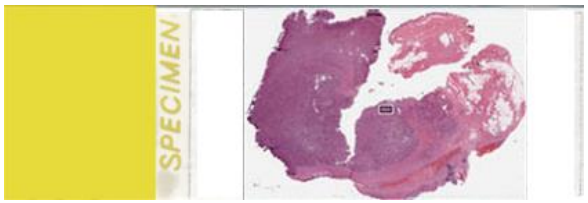
Tittar inte direkt på objektet utan det är en speglad bild som skapas ca 10cm under glaset med vävnad.

DIGITAL PATHOLOGY

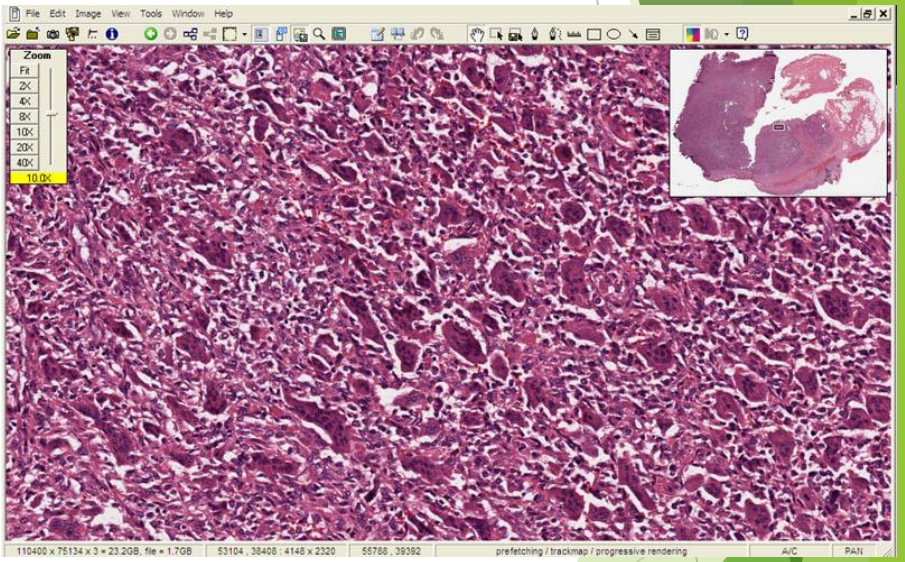
Suppl 145



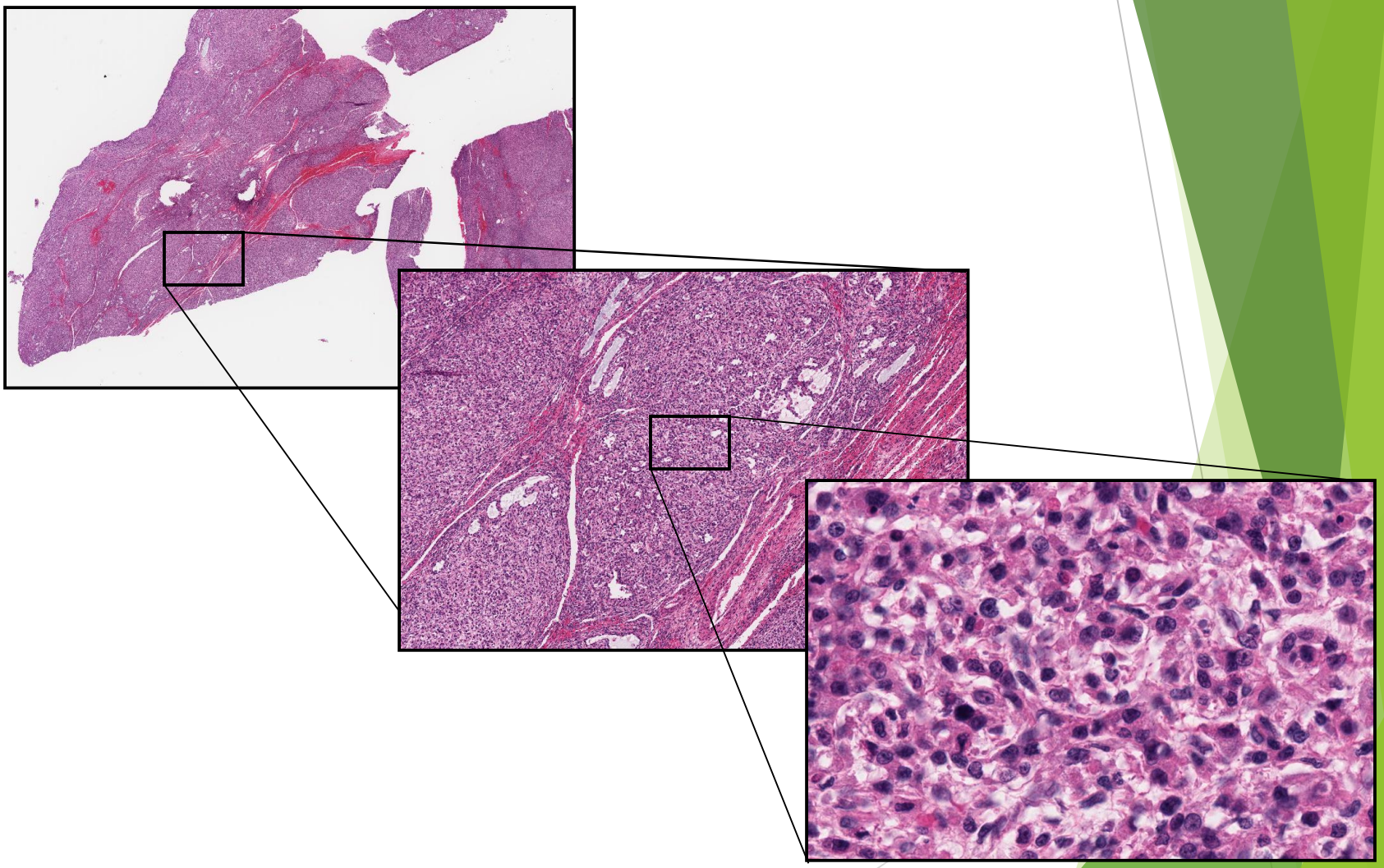
Whole Slide Imaging (WSI)



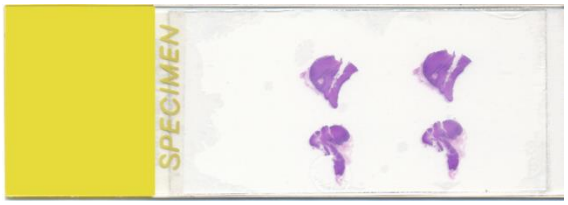
Scanner

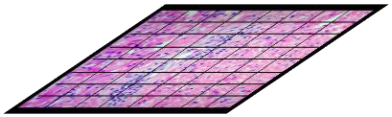


Utmaningar vad gäller upplösning



Bildstorlek



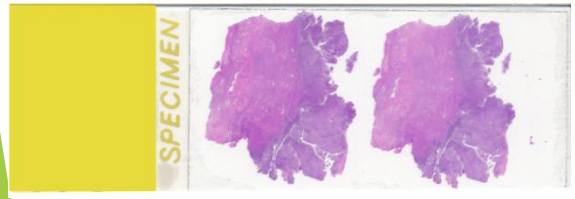


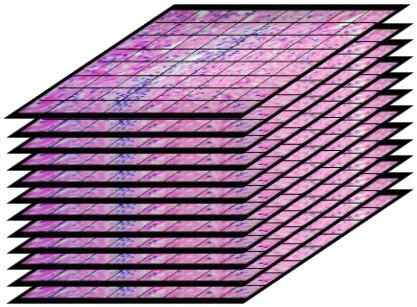
1 focal plane

24 bit color

40x magnification

15 Gigabytes





10 focal planes

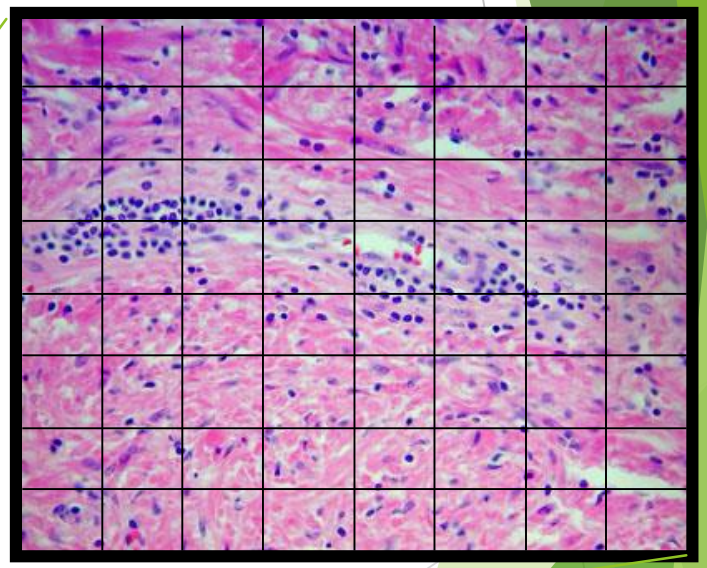
24 bit color

40x magnification

3.75 Terabytes

Tiling and Multi-frame encoding

- Whole Slide Image divided into tiles
- Each tile encoded into a frame of multi-frame image object
- Per-frame header gives spatial location for each tile: X, Y, and Z (focal plane)



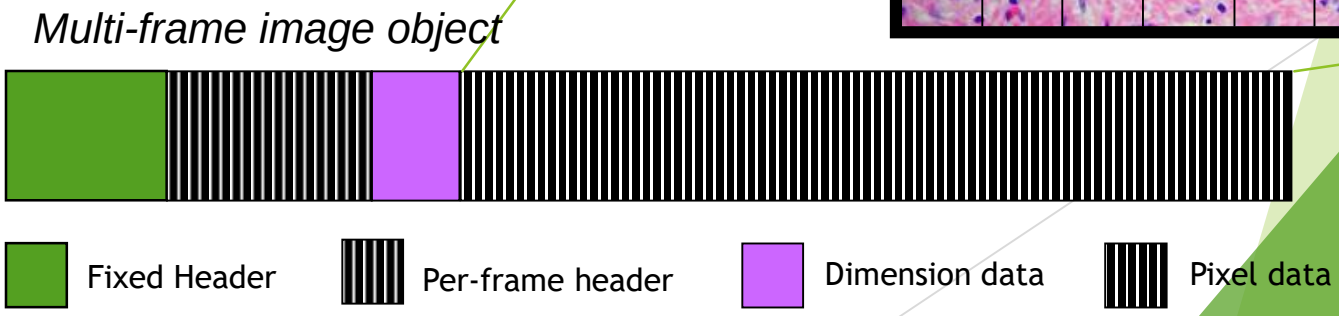
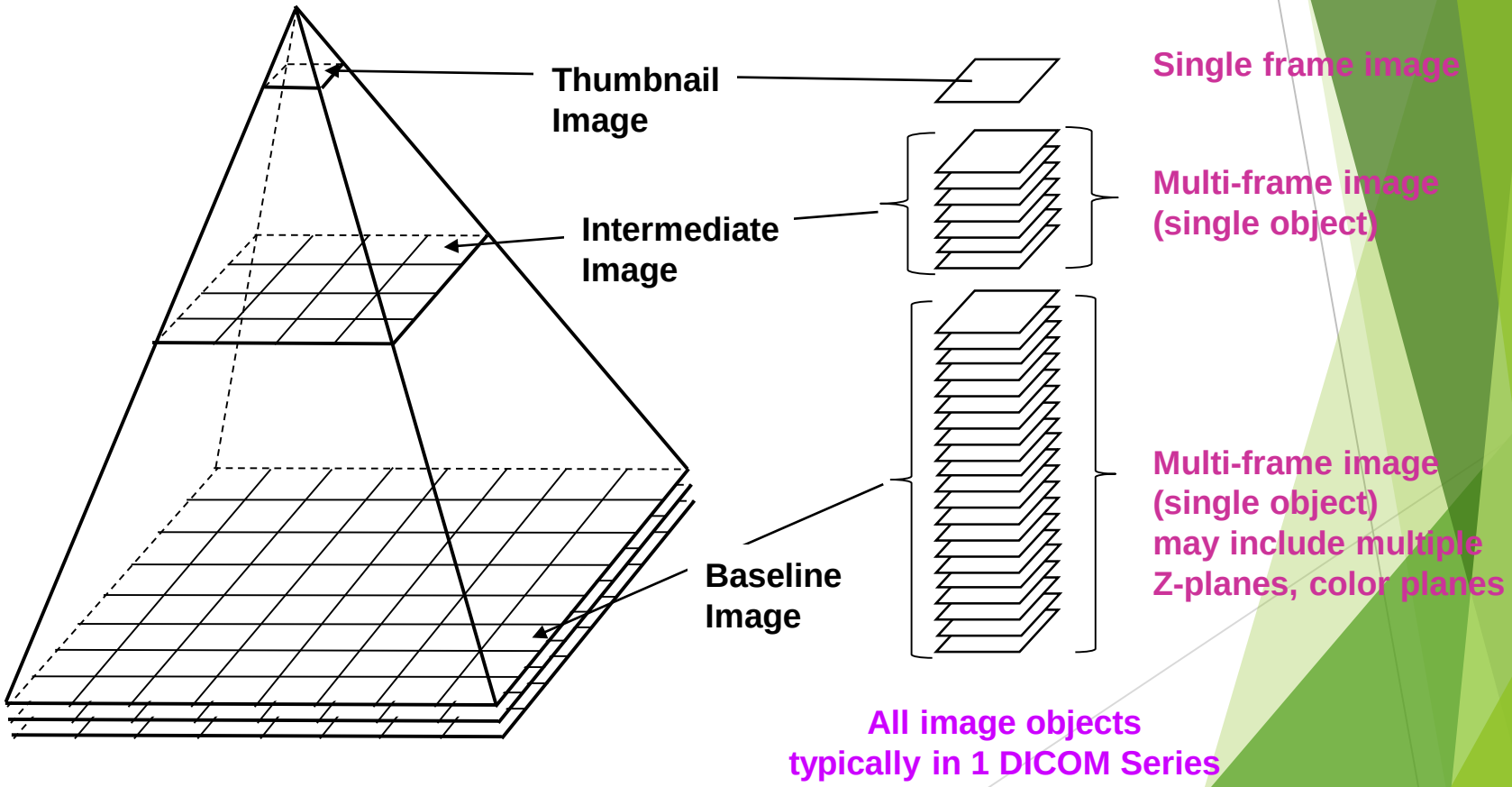
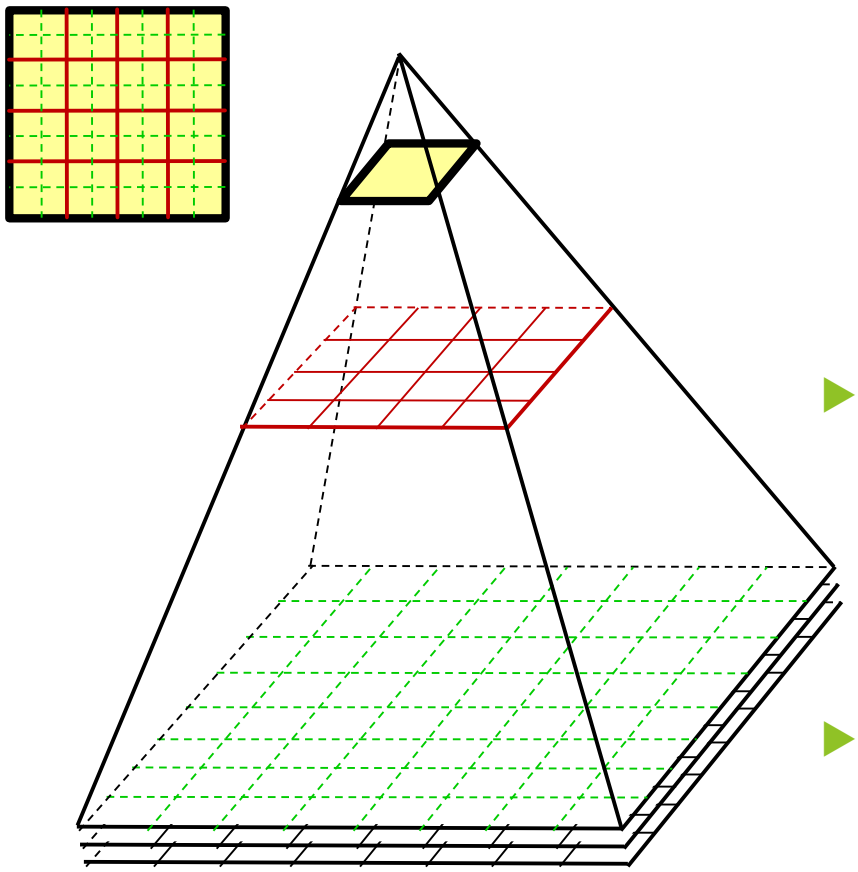


Image Pyramid



Localizer image “flavor”



- Thumbnail image (single frame) plus navigation links to each frame at each resolution
  - Each tile of other resolution images has its corresponding area identified in thumbnail
- Full description of target tiles
  - Object Unique ID and frame number
  - Resolution
  - Z-plane, color
- Multiple target frames can overlap
  - Different resolution, Z-plane, color, etc.
- Presentation and any interactive behavior is not defined in standard

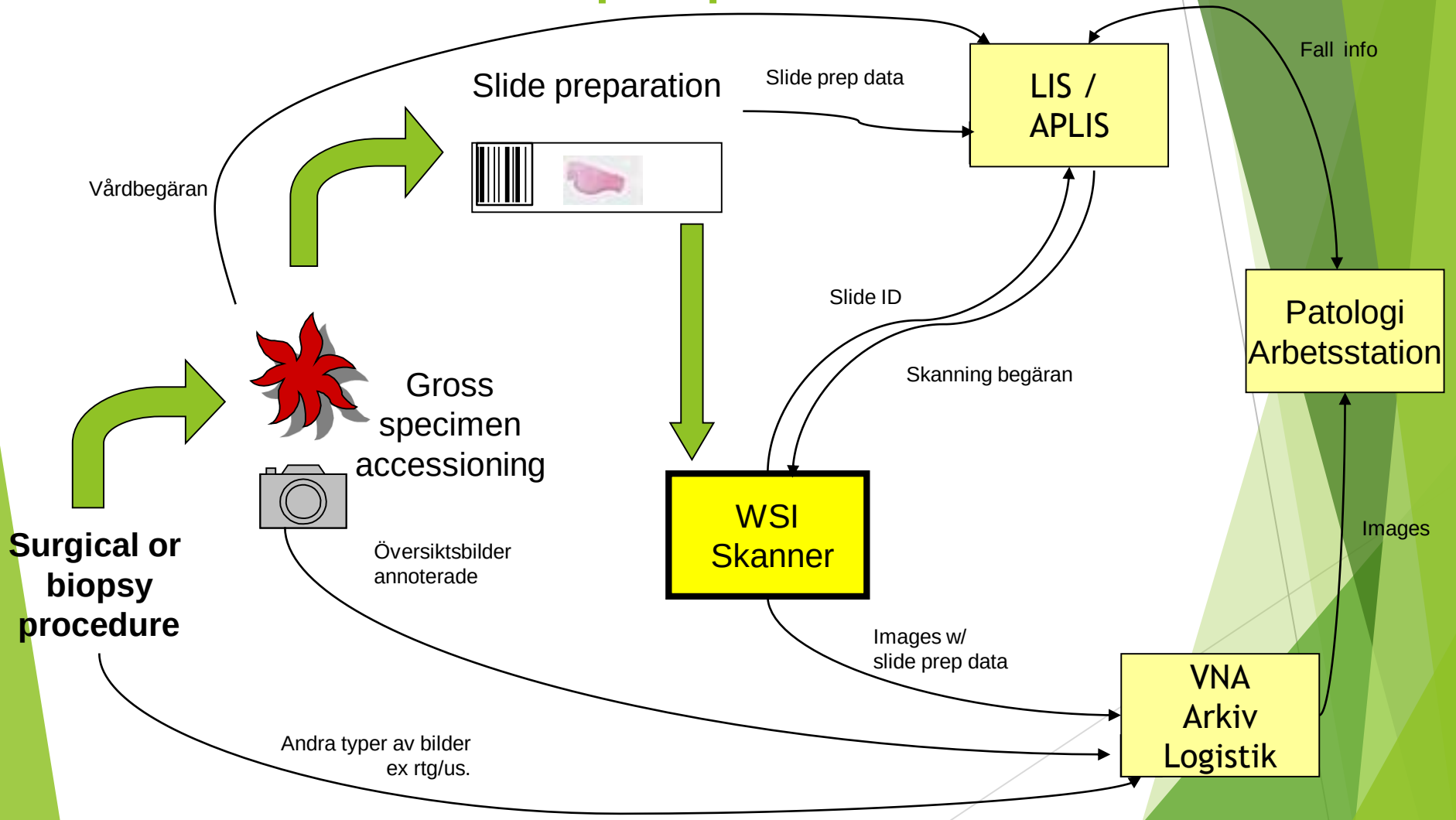
IHE INTERNATIONAL | Integrating the Healthcare Enterprise

Integrating the Healthcare Enterprise, IHE, är ett initiativ drivet av yrkesutövare och industri för att ge rekommendationer för systemintegration inom hälso- och sjukvård. Det finns idag ett relativt brett stöd för IHE:s integrationsprofiler i olika hälso- och sjukvårdssystem. Över 200 produkter har stöd för en eller flera av IHE:s integrationsprofiler.

IHE sponsras av Healthcare Information and Management Systems Society (HIMSS), Radiological Society of North America (RSNA) och American College of Cardiology (ACC).

Många refererar till IHE som en standard, men mer korrekt är att den anger rekommendationer för hur man skall tillämpa olika standarder, huvudsakligen DICOM och HL7, men även andra, som exempelvis syslog. I flera situationer ställer IHE högre krav än den underligganden standarden.

Arbetsflöde (grovt) efter pre-prep



HL7
Behövs för att ”föda” bilderna med rätt metadata

Copy of DICOM122 vs HL7SpecDAM_HL7V2MapAdded_GH (1)

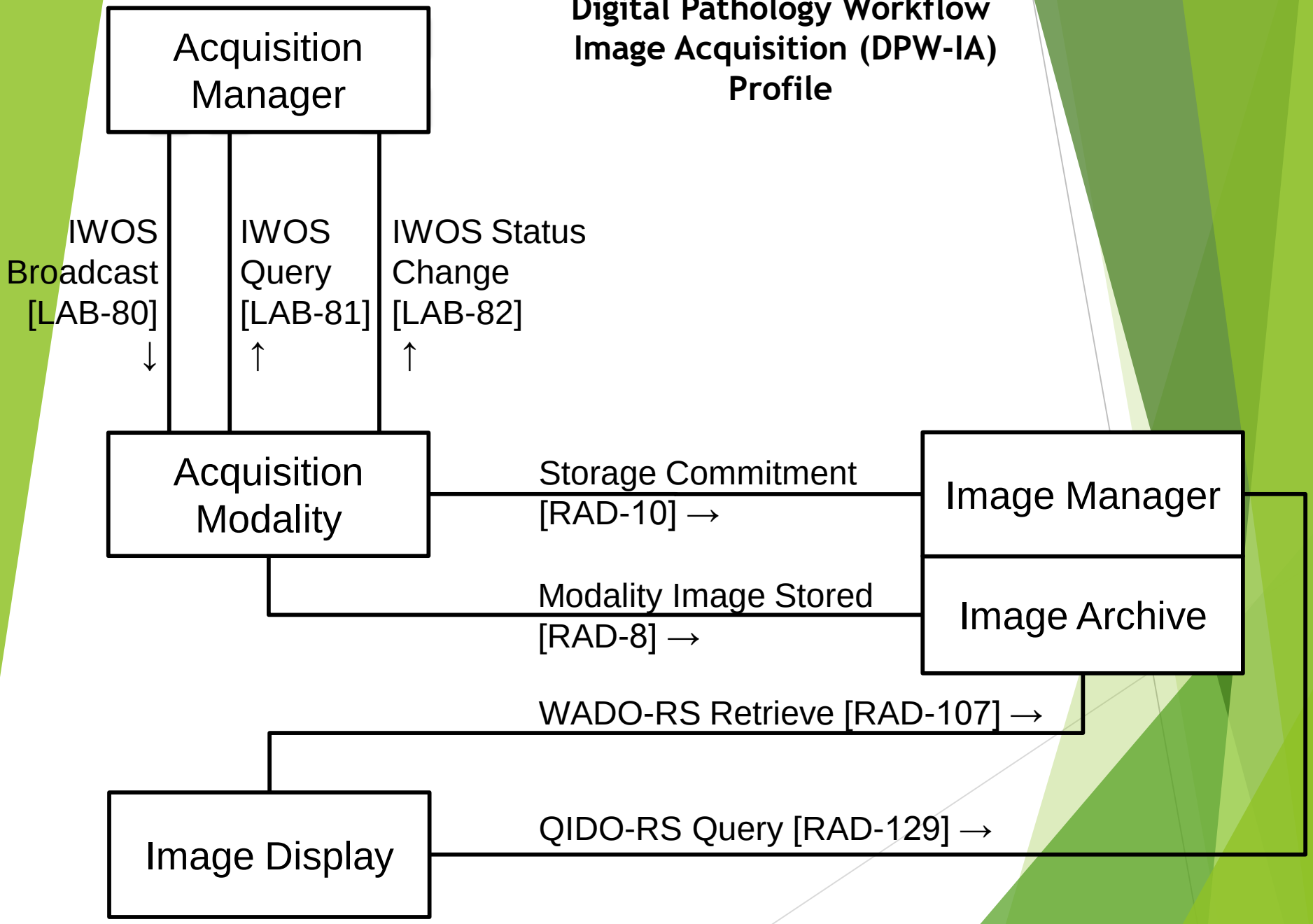
Arkiv Redigera Visa Infoga Format Data Verktyg Tillägg Hjälp

Dela

Direction

A	B	C	D	E	F	G	H	I	J
Direction	DICOM	Type	Code	HL7	HL7 Title	DICOM Title	Example	Notes	
bound (LAB-80)	(0010,0020)	Type 1	PID-3		Patient ID	Patient ID	12345~98765^^^SSN		
bound (LAB-80)	(0010,0010)	Type 1	PID-5		Patient Name	Patient's Name	Ummy^Daniel^^^Mr		
bound (LAB-80)	(0010,0030)	Type 1	PID-7		DateTime Of Birth	Patient's Birth Date	20011222		
bound (LAB-80)	(0010,0040)	Type 2	PID-8		Administrative Sex	Patient's Sex	M		
bound (LAB-80)		Type 2	ORC-2		Placer Order Number		123456789	Unique ID request for the digital scan (IWOS ID), must match OBR-2	Should we use ORC-4 to group the scan requests together?
~~bound (LAB-80)~~		~~Type 2~~	~~ORC-7.6~~		~~Priority (0-1)~~		~~1~~	~~STAT or not. Gets into Scanner Control but upstream data systems represent source. Minimal use at the moment.~~	
bound (LAB-80)	(0040,2016)	Type 1	OBR-2		Placer Order Number	Placer Order Number / Ima	123456789	Unique ID request the digital scan (IWOS ID)	
		Type 1	OBX-5 or IPC	R	Study Instance UID			Study Instance globally UID (1:1 related to accession # generally)	
bound (LAB-80)		Type 2	OBR-3		Filler order number	Acquisition UID	(blank inbound or might be provided to the acquisition modality)	place to store the future SCAN UID. THE HL7datatype requires the assignign authority to be present - it can be done using the namespaceID or a universalID plus the UID ID type	
bound (LAB-80)		Type 2	OBR-4	R	Universal service identifier		SCAN20x or SCAN40x	Required by HL7 for the order message (might be hard coded) and represents procedure codes, value set to be agreed to by vendors during implementation	
		Type 1	TBD		Barcode	Barcode Value	\SP19-000425 B2 L1\	Might be slide Unique ID with control characters	
		Type 1	SPM-2		Glass Slide ID	Container Identifier	SP19-000425 B2 L1	Slide Unique ID	
		Type 2	SPM-31 or OBX-3 (see open issue #12)		DisplayIdentifiers		\SP19-000425 B2 L1\^^^Beaker^Barcode~00001^^^Beaker^SortForDisplay~SP19-425-B2-L1^^^Beaker^DisplayID	Will be repeated for Glass Slide ID, Block ID, Parent Specimen ID as needed (optional sort order / display order)	
		Type 1	SPM-2		Block ID		SP19-000425 B2		
		Type 1	SPM-3		Parent Specimen ID		SP19-000425-B	Container (Bucket) Unique ID	
		Type 1	SPM-31		Specimen UID	Specimen UID	1.2.3.23.34.23.3	Specimen OID	
	(0008,0050)	Type 1	SPM-30		Accession number	Accession Number	SP19-000425	Case Unique ID	
bound (LAB-80)		Type 2	SPM-17		Collection DateTime	Study Date & Study Time	201902231200	Collection Date/Time (Date of Service)	201901301510
			ORC-9		Ordering DateTime		201902301222		
~~bound (LAB-80)~~		~~Type 2~~	~~OBR-32~~		~~Principal Result Interpreter~~		~~AssignedPathologist_ID~~		
~~bound (LAB-80)~~		~~Type 2~~	~~OBR-33~~		~~Assistant Result Interpreter~~		~~SecondPathologist_ID~~		
			SPM-6		Specimen Additive		434162003 | Neutral buffered formalin (substance) |	this field repeats paraffin embedded could indicate the fixative used for the block here	BF10 (Buffered 10% Formalin) from HL7 table 0371 could also be used
			SPM-27		Specimen Container Type (like CID 8103)		Glass Slide with coverslip		
bound (LAB-80)		Type 2	SPM-4		Specimen Type		119376003 | Tissue specimen		

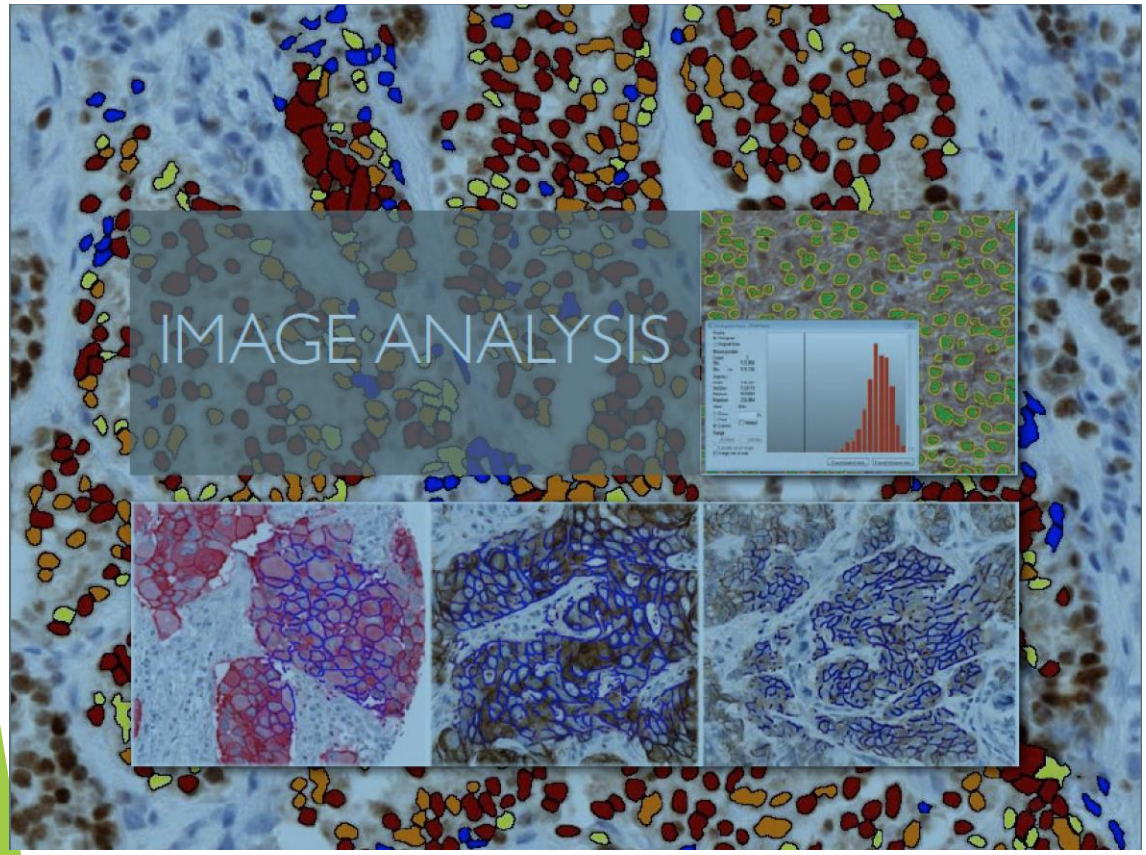
Digital Pathology Workflow Image Acquisition (DPW-IA) Profile



HEALTH

Image Analysis

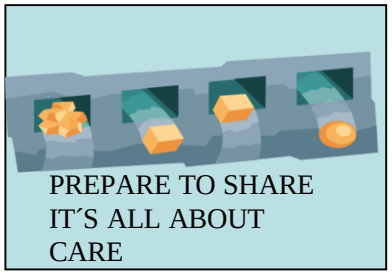
”AI”

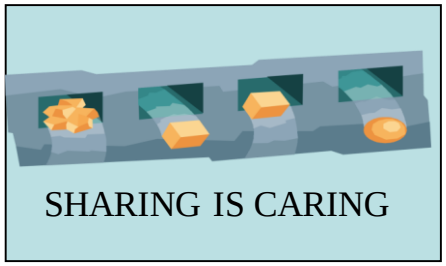


Varför digitalisera Patologin med hjälp av standarder?

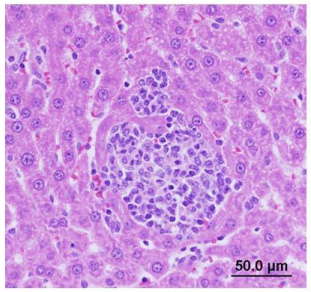
- Oberoende av tid och rum
- Dela bilder i “nätverk”
- Etablera nya analysmetoder
  - Datorbaserad screening av gyn-cellprover
  - Bildanalys av specialfärgade vävnader
  - Beslutsstöd för diagnos
- Framtidssäkra informationen

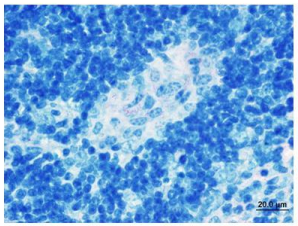
Sammanfattning

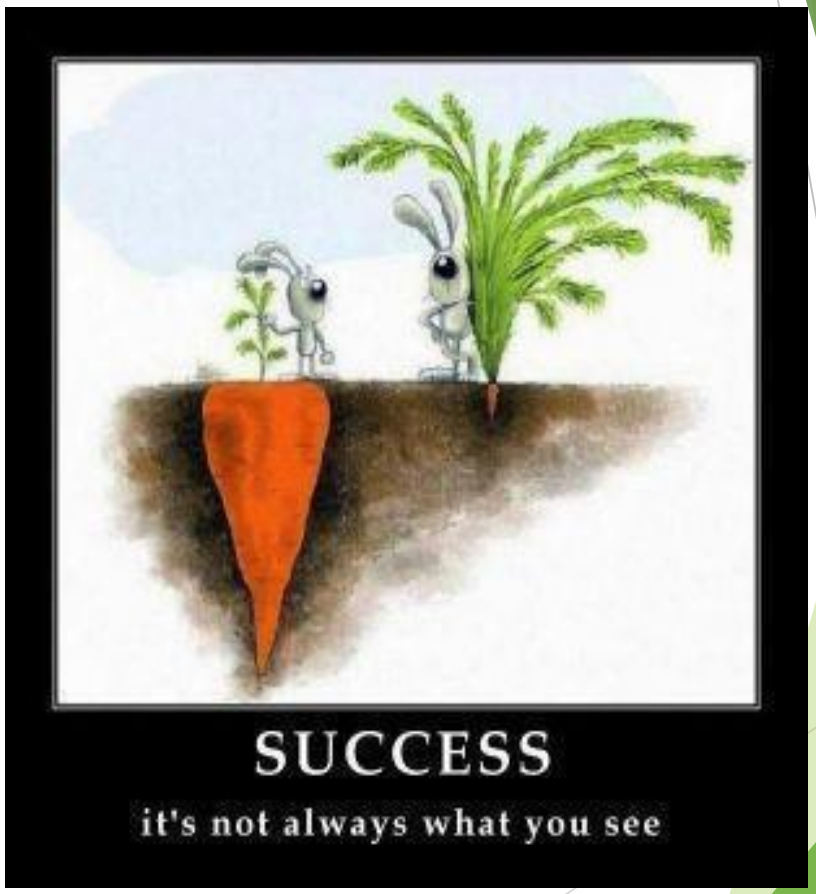




Kom ihåg!







But everybody will be a part of it !