Introduction to DICOM

How to teach yourself this skill



About the Presenter

- Biomed since 1996
- Worked in Imaging support since 96
- First Implemented Merge systems / DICOM 2.0
- Instructed DICOM for College credit – 2 schools
- Currently Working in the field of Imaging - VA Imaging BESS

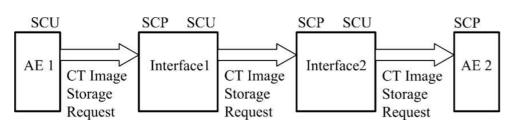
What is DICOM?

- Digital Image and Communications in Medicine. (DICOM)
- Public Use, Open-Source Communication Protocol
- A technique for transmitting, storing, and displaying medical images
- Expanded to processing, overlaying, and reporting changes
- Creates a unique folder and file that does not have name conflicts if transferred anywhere.
- Allows for Private data OEM "Trade Secrets"
- Continually added to and updated.



How Does DICOM work?

- Server, Workstation, Modality
- <u>AE title, IP address, Port</u>
- Requirements found in a Conformance Statement
- Users vs Provider Roles (SCU vs SCP)
- Accession Numbers
- A Header and an Image



Dicom Con	nections		GE Healthcare Austria	
	10		DICOM®	
Server Name	~		Conformance Statement	
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			Revision 3.0	
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Port	1024		VOLUSON" S6/S8 11.x.x/12.x.x/14.x.x/15.x.x/SPC310	
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StudyID

SeriesNumber

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InstanceNumbe

0020.0010

0020,0011

0020,0013

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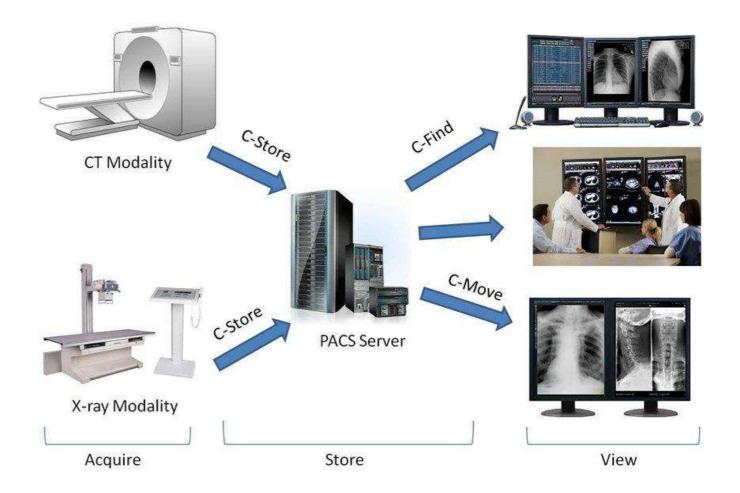
0020,0037

0020,0052

Accession No:

What Does a DICOM Network look like?

- A modality takes an image (SCU)
- It stores the image on a server (SCU / SCP)
- A workstation finds and copies the image (SCU / SCP)
- A radiologist "reads" the image



What are we going to do today?

Let's build a DICOM network

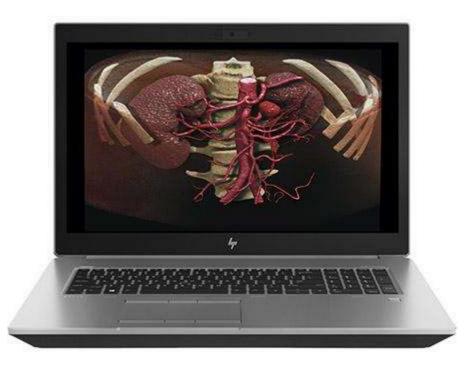
On one Laptop....

Using the same login....

With the software already installed...

Ok.. We are just walking through the setup...

Deep breath... let's dive in!



Setting up a test DICOM server – Use ConQuest

ConQuest DICOM server 1.4.16beta - CONQUESTSRV1		ConQuest DICOM server 1.5.0 - CONQUESTSRV1 - 🗆 🔀
Configuration Installation Maintenance Known DICOM providers Browse database Server status Query / Move		Configuration Installation Maintenance Known DICOM providers Browse database Server status Query / Move
This screen contains essential parameters for operation of the ConQuest DICOM server. Local unique name of this DICOM server (application entity, AE) : CONQUESTSRV1	Save configuration	/* ***********************************
TCP/IP port to use (other DICOM systems must know this number) : 5678	Restore original configuration	<pre>* AE name, (IP adress or hostname) and port number. The * * first entry is the Conquest server itself. The last ones * * with * show wildcard mechanism. Add new entries above. * *</pre>
Local disk directory to store DICOM images : E c: [softpedia]		<pre>* The syntax for each entry is : * * AE <ip adress host="" name=""> port number compression * * * For compression see manual. Values are un=uncompressed; *</ip></pre>
Enable JPEG(2000) support Images on disk are stored:	Install server as NT service	<pre>* ul=littleendianexplicit,ub=bigendianexplicit,ue=both * * j2=lossless jpeg;j3j6=lossy jpeg;n1n4=nki private * * js =lossless jpegLS; j7=lossy jpegLS * * jk =lossless jpeg2000;j1=lossy jpeg2000 * * J3NNj6NN, JLNN or J7NN overrides quality factor to NN% *</pre>
Uncompressed NKI compressed O JPEG or NKI	Uninstall server as NT service	* J3NNj6NN. JLNN or J7NN overrides quality factor to NN% * * * * * * * * * * * * * * * * * * *
C Lossless JPEG C Lossy JPEG C Lossless JP2000 C Lossy JP2000 C JPEG or Uncompressed		CONQUESTSRV1 127.0.0.1 5678 un V* * 1234 un
Images on disk are named:		V = 1234 un V = 4666 un S = 5678 un
C DCM (standard format) Cleanup disk below: (MB)	Hide the server (as tray icon)	Hide the server (as tray icon)
Cleanup nightly below: (MB)	About this server	About this server
Below 0 MB, move to: Image: C:\\dicomserver1416beta\Data Image: Keep Server Alive Free disk space: 26112 megabyte	Close the server	Close the server

https://image-systems.biz/products/free-dicom-pacs-tools/conquest/

Warning : Install this DICOM software in a folder on the root of your hard drive (c:\)

In "Known Providers" – Always Use the keyboard Tab and Enter Keys

Setting Up a test DICOM Workstation – GinkGo CAD

File Edit View Series Tools Help Image: Show history Alt+h Image: Show history Alt+h Image: Open file Alt+f Image: Open file Alt+d Image: Open file Alt+d	Settings	DICOM Node DICOM Node Workli	
Open file Open folder Open folder Alt+d Open folder	⊡- Ginkgo CADx General		
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http://ginkgo-cadx.com Remember that when you buy Ginkgo CADx Pro, you are Powered by MetaEmotion Healthcare	DICOM Nodes are	Retrieve method	Move 🖌
	most important	WADO URL	
🥘 0 running tasks. 🥵 👘		Retrieve mode	Series 🗸

Reuse connection

Test connection

Accept

Cancel

https://ginkgo-cadx.com/en/

Set AE title, IP and Port for the Workstation into the server "Known Providers" tab and server AE title, IP and Port into the workstation "DICOM Node".

Adding a Modality – Usually in the field

General	Store	C-Store	Worklist	MPPS	Print	
Peripheral	Service	List D	icomStore			
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	Conn	ect Timeout	(sec) 10	Re	peat Count	2
Exit	Dims	e Timeout (s	sec) 10	Ac	se Timeout (sec) 30
		Send After I	Every Image	Stored		
		Send At End	l of Exam			Appl

- Set up like a Workstation
- Usually works just as an SCU
- May have special requirements check the Conformance Statements
- May do a storage, or other functions like Storage Commitment (STC), Worklist (most common), printing, and Modality Performed Procedure Step (MPPS).

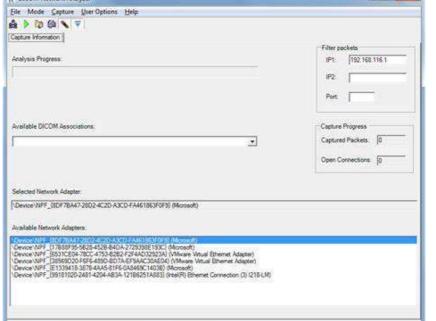
Troubleshooting DICOM

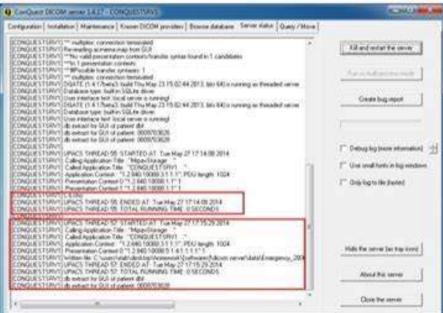
Ping

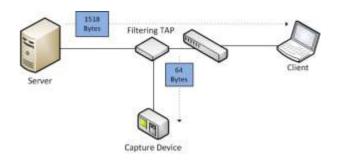
Echo

- TCP/IP Ping
- DICOM Echo
- Server Status in ConQuest
- Debug Logs
- DVTk Network Analyzer
- WireShark
- Conformance Statements https://www.dvtk.org/downloads/

Command Prompt	-	×
Microsoft Windows [Version 10.0.18362.900] (c) 2019 Microsoft Corporation. All rights reserved.		^
C:\Users\gabri>ping 192.168.1.1		
Pinging 192.168.1.1 with 32 bytes of data		
Reply from 192.168.1.1: bytes=32 time=2ms TTL=64 Reply from 192.168.1.1: bytes=32 time=3ms TTL=64		
Reply from 192.168.1.1: bytes=32 time=3ms TTL=64 Reply from 192.168.1.1: bytes=32 time=3ms TTL=64		
Reply from 192.168.1.1: bytes=32 time=2ms TTL=64		
Ping statistics for 102 160 1 1.		
Packets: Sent = 4, Received = 4, Lost = 0 (0% los	5),	
Ap		
Minimum = 2ms, Maximum = 3ms, Average = 2ms		
C:\Users\gabri>		
c. (osci s (gubi 1)		







No.	17830	Source	Destination	Protocol	Sec.	Dst.	brio
45	15,267502	192,168,222,1	197.168,222,129	DICOM	2550	104 //	A-ASSOCIATE request SCU -+> SCP
- 46	15,269415	192,168,222,129	192,168,222,1	DICOM	104	1550	A-ASSOCIATE accept SCU K++ SCP
49	15,485986	192,168,222,1	192.168.222.129	DICOM	1550	104	P-DATA, C-ECHO-RO
51	15,486850	192.168.222.129	192,168,222,1	DICOM	2.04	1550	P-DATA, C-ECHO-RSP
55	15,704683	192.168.222.1	197.168.222,129	DICOM	1550	104	A-RELEASE request
56	15,704890	192,168,222,129	192,168,222,1	DICOM	104	1550	A-RELEASE response
105	37.712700	192.168.222.1	192.168.222.129	DICOM	1553	104	A-ASSOCIATE request SOU> SCP
106	INTERNATION OF THE	10000 1000 000 000 000 000 000 000 000	0 10 30 10 mp 2 2 m 10	DICOM	104	0559.00	TRAFFICE STOCKED AND AND AND AND AND AND AND AND AND AN
108	37.851629	192.168.222.1	192,168,222,129	DICOM	3553	104	P-DATA, C-STORE-RO
121	37.852550	192.168.222.1	192.168.222.129	DICOM	2553	104	P-DATA, RT Plan Storage (more fragments
134	37,853069	192,168,222.1	192.168.222.129	DECOM	1559	104	P-DATA, RT Plan Storage (more fragments
146	37,853750	192.168.222.1	192.168.222.129	DICOM	1553	104	P-DATA, RT Plan Storage (more fragments
158	37.854285	192.168.222.1	192.168.222.129	DICOM	1553	105	P-DATA; RT Plan Storage (more fragments
171	37,854730	192,168,222,1	192.168.222.129	DICOM	1553	104	P-DATA, RT Plan Storage (more fragments

Internet Protocol. Sec: 192 168 222 129 (192 168 222 129), bst: 192 168 222 1 (192 168 222 1) Transmission control Protocol, Src Port: 104 (104), Dat Port: 1553 (1553), Seg: 1, Ack: 287, Len: 223 DICON

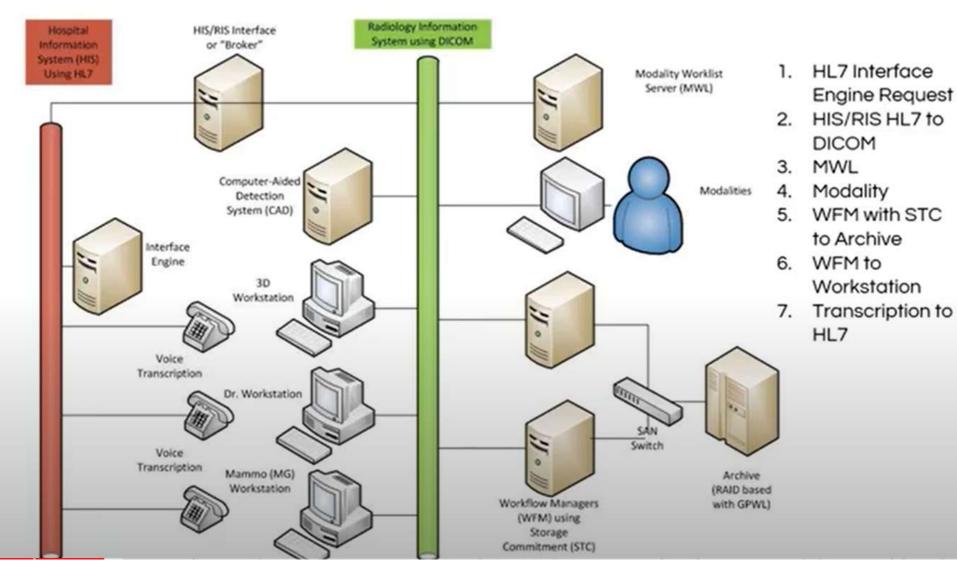
PDU Type 0x2 (ASSOC Accept) PDU Length: 217

C C X

OPDU Detail: A-ASSOCIATE accept SCU <-- SCP # Application context: DICOM Application Context Name (1.2.840.10008.3.1.1.1)

8 Presentation Context: 10 0x01, Accept, Explicit vR Big Endian, RT Plan Storage a presentation Context: 10 0x01, Accept, Explicit vR Little Endian, et Plan Storage 8 user Info: Max POU Length 16384, implementation UB 1.2,2766.03200013.03.35, NewSion OFFIS_DOMM_353

What does a full DICOM network really look like?



- <u>Additional</u> <u>Functions:</u>
 - HIS/RIS Integration
 - Worklist
 - STC
 - Transcription
 - MPPS
 - Cloud / Teleradiology
 - CAD
 - SR
 - Printing
 - Video

Who Doesn't Have Questions?