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# Excuse Me, Do You Own Your Medical Images?
*What Your Didn't Know About Your Image Archive*

*By: Dr. Adam CHEE*

**Image Archives are not made the same**

That's right; the image archives of the various PACS solutions out there are not made the same. No, I am not referring to the storage technology (e.g. SAN, NAS or CAS) nor the type of media adopted (Hard disk, Tape etc) but rather the digital format that your medical images are being stored as.

Now hold-on a second, before you start blasting me for my ignorance on the DICOM standard, I have a disclaimer to make. *While I do not proclaim to be the "know all and be all" of all things DICOMish, I am well aware (to a good extend) of the purpose and practicality of the DICOM Standard.*

DICOM or Digital Imaging and Communications in Medicine, is a global Information-Technology standard that is designed to ensure the interoperability of systems used to Produce, Store, Display, Process, Send, Retrieve, Query or Print medical images and derived structured documents as well as to manage related workflow – at least this is what the official DICOM Homepage (at http://medical.nema.org/) claims. If you have read my previous whitepaper titled "***The DICOM Conformance BlackPaper***", you will understand that DICOM is not an enforced standard, hence the main reason why we are witnessing complications pertaining to interoperability (or rather, the lack of it) in the medical imaging industry.

Some industry professionals have highlighted that while serving as the de facto industry standard for ensuring interoperability pertaining to all things 'medical imaging',

DICOM did not provide specifications on the archival aspects of medical images. As a result, some solution providers opt for archival of medical images in a customised version of DICOM. Some solution providers chose to archive images in a proprietary format, other solution providers chose to archive the pixel data (e.g. TIFF) and the metadata separately etc. The lack of standards in this area resulted in difficulties if not impossibility in achieving true interoperability during data migration of image archives between PACS solution providers (I have several first-hand experiences with horrors of this nature).

Now in all honesty, the 'aspiration' of a truly interoperable data format is not exactly unreasonable, take a look around us and you will find this little 'desire' to be an ordinary one; take for example your VCDs or DVDs, you don't need to perform a data migration every time you try to play them using players provided by different manufacturers, or how about copying files from your hard disk to a flash drive? Nothing dramatic took place; the copying process was really just 'plug and play' – as it should be.

**The role of DICOM in image archival**

The DICOM Standard in all its glory comprises of many parts and of particular to this topic is DICOM Part 10 - Media Storage and File Format for Media Interchange. Now wait a minute, didn't I write just a few paragraphs back that some industry professionals highlighted that there is no DICOM standard for archival? Doesn't "Media Storage and File Format for Media Interchange" fill this space?

DICOM Part 10 has predominantly been used only for exchange of DICOM image studies via **removable** media (E.g. CDs, DVDs etc) because the exchange of medical images by physically transporting removable media from one computer to another as opposed to transferring them over a computer network (be it LAN or WAN) was necessary due to the limitations of network bandwidth. Now this might sound like a strange practice but 5 to 10 years back, network bandwidth was a scarce resource (the problem still exists but it is usually not a 'showstopper').

So what impact did the lack of bandwidth have on the design of DICOM archives? Well for starters; It didn't make sense to store medical images in something as complicated

as DICOM Part 10 since the PACS solution will never be accessed directly by another solution provider's workstation or PACS because all exchange of medical images takes place via CDs or some other cheap removable media. So what do I mean by complicated? It is important to take note that many of the PACS systems in place today have their core system architecture designed at least 10 – 15 years ago when DICOM was still in its infancy stage (or even during the pre-DICOM days) and DICOM is (and most probably will forever be) evolving as a standard. This makes 'retrofitting' and constant revision a tedious if not expensive progress for PACS solution providers, especially those with "production sites" globally.

So how does this PACS solution handle the constant revision of the DICOM Standard? Simple, by putting a disclaimer in the relevant DICOM conformance statement on reserving the rights to discontinue its delivery for a new version of the DICOM Standard (Please read my previous whitepaper titled "***The DICOM Conformance BlackPaper***" on the typical disclaimers issued by modality and PACS solution)

**DICOM Part 10**

So what exactly is DICOM Part 10? We know that it addresses issues in the areas of Media Storage and File Format for Media Interchange but what exactly does it mandate? Let us take a look at DICOM Part 10's the Media Storage Application Profiles;

"*defines a selection of choices at the various layers of the DICOM Media Storage Model that are applicable to a specific need or context in which the media interchange is intended to be performed. Such choices are formally specified as a Media Storage Application Profile in order to ensure inter-operability between implementations conforming to the same Media Storage Application Profile. It facilitates conformance statements that allow users to assess interoperability of different implementations.*

*Media Storage Application Profiles shall include:*

*a) The description of the need addressed by the Application Profile*

*(e.g., cardiac, echography, angiography) and its context of application;*

b) *The selection, at the Data Format Layer, of a number of specific IODs and associated SOP Classes. For standard DICOM SOP Classes, this shall be done by reference to PS 3.4 of the DICOM Standard. These SOP Classes, like any other DICOM SOP Classes are assigned a unique registered UID. For each SOP Class it shall be stated if its support is required or optional within the context of this profile;*

c) *The selection of a specific Media Format definition. This is done by reference to PS 3.12 of the DICOM Standard that specify the selected Physical Medium, a specific associated Media Format and the mapping of this Media Format (or file system) services onto the DICOM File Service;*

d) *The selection of appropriate Transfer Syntaxes;*

e) *The selection of a specific Security Profile. This is done by reference to PS 3.15 of the DICOM Standard which specifies the cryptographic algorithms to be used to encapsulate the DICOM Files of the DICOM File Set into Secure DICOM Files. If a Media Storage Application Profile selects no Security Profile, then the Application Profile is unsecure and the Secure DICOM File Format shall not be used with that Application Profile;*

f) *Other choices facilitating interoperability such as specific limits ( e.g., maximum file sizes, if necessary, support of options, if any)."*

Looking at the abstract quoted above, it would appear that DICOM Part 10 has defined a pretty robust framework for ensuring interoperability of medical images, but what about the relevant 'metadata' like annotations, labels, positions, arrows, circles illustrating region-of-interest or window level to ensure consistency in display and contrast settings etc? These 'metadata' are actually called **Presentation State** objects and they are stored separate from the pixel data (the actual images). The good news is, DICOM Part 10 does cover Presentation State Information Object Definition (IODs) to convey specific medical imaging information at the Data Format Layer.

So what is stopping 'modern day' PACS solution providers from ensuring that their archive uses DICOM Part 10? The answer is 'nothing'. There is really nothing stopping 'modern day' PACS solution providers from adopting DICOM Part 10 as their format of choice for image archival, in fact, there are some commercial PACS solutions providers out there doing precisely this and their existence dispels the age old myth of 'performance issue' one would encounter if medical images are stored and retrieved in 'pure DICOM'.

Then why does the problem remains a problem when a readily available solution exists? Well, the real problem lays in the fact that most end-users do not know about the existence and purpose of DICOM Part 10. It is a situation of "not knowing what they don't know", hence the reason for this whitepaper.

**Do You Own Your Data?**

Now I would like to pose the million dollar question - Do you own your medical images? Please do not get me wrong, I am not enquiring if your healthcare enterprise owns or lease the;

- Modalities that acquires the medical images
- Network infrastructure that transmits the medical images
- Servers that process the medical images
- Storage that stores the medical images
- Applications that enable you access to the medical images

Rather, I am questioning ownership in the sense of **exclusive rights** and **control** over your medical images. If you really own your medical images then you should not be rendered totally helpless in events that you decide to replace your existing PACS solution with one from another provider. However, the reality today for PACS replacement projects involving different vendors almost guarantees the following;

- With the exception of the incumbent PACS solution provider, direct access to your medical image archive will be impossible

- A long (we are talking months here), tedious, disruptive (to the daily operations) and extremely costly data migration process needs to take place
- The data migration process will depend heavily not only the on the capabilities and relevant experience of your new PACS solution provider but also the full co-operation of the incumbent PACS solution provider – which may be difficult to obtain since they are being replaced

Even if you choose to retain the services of the incumbent PACS solution provider by opting for an upgrade, chances are, a data migration described above will still be required because in order to cut down on R&D costs, many big companies acquires smaller companies with innovative PACS offerings that incorporates cutting edge technology, and features as product line replacement. So what you might end up with after the upgrade project is a totally different PACS as opposed to a newer version but both solutions carry the same brand name. Misleading? Sometimes.

Now here is the part that hurts, after going through with the hassle (or nightmare) of a data migration, you will most probably end up with the same situation **again** should you ever decide to replace your PACS solution in the future!

**The Solution?**

To eradicate such bad practices, the logical solution would be;

- End-users to lobby for the use of DICOM Part 10 as the archival format for PACS solutions
- Development of another new standard and lobbying for the adoption of that standard as the archival format for PACS solutions
- Purchase only PACS solutions that utilize DICOM Part 10 as their archival format for PACS solution.

However, there are no guarantees if the first two options will ever take place (what motivation is there for PACS solution providers to ensure interoperability of their medical archive?) and the last option will tremendously limit your options (and it is the clinical functionality that counts in selecting your PACS solution, not the archival)

This is where Vendor Neutral Archives (VNA) comes in useful. As the name implies, VNAs are vendor neutral in nature and all VNA solutions I have come across (so far) store medical images in DICOM Part 10.

To gain a quick overview on the basic purpose of a VNA, please read the whitepaper **Vendor Neutral Archival & How It Will Change the World (of Medical Imaging Informatics)**. However, the topic of VNAs is huge and it will take more than a whitepaper to be effectively communicated. To find out more about Vendor Neutral Archive and how it will change the world of medical imaging informatics, please stay tuned for the upcoming release of the Ebook entitled the "**Vendor Neutral Archive & How It Will Change the World** *(of Medical Imaging Informatics)*" a community project by binaryHealthCare.

This Ebook will address related topics including;

- What PACS vendors are not telling you about VNA
- Areas of assessment in selecting a VNA solution
- Best practices associated with VNA in areas of PACS Administration, Change Management, Data Migration etc
- What new exciting possibilities exists for your facility if it achieved an effective implementation of VNA
- Emerging trends in imaging informatics after the impact of VNA

## Contact

Media and all other Queries:  media@binaryhealthcare.com

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