

Lessons Learned During the Development and Deployment of DICOM

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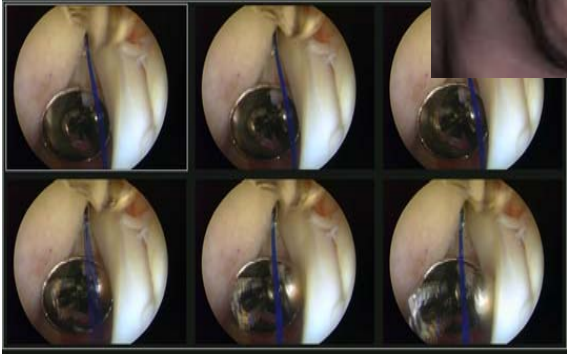
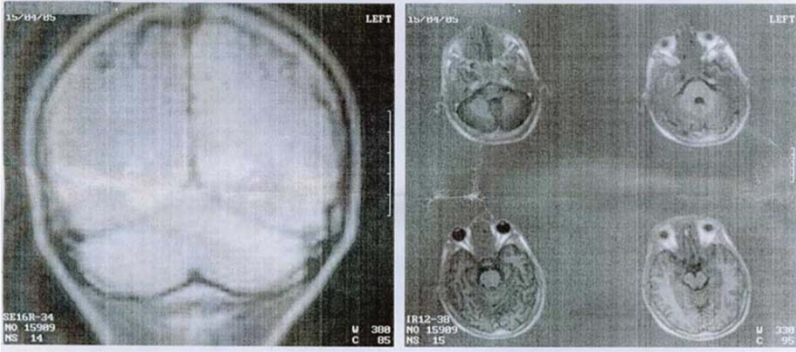
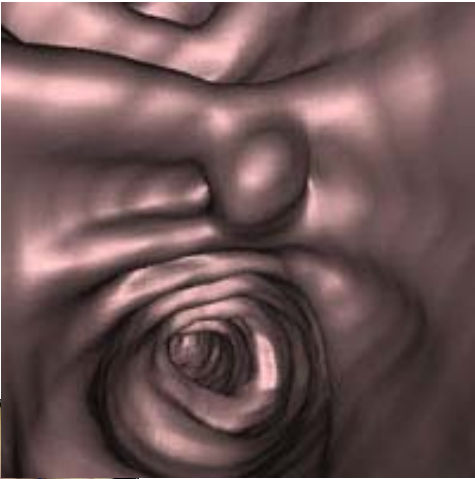
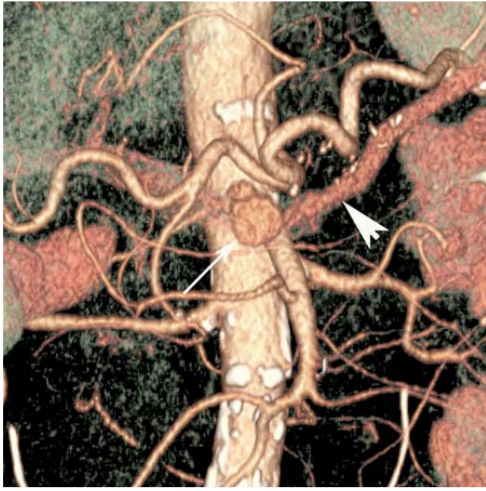
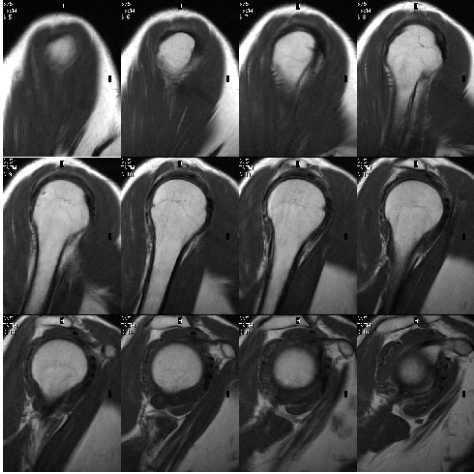
DICOM for DHS and TSA

- DICOM standard, introduced in the late 1980s, has revolutionized medical image acquisition, exchange, and processing
- DICOM solved several fundamental problems:
 - Standardization of terminology, formats, workflow
 - High-quality *diagnostic* digital imaging and data
 - Vendor-neutral interfacing, networking, and processing
- Why should DHS and TSA learn from DICOM?
 - *Same goals*: Optimal data representation, seamless exchange, and complex analysis
 - *DICOM expertise*: Nearly three decades of DICOM implementation history provide extremely valuable lessons on what to do, and what to avoid

Was is easy? No!

- Hospital conservatism and resisting physicians
- Existing non-DICOM devices
- Simplicity of pre-digital printed film
- Lack of IT experts, networks, computers
- Technical limitations (need for diagnostic-quality monitors, large digital archives, bandwidth, etc.)

Medicine before and after DICOM



Before: Hardcopies, film, and incoherent digital scans

After: Digital data we can fully explore

What can DICOS learn from DICOM?

Design:

- Use abstract, implementation-independent language (“data objects”, “service classes”)
- Define default data format and protocol, which will *always* work. Then add advanced format/protocol negotiation
- Do NOT reinvent the wheel – use other existing standards wherever possible
- Get everybody on board, from day one: vendors, users, security experts, DICOM gurus

What can DICOS learn from DICOM?

Implementation:

- Get in the right, problem-solving mood!
- Start small, solve the most important problem, then expand
- Emphasize compatibility and robustness over fancy
- Do not copy the entire DICOM, but get the best of it

Vendors:

- Vendor-specific interfaces are pain to maintain and to work with – *even for the vendors themselves*
- In DICOS, leave the vendors with enough room for proprietary. You are developing an *interface*
- Get the principal vendors involved, and the rest will follow

Who benefits from DICOM

- *Hospitals*: Universal interface for medical images
- *Patients*: Can take their DICOM data anywhere
- *Vendors*: Can take over other vendors' data, no more “proprietary hell”

But keep in mind that the same hospitals and vendors may hate DICOM for the same exact reasons. DICOM is nothing but a tool, and everything depends on how you want to use it.

Learning from DICOM implementation

- Standards take time to develop, to learn, and to master
- Standards introduce inertia: they are hard to update/change
- Implementation inconsistencies can be frequent and even intentional, and there is no “DICOM police”
- Market wars (“Why should I interface with my competition?”)
- Dependency on human input (“garbage in – garbage out”)
- May not fit your workflow

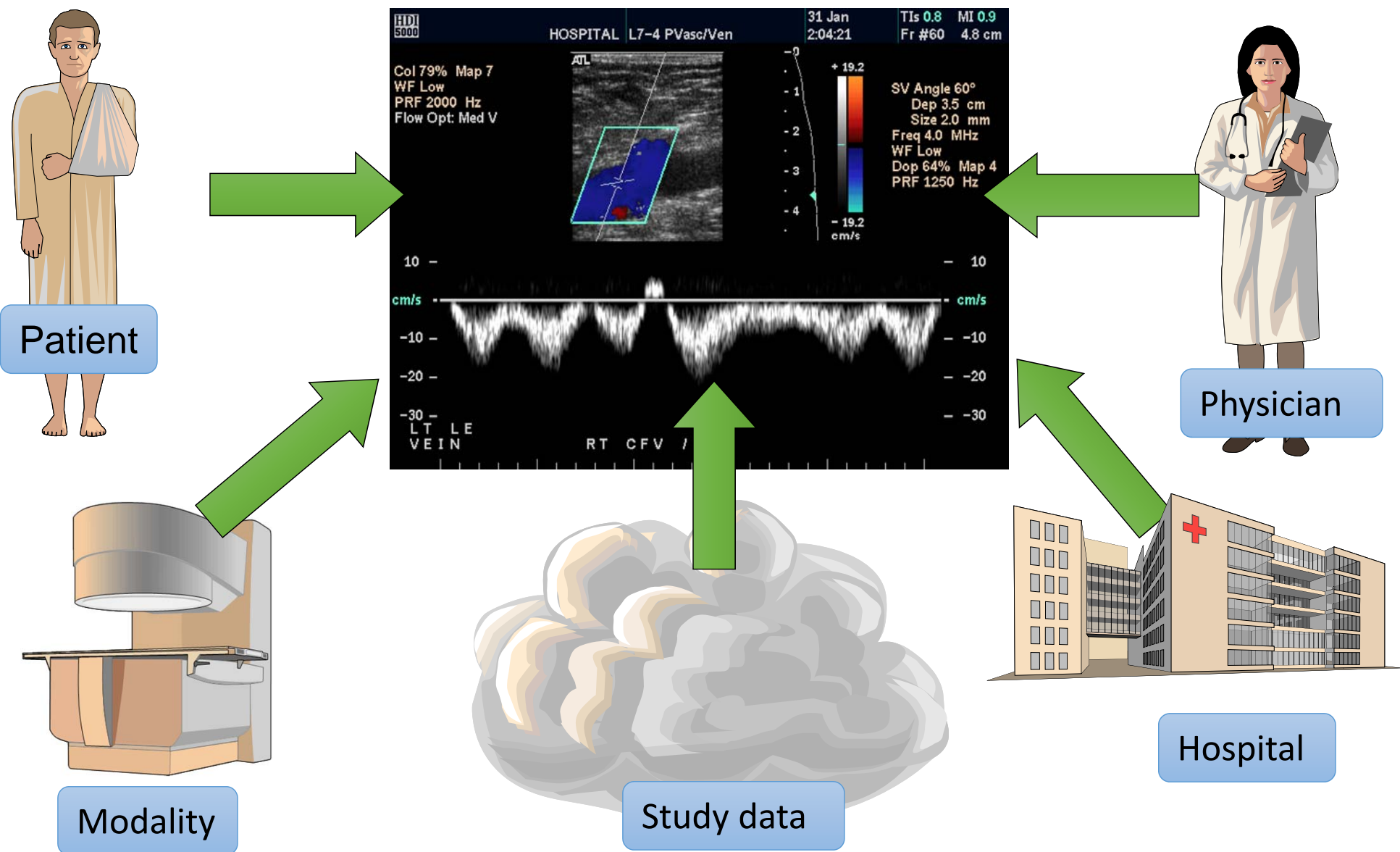
All this can make working with standards difficult, but if you need a sustainable solution, there is no other alternative.

Conclusions

“Only a fool learns from his own mistakes. The wise man learns from the mistakes of others.”

Extra slides

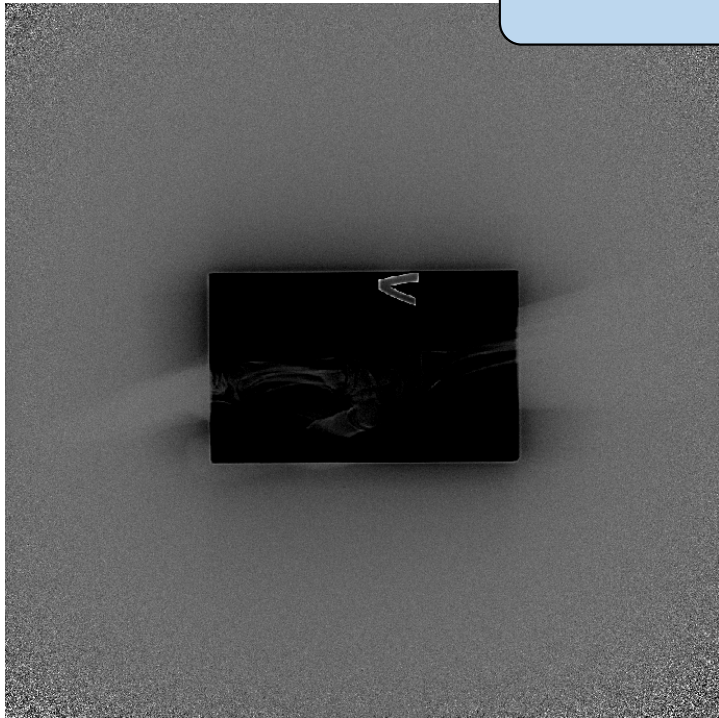
Example: Encapsulating data in DICOM image



Example: Data acquisition quality

- You still need human staff to acquire your data. When it's not done right, your data can be completely useless. Train your staff!

Hand X-Ray – which one is better?



Example: DICOM Patient ID misuses

- Patient ID is meant to uniquely identify a patient, but it is often entered manually.
- Consequently, Patient ID is the most misused item in healthcare workflow. But when proper item identification is not present, integrated digital workflow is simply impossible.

Patient Name	Patient ID	Birth Date	Study Time	Body Part	Moda...	Descr.	Images
HELEE MICHAEL	NECK PAIN	♂ 05 Jan 1...	16 Apr 2012 07:52		MR	SPINE CER...	122
PIANYKH OLEG		♂ 08 Nov 1...	26 Apr 2007 15:55	CHEST	DX	CHEST (PA ...	6
TEST	887744		22 Mar 2005 11:12		MR	TEST	79
TIRULINS L.F.	4257 MSCT	♀ 06 Sep 1...	28 Feb 2005 15:31	ABDOMEN	CT	Abdomen V...	30
BRAIN	10/29/2004		29 Oct 2004 14:40		MR		99

Samples from *real* hospitals
(confidential data
anonymized)