

DICOM in clinical electrophysiology

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Agenda

- What is the DICOM standard
- Current status of data in clinical electrophysiology
- How to expand the DICOM standard to clinical electrophysiology
- Clinical electrophysiology an the NEMA standard

What is the DICOM standard?

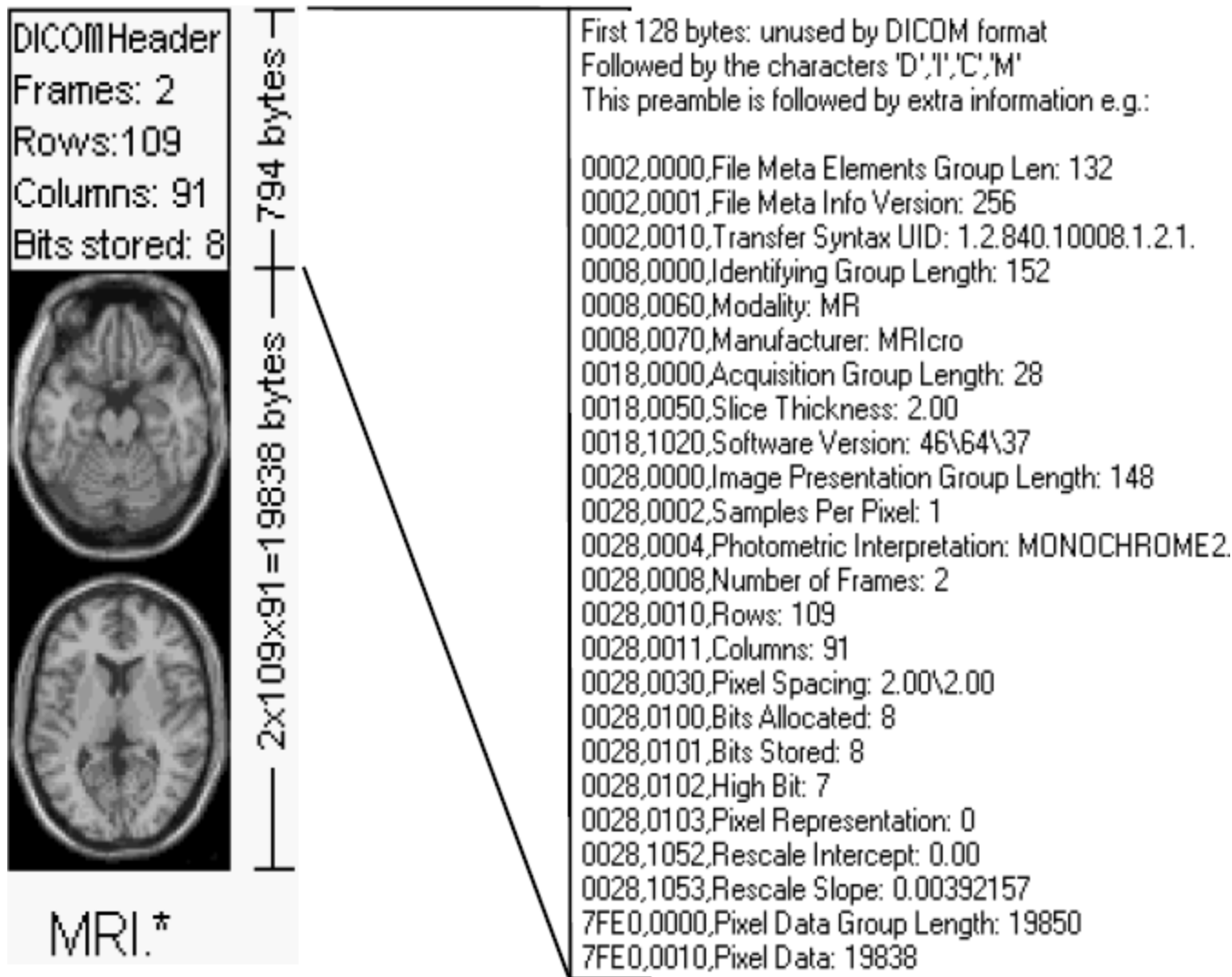
- Digital Imaging and Communication in Medicine (DICOM)
- DICOM is the **ONLY** standard in the world that covers the exchange of medical images

- Part 1 - Introduction and Overview
- Part 2 - Conformance
- Part 3 - Information Object Definitions
- Part 4 - Service Class Definitions
- Part 5 - Data Structures & Semantics
- Part 6 - Data Element Listing and Typing
- Part 7 - Message Exchange Protocol
- Part 8 - Network Support for Message Exchange
- Part 9 - Point to Point

- Part 10: Media Storage and File Format for Media Interchange
- Part 11: Media Storage Application Profiles
- Part 12: Media Formats and Physical Media for Media Interchange
- Part 14: Grayscale Standard Display Function
- Part 15: Security and System Management Profiles
- Part 16: Content Mapping Resource
- Part 17: Explanatory Information
- Part 18: Web Access to DICOM Persistent Objects (WADO)

More than 100 extensions to the Standard provide additional capabilities

- ▶ Header containing
 - the patient's name / id
 - type of media (CT, MRI, audio recording, etc.)
 - image dimensions
 - ...
- ▶ Body, containing «information objects»
 - medical reports
 - audio recordings
 - images



All DICOM attributes are formatted according to 27 value representation (VR) types

Patient in
Real World

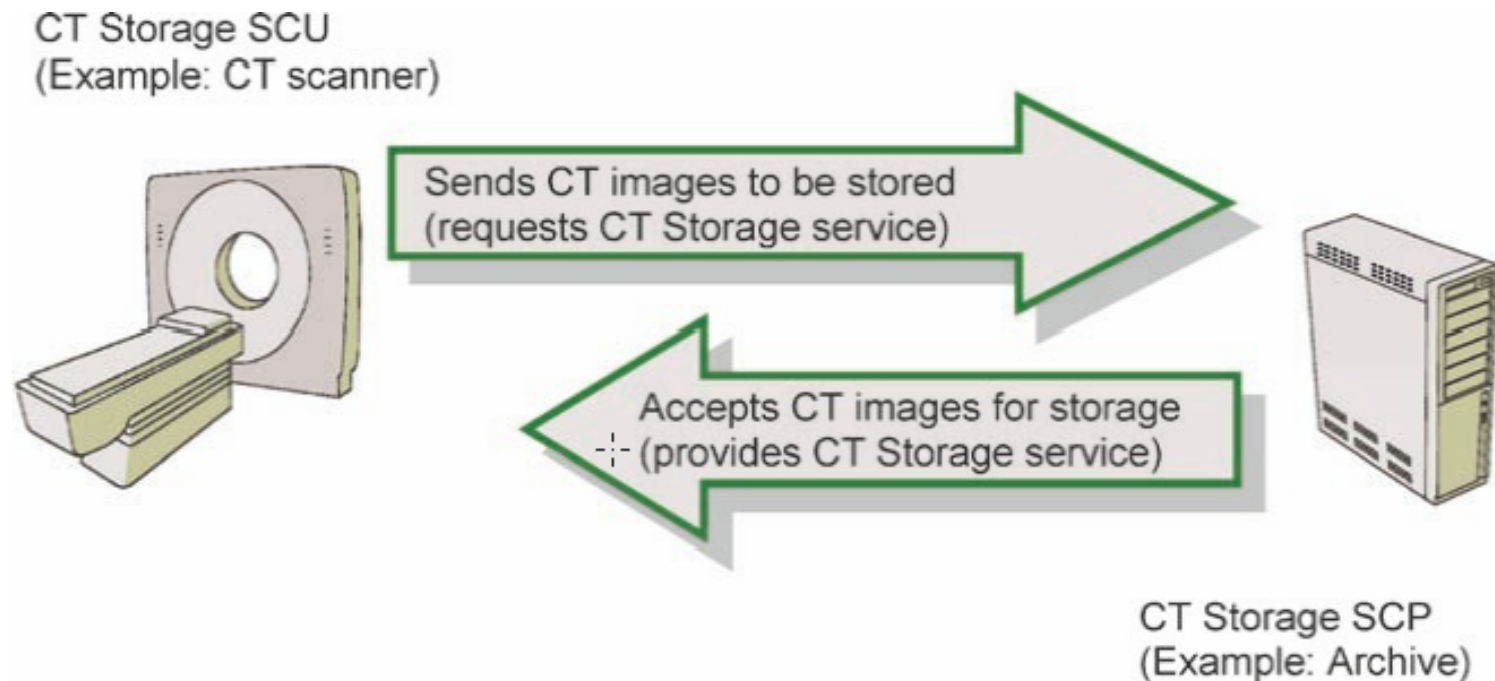


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Patient object in
DICOM World

Name	John Smith
ID	123456
DOB	19681108
Weight	75.5
Sex	M
.....	

} Patient IOD
(Information
Object
Definition)



CT image = DICOM IOD (DICOM data object).

CT Storage = DICOM Service

CT Scanner = SCU (Service Class User)

Digital Archive = SCP (Service Class Provider)

Current status of data in clinical electrophysiology

- For the last 20 years, the International Federation of Clinical Neurophysiology (IFCN) recommends that all original equipment manufacturers make their digital data available in a file format that can be read by others who use systems produced by other vendors

Current status of data in clinical electrophysiology

- There is no common standard digital format for storing clinical neurophysiologic data.

EEG	
<u>ANT Neuro</u>	(.avr, .cnt, .trg)
BESA	(.avr, .swf)
<u>Biosemi BDF</u>	(.bdf)
<u>BrainVision</u>	(.eeg, .seg, .dat, .vhdr, .vmrk)
CED - Cambridge Electronic Design	(.smr)
EEGLAB	(.set, .fdt)
<u>Electrical Geodesics, Inc. (EGI)</u>	(.egis, .ave, .gave, .ses, .raw, .mff)
NeuroScan	(.eeg, .cnt, .avg)
Nexstim	(.nxe)
TMSi	(.Poly5)
generic standard formats	(.edf, .gdf)

How can we exchange data in clinical electrophysiology?

Why DICOM?

How to expand the DICOM standard to clinical electrophysiology

- Multiscale Electrophysiology Format, version 3 (MEF3)¹
- DICOM waveforms²
- DICOM Working Group 32³

³<https://www.dicomstandard.org/activity/wgs/wg-32>

Clinical electrophysiology and the NEMA standard

create a format which is more advanced than the currently available non-DICOM) formats

to integrate with enterprise infrastructure and security requirements

to promote data exchange (research data and clinical data)

Improve long-term storage

Improves all aspects of data management

Clinical electrophysiology an the NEMA standard

WG-32 > extend DICOM as standard format for clinical neurophysiology data exchange.

Including:

- time-based neurophysiology signal data (and associated video recordings) from
- electroencephalography (EEG),
- video-electroencephalography (VEEG),
- electromyography (EMG),
- evoked potentials (EP),
- polysomnograms (PSGs),
- Electoroculography (EOG),
- electrocardiograms (ECGs)
- Magnetoencephalography,
- other types of neurophysiology signals.

Clinical electrophysiology an the NEMA standard

- Propose a new IOD, with references to existing IODs, to address the two already identified highest priority needs of the neurophysiology community
- storing neurophysiology in the Picture Archiving and Communication Systems (PACS) and Vendor Neutral Archive (VNA) systems in a manner that allows direct association with the relevant patient (and any related objects such as video, ECG and pulse waveforms with which the data is synchronized)
- Perform further gap analysis of the existing DICOM Standard with respect to potential neurophysiology requirements (e.g. time-based waveform compression)
- Establish priorities for filling gaps identified

Clinical electrophysiology an the NEMA standard

- Adoption by creators
- Adoption by recipients

Thank you for your attention!