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Enhanced family of Image SOP Classes

Wim Corbijn van Willenswaard

Philips Healthcare

Interoperability Architect

Bangalore, India

Chair WG16 (MRI)

PHILIPS

Introduction

Multi Frame model

Functional benefits

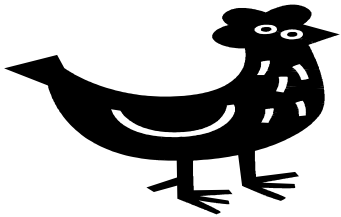
Performance benefits

Modalities and policy

Conversion approach

Conclusions

- **Why Multi-Frame**

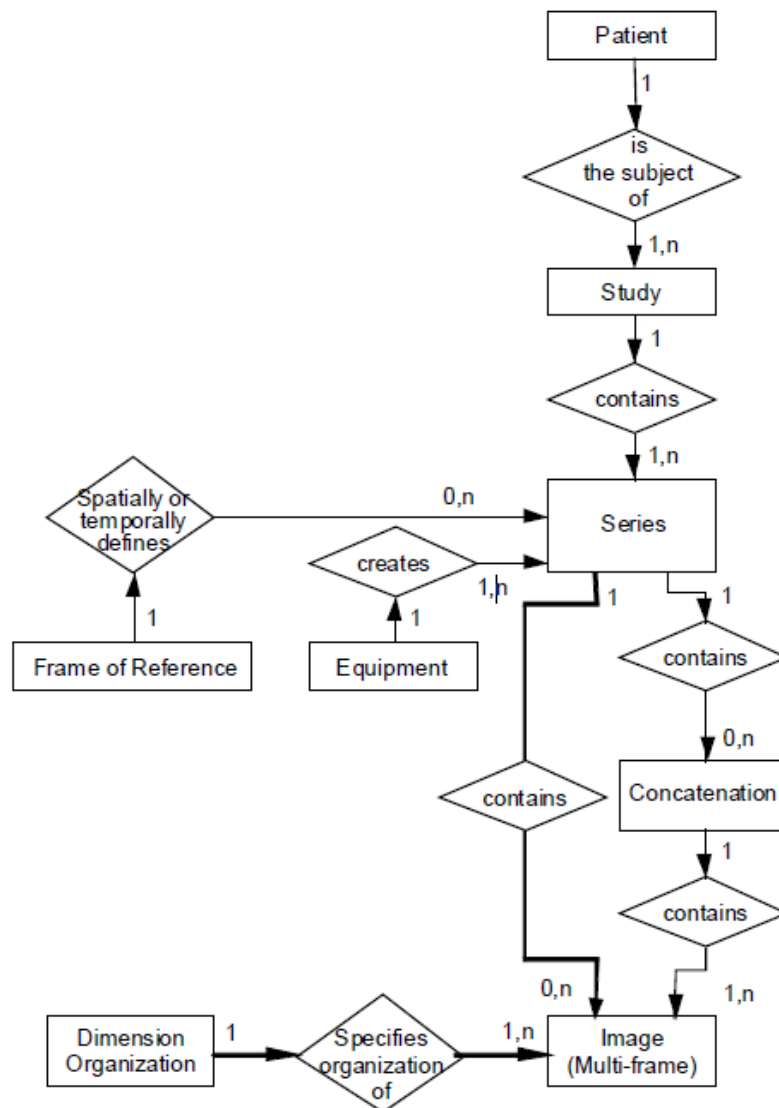


> 10 Years

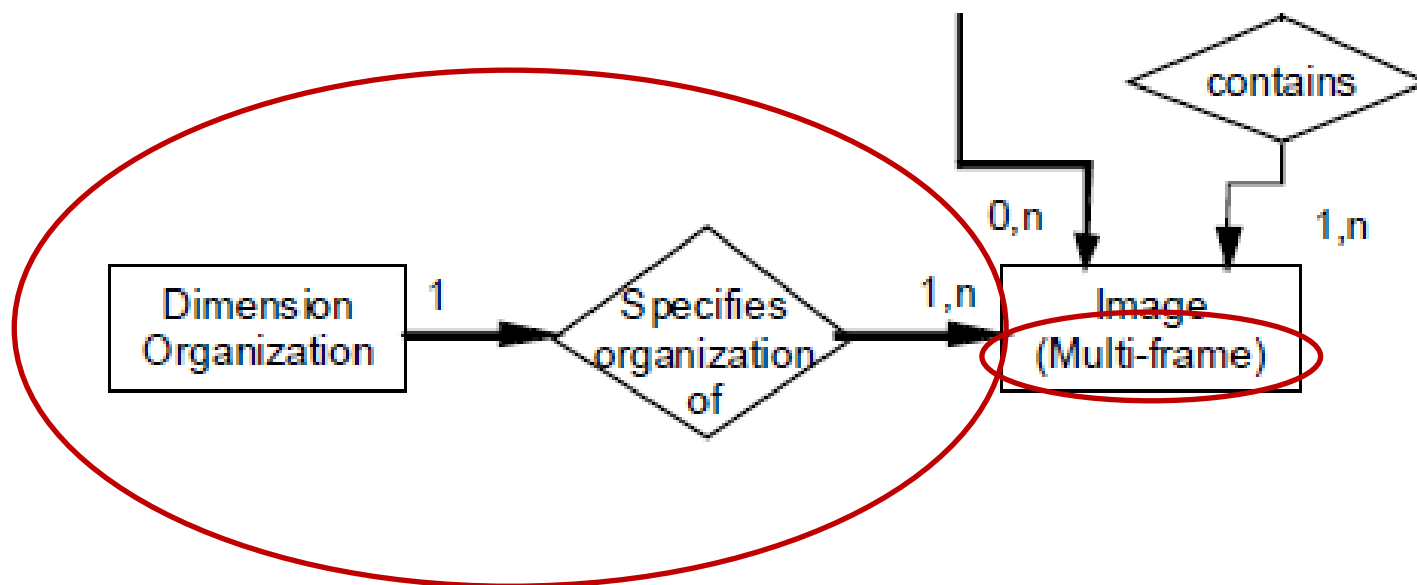
- **Standard object structure**

- **Sup XXX Enhanced Nuclear Medicine (Proposed)**
- **Sup 43 Enhanced US Volume (Approved 2010)**
- **Sup 141 Enhanced MR Color (Approved 2009)**
- **Sup 43 Enhanced Ultrasound (Approved 2009)**
- **Sup 125 Breast Tomosynthesis (Approved 2008)**
- **Sup 117 Enhanced PET (Approved 2008)**
- **Sup 110 Ophthalmic Coherence Tomography (Approved 2007)**
- **Sup 116 3-D X-Ray (Approved 2007)**
- **Sup 83 Enhanced XA/XRF Image (Approved 2004)**
- **Sup 58 Enhanced CT (Approved 2003)**
- **Sup 49 Enhanced MR (Approved 2001)**

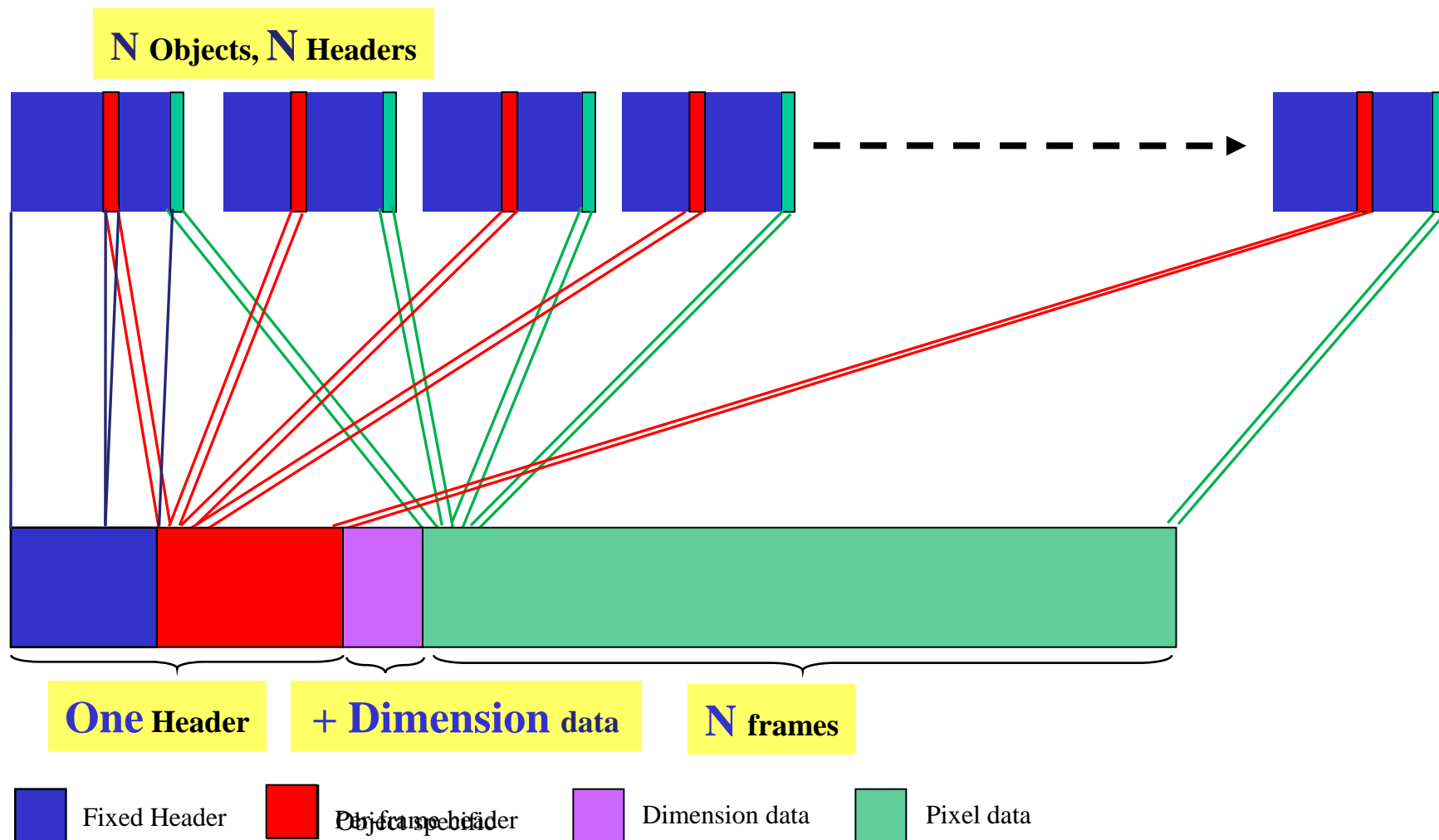
Multi Frame model



Multi Frame model



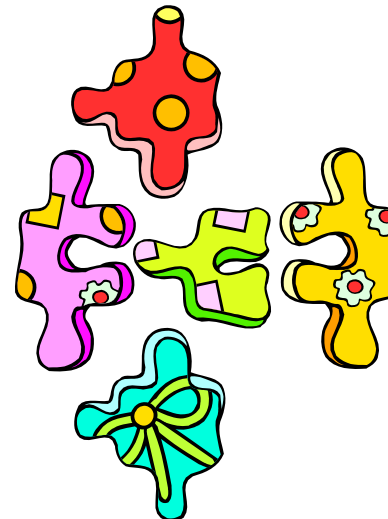
Single-frame to MultiFrame



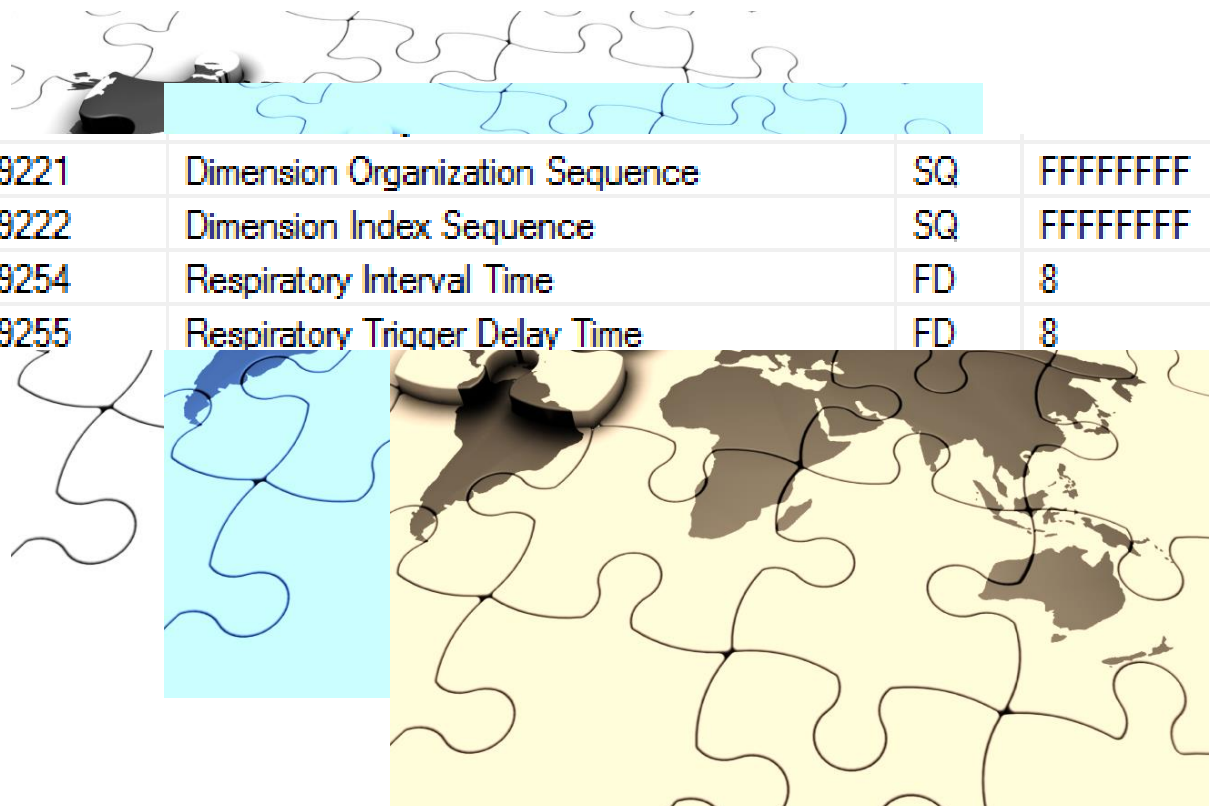
Single Frame (Classic objects)



Multi-Frame



- Dimension organization makes it easier to view



0020	9221	Dimension Organization Sequence	SQ	FFFFFFFF	(Sequence Data)
0020	9222	Dimension Index Sequence	SQ	FFFFFFFF	(Sequence Data)
0020	9254	Respiratory Interval Time	FD	8	0.000000
0020	9255	Respiratory Trigger Delay Time	FD	8	0.000000

Latest technology

- **Dimension Organization**
- **Functional groups**



A.38.1.3

Enhanced CT Image IOD Module Table

Table A.38-1
ENHANCED CT IMAGE IOD MODULES

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	General Series	C.7.3.1	M
	CT Series	C.8.15.1	M
	Clinical Trial Series	C.7.3.2	U
Frame of Reference	Frame of Reference	C.7.4.1	M
	Synchronization	C.7.4.2	C- Required if time synchronization was applied.
Equipment	General Equipment	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M

Table C.7-7
Synchronization Module Attributes

Attribute Name	Tag	Type	Attribute Description
Synchronization Frame of Reference UID	(0020,0200)	1	UID of common synchronization environment. See C.7.4.2.1.1.
Synchronization Trigger	(0018,106A)	1	Data acquisition synchronization with external equipment Enumerated Values: SOURCE - this equipment provides synchronization channel or trigger to other equipment EXTERNAL - this equipment receives synchronization channel or trigger from other equipment PASSTHRU - this equipment receives synchronization channel or trigger and forwards it NO TRIGGER - data acquisition not synchronized by common channel or trigger
Trigger Source or Type	(0018,1061)	3	Specifies equipment ID of trigger source and/or type of trigger
Synchronization Channel	(0018,106C)	1C	Identifier of waveform channel that records the synchronization channel or trigger, see C.7.4.2.1.3. Required if synchronization channel or trigger is encoded in a waveform in this SOP Instance
Acquisition Time Synchronized	(0018,1800)	1	Acquisition DateTime (0008,002A) synchronized with external time reference. Enumerated Values: Y, N

A.38.1.3

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Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	General Series	C.7.3.1	M
	CT Series	C.8.15.1	M
	Clinical Trial Series	C.7.3.2	U
Frame of Reference	Frame of Reference	C.7.4.1	M
	Synchronization	C.7.4.2	C- Required if time synchronization was applied.
Equipment	General Equipment	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M

ENHANCED GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	1	Manufacturer of the equipment that produced the composite instances.
Manufacturer's Model Name	(0008,1090)	1	Manufacturer's model name of the equipment that produced the composite instances.
Device Serial Number	(0018,1000)	1	Manufacturer's serial number of the equipment that produced the composite instances.
Software Versions	(0018,1020)	1	Manufacturer's designation of software version of the equipment that produced the composite instances. See Section C.7.5.1.1.3.

Functional benefits

Image	Image Pixel	C.7.6.3	M
	Enhanced Contrast/Bolus	C.7.6.4b	C - Required if contrast media was applied.
	Multi-frame Functional Groups	C.7.6.16	M
	Multi-frame Dimension	C.7.6.17	M
	Cardiac Synchronization	C.7.6.18.1	C - Required if cardiac synchronization was applied.
	Respiratory Synchronization	C.7.6.18.2	C - Required if respiratory synchronization was applied.
	Supplemental Palette Color Lookup Table	C.7.6.19	C - Required if Pixel Presentation (0008,9205) in the Enhanced CT Image Module equals COLOR or MIXED.
	Acquisition Context	C.7.6.14	M
	Device	C.7.6.12	U
	Specimen	C.7.6.22	U
Enhanced CT Image	C.8.15.2	M	

Table C.8-122
CT GEOMETRY MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
CT Geometry Sequence	(0018,9312)	1	Contains the attributes defining the CT geometry. Only a single Item shall be included in this sequence.
>Distance Source to Detector	(0018,1110)	1C	Distance in mm from source to detector center. See C.8.15.3.6.1. Note: This value is traditionally referred to as Source Image Receptor Distance (SID). Required if Frame Type (0008,9007) Value 1 of this frame is ORIGINAL. May be present otherwise.
>Distance Source to Data Collection Center	(0018,9335)	1C	Distance in mm from source to data collection center. See C.8.15.3.6.1. Required if Frame Type (0008,9007) Value 1 of this frame is ORIGINAL. May be present otherwise.

Latest technology

- **Functional groups**
- **Most attributes are mandatory**
- **Reducing overhead**



General mechanism



“Complete” set of frames



Dimension makes it easier to view



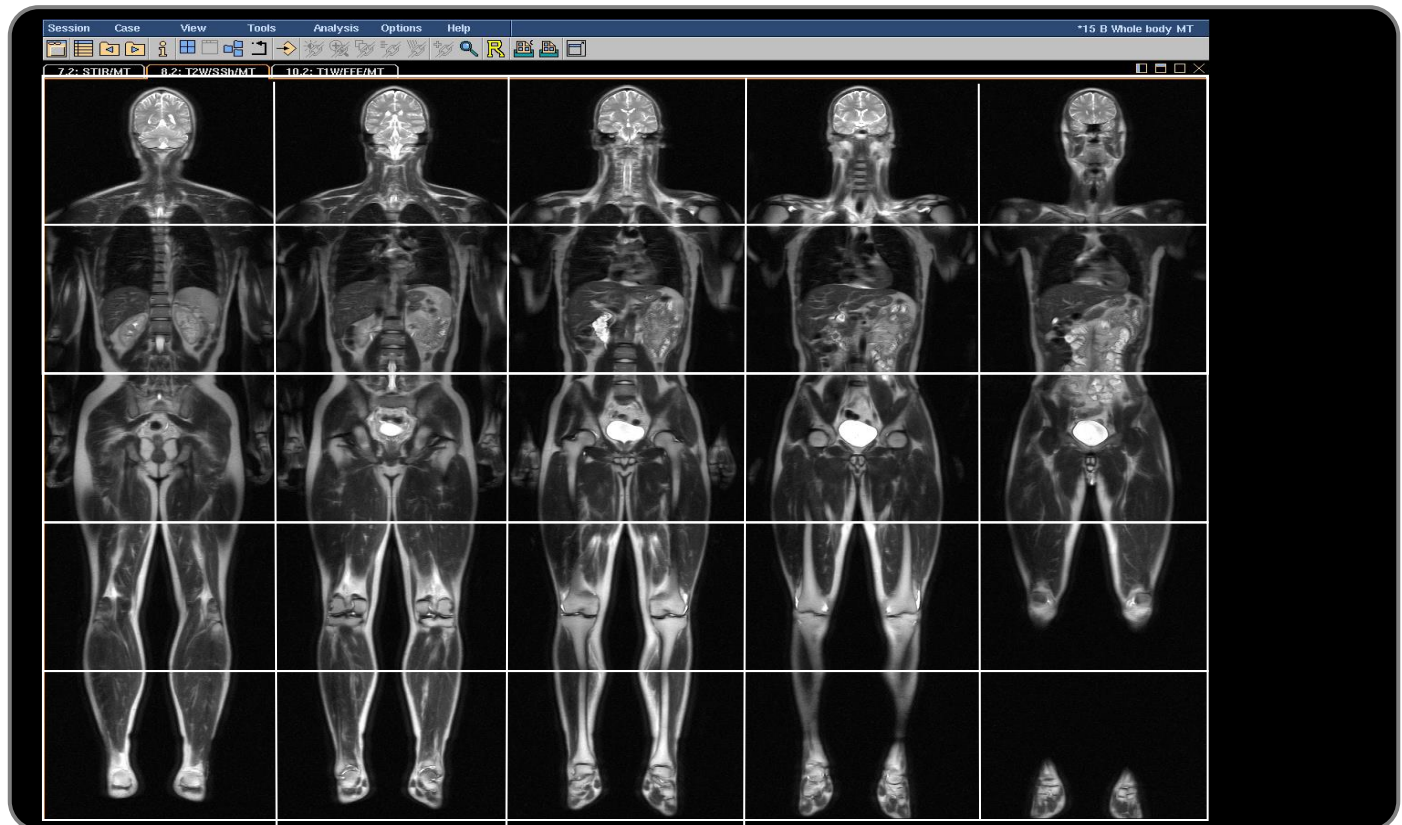
Latest technology



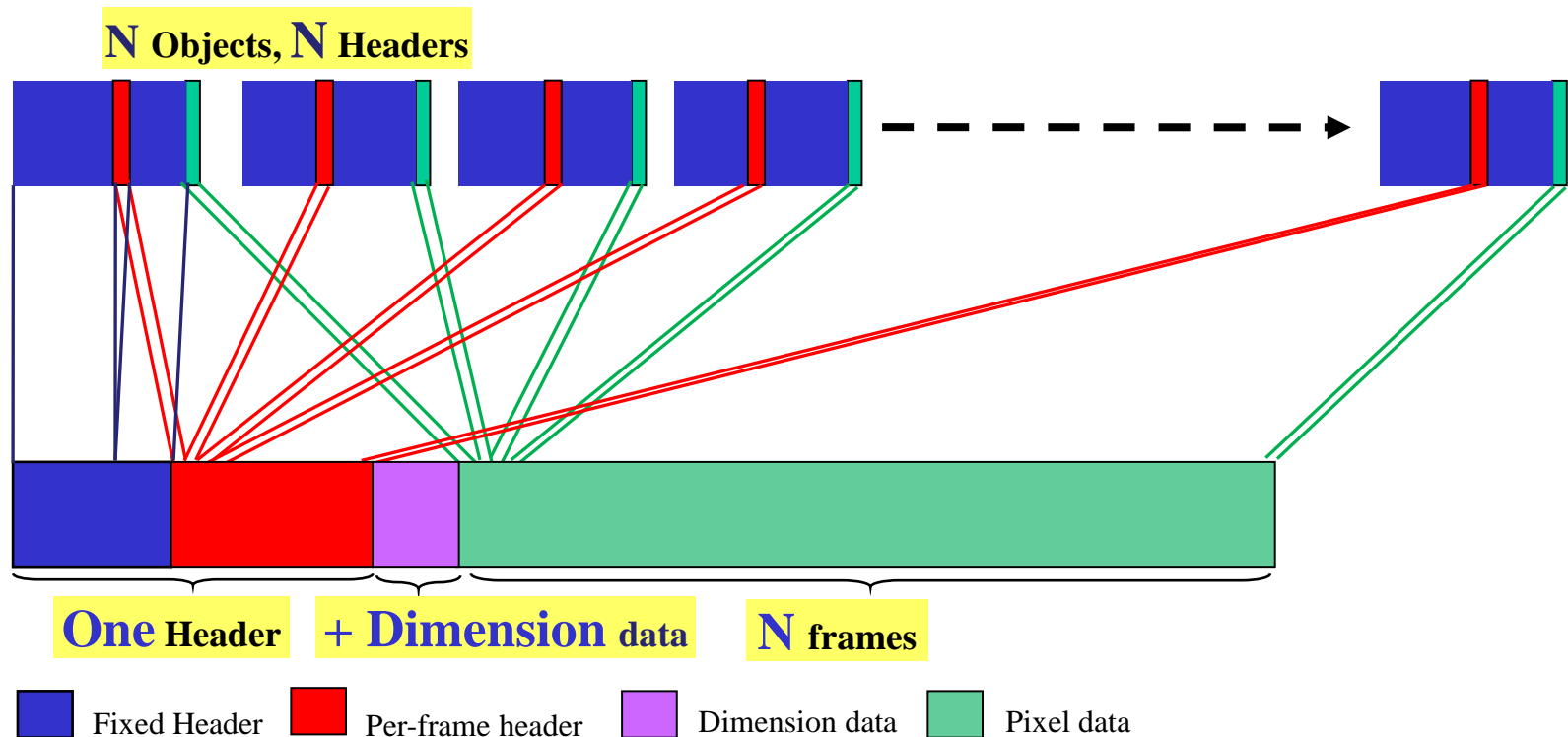
General mechanism for all new objects.



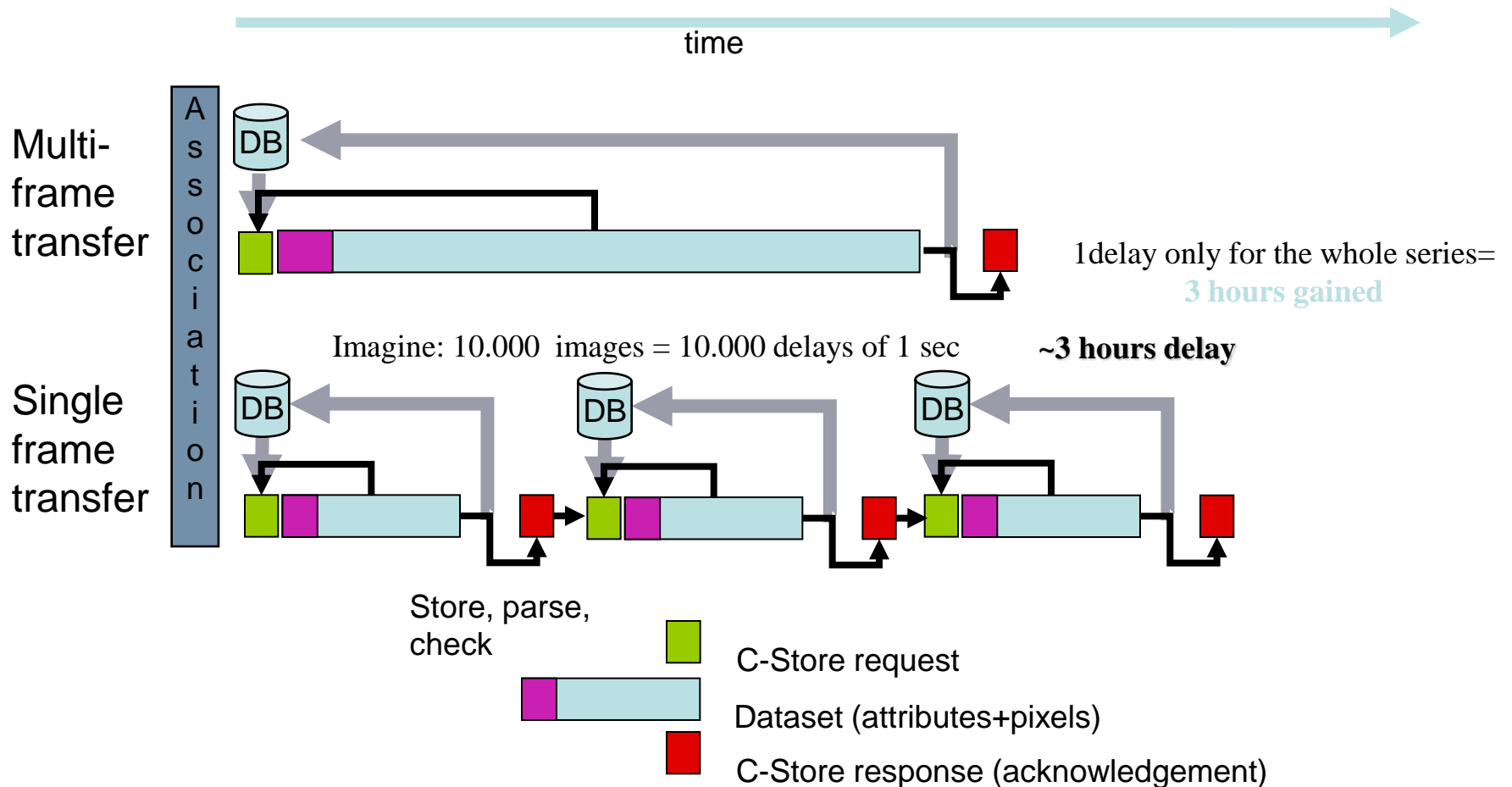
One object defines full series



Storage simpler



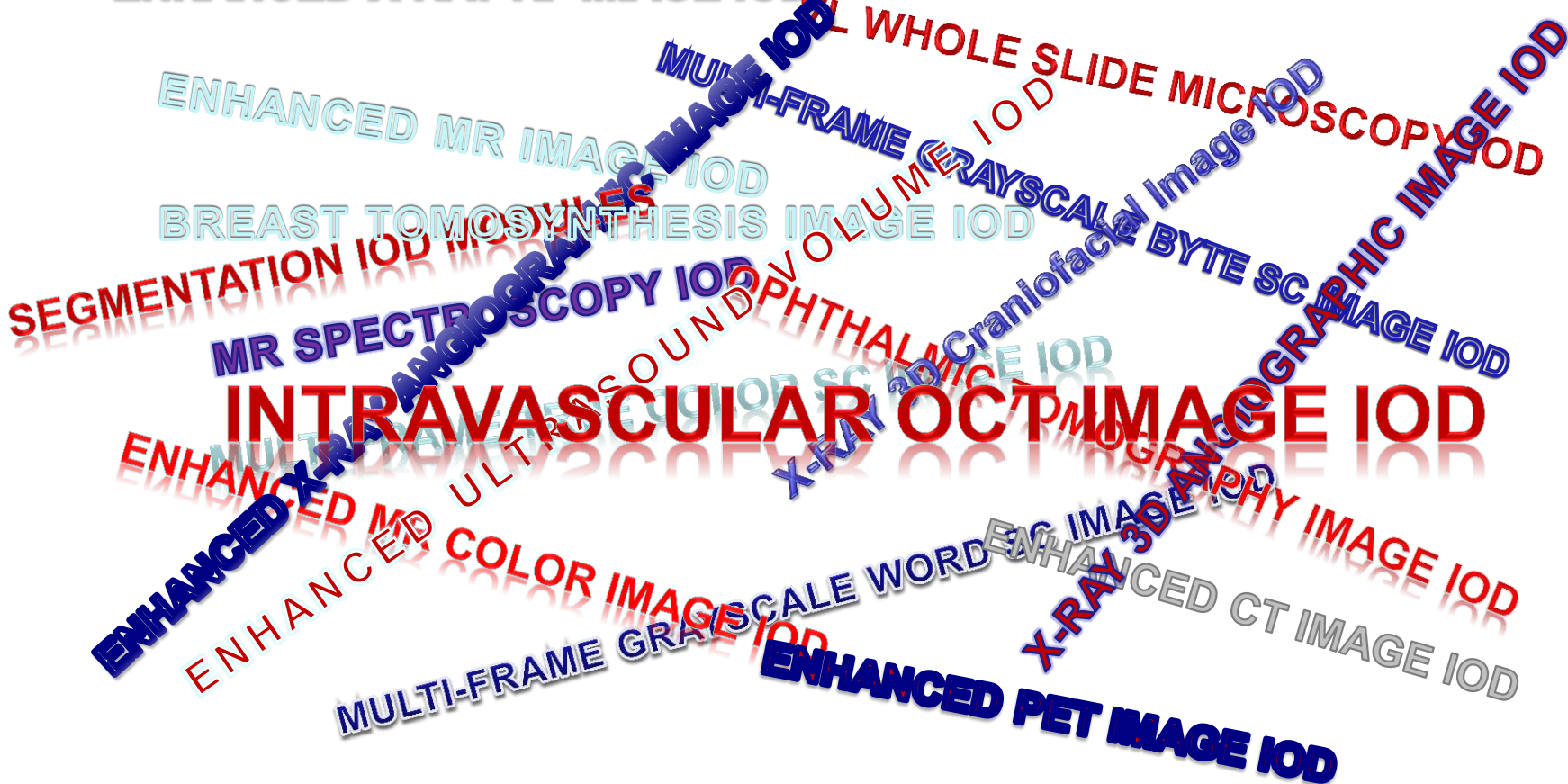
Network overhead reduced.



* Slide Courtesy: David A.Clunie

18 IOD's with Multi-Frame Dimension group

ENHANCED X-RAY RF IMAGE IOD



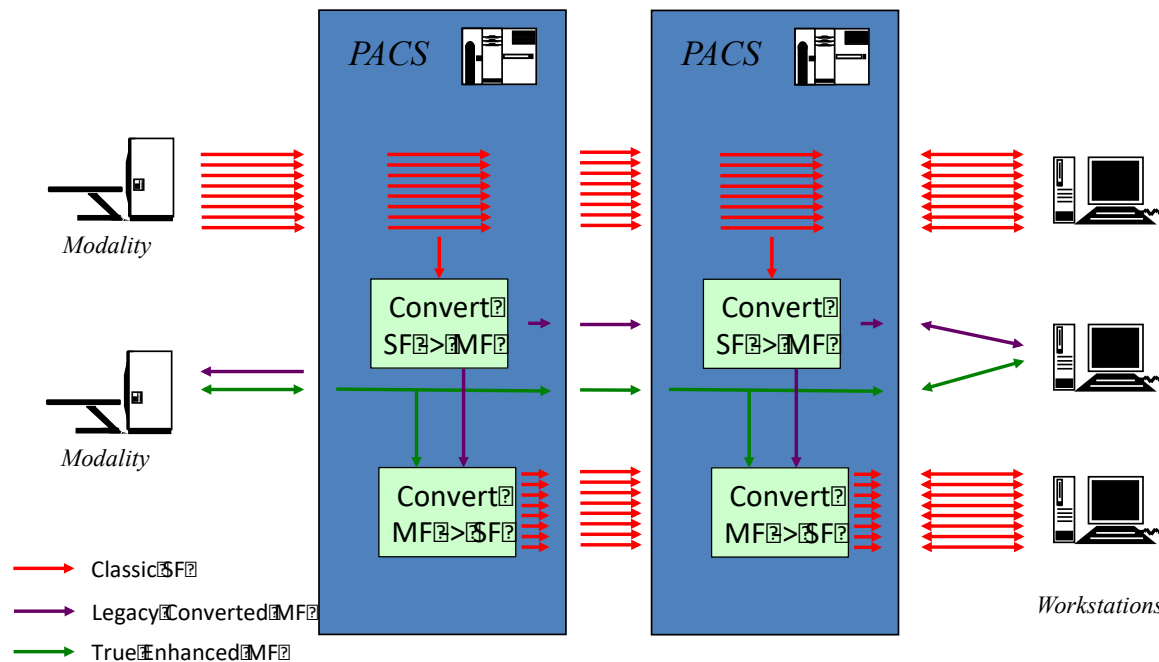
WHOLE SLIDE MICROSCOPY IOD
ENHANCED MR IMAGE IOD
MULTI-FRAME CRAYSICAL Image IOD
BREAST TOMOSYNTHESIS IMAGE IOD
SEGMENTATION IOD
MR SPECTROSCOPY IOD
ENHANCED X-RAY ANGIOGRAPHIC IMAGE IOD
ENHANCED MR ULTRASOUND PHTHALMICRANIOFACIAL BYTE SCALPHIC IMAGE IOD
INTRAVASCULAR OCT IMAGE IOD
ENHANCED MR ULTRASOUND PHTHALMICRANIOFACIAL BYTE SCALPHIC IMAGE IOD
ENHANCED MR ULTRASOUND PHTHALMICRANIOFACIAL BYTE SCALPHIC IMAGE IOD
X-RAY 3D ANGIOGRAPHIC IMAGE IOD
ENHANCED MR ULTRASOUND PHTHALMICRANIOFACIAL BYTE SCALPHIC IMAGE IOD
MULTI-FRAME GRAF IOD
ENHANCED PET IMAGE IOD
ENHANCED CT IMAGE IOD

New supplement coming:

Multi-Frame Converted Legacy Images

Conversion workflow

Heterogeneous environment with conversion from single to multi-frame objects



Why conversion

- **Enormous archive of Classic objects**
- **Supports the transition from Classic to Enhanced environment**
- **More often used on different places**
- **Transportation needs speeding up**
- **Leverage most of the benefits**

Requires

- **Conversion done by independent stations**
- **Build knowledge for various vendors**
- **Relaxation of Mandatoriness**

- **Huge potential benefit for using Enhanced objects**
- **Support is growing**
- **Pushed by**
 - **Increased Interoperability**
 - **Increasing datasets**
 - **Potential Speed gain**
 - **Higher availability**
 - **Coming conversion definition**

Start using

B. Revet:

What's New in DICOM

SPIE 2012

<http://?>

B. Erickson, D. Clunie:

The New CT and MR DICOM Objects: Why All the Fuss?

SCAR 2005

<ftp://medical.nema.org/medical/dicom/Multiframe/Presentations/SCAR-2005/>

K. Verduin:

Enhanced MR addresses Multi-Vendor Interoperability issues in clinical radiology

DICOM Conference China 2008

ftp://medical.nema.org/MEDICAL/Private/Dicom/Conferences/2008_China/Day_2/

Wim Corbijn van Willenswaard

Wim.Corbijn.van.Willenswaard@Philips.com

Philips Innovation Campus

Bengaluru

Thank you for your attention !