

DICOM Hanging Protocols

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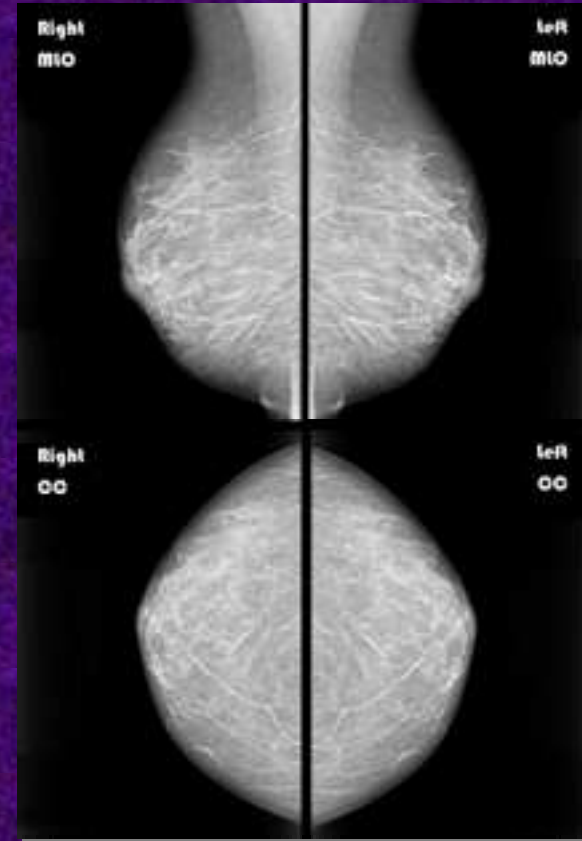
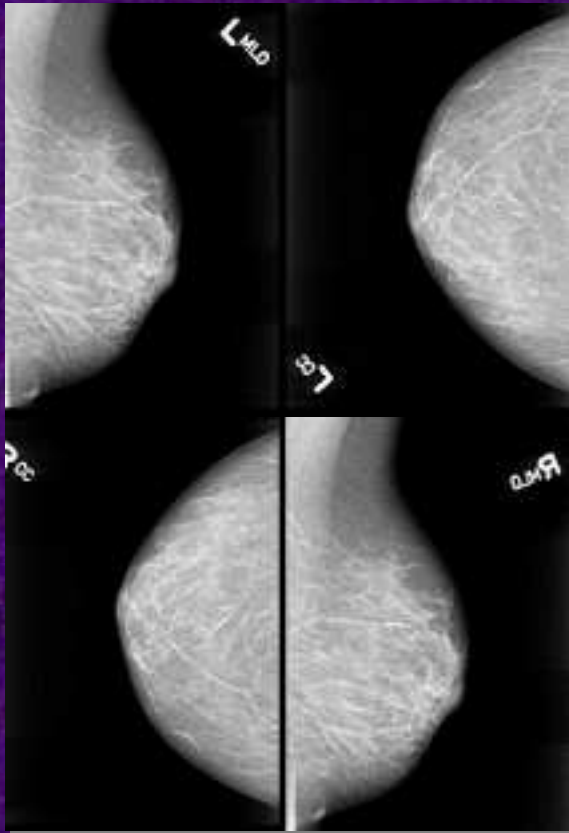
Chair WG-11

-Thanks to David Clunie for many slides

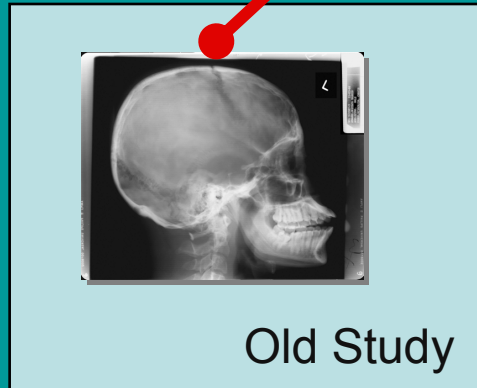
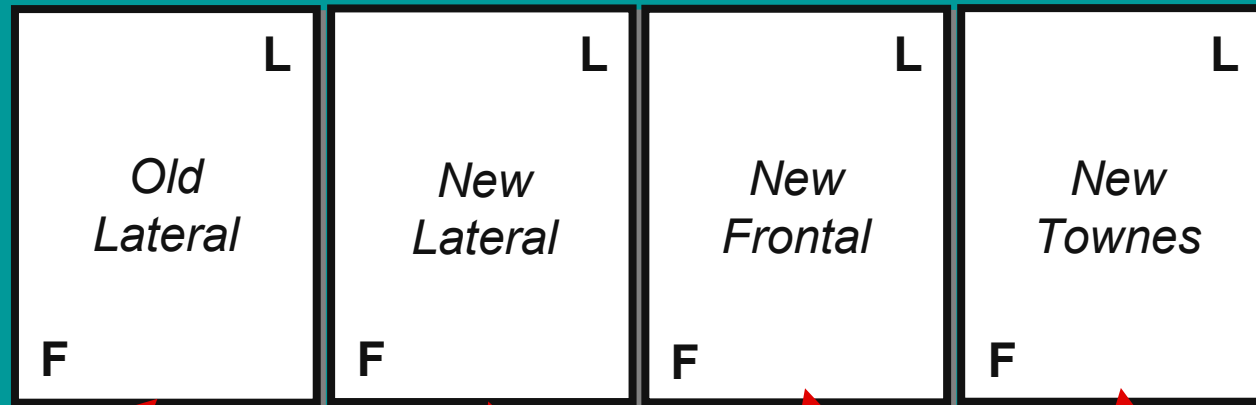
Hanging Protocols

- “Default display protocols”
- A set of instructions
- How to layout a class of images for display
- Order, orientation, windowing, processing
- Not specific to a particular patient’s images
- Hence a protocol, not a presentation state

Hanging Protocols



Hanging Protocols



Hanging Protocol Goals

- **Encode**
 - Applicability of protocol (type of display & images)
 - Selection of images
 - Display of selected images
- **Store centrally, retrieve and exchange**
 - Persistent composite objects
 - Query, retrieval and media encoding
- **Vendor neutrality**
 - Interchange between sites, PACS and workstations
 - Survive upgrades and replacements
 - “Public” library of “good” hanging protocols ?

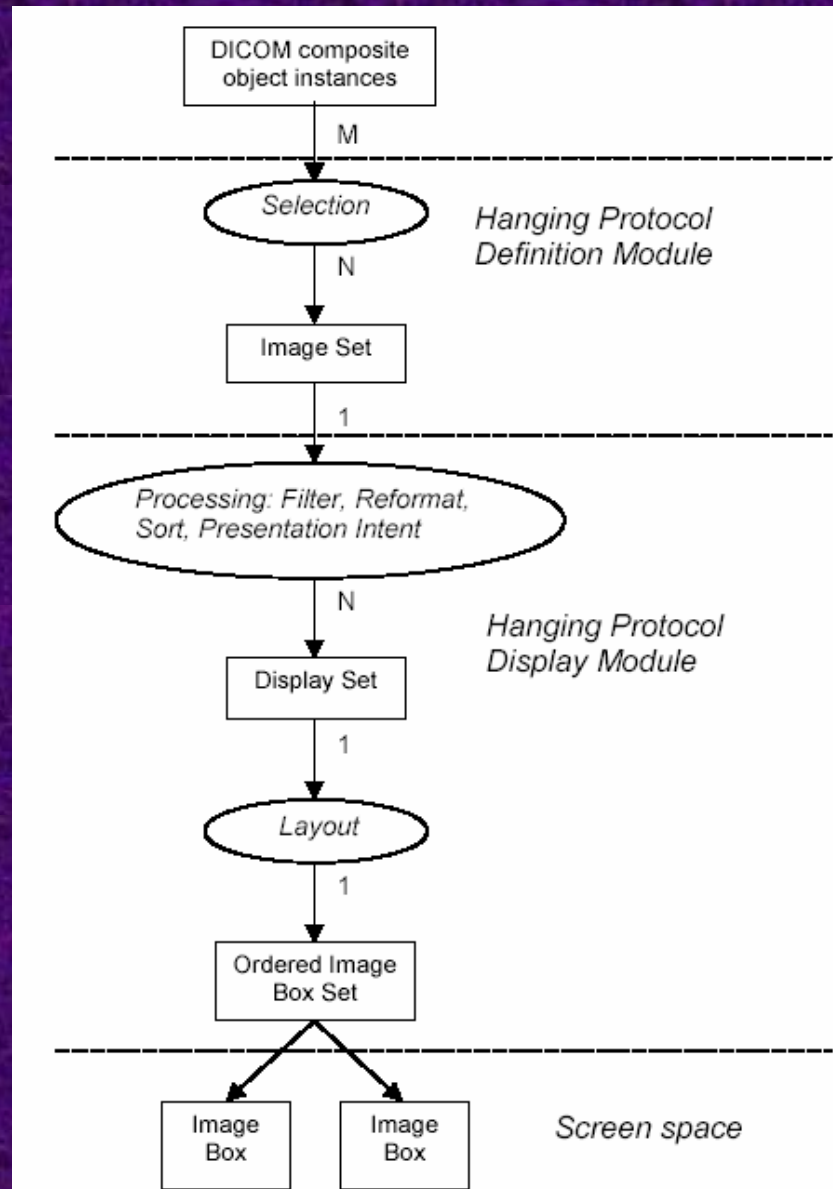
New Information Model

- Required for storage and query/retrieval
- No Patient/Study/Series hierarchy
- New Storage Service Class
- New Query Model
- Still C-STORE, C-FIND, C-MOVE

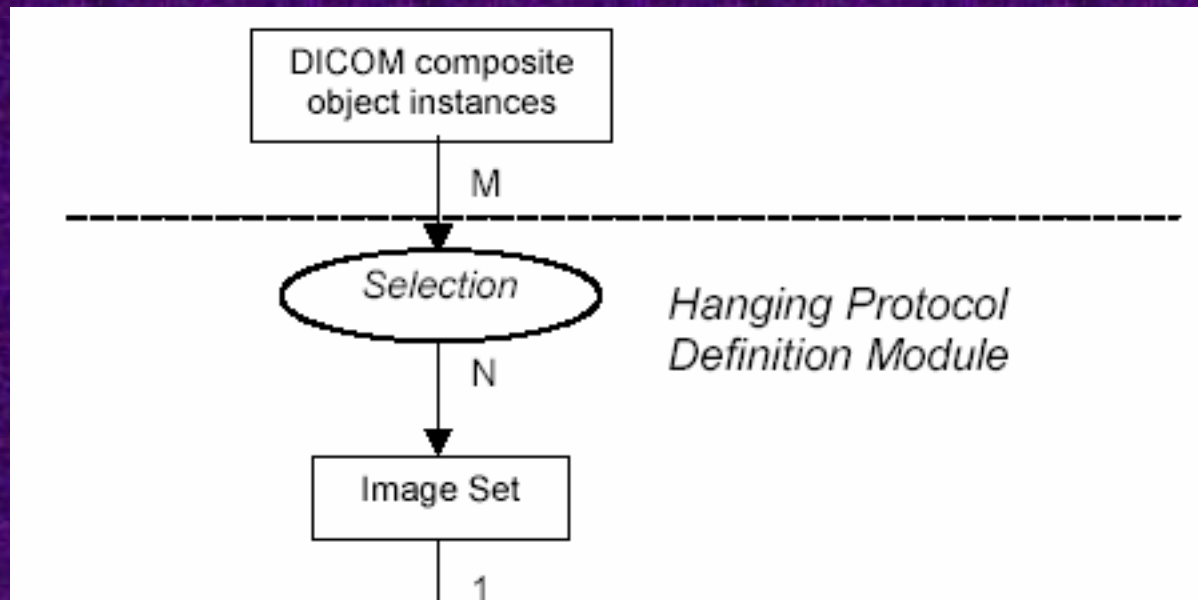
Using a Hanging Protocol

- Given a current exam (e.g. reading worklist)
- Find potentially applicable protocols
- Retrieve them from archive
- Select one from those available
- Select image +/- other studies to which it applies
- Display selected images as instructed

HP Internal Process Model



Finding a Protocol



Finding a Protocol

- **HP Definition Module**
 - Name, description, level, creator, creation datetime
 - Modality, anatomy, laterality
 - Procedure, reason for procedure
 - Number of priors
- **HP Environment Module**
 - Number of screens
 - Size(s) of screens
 - Color or grayscale bit depth

Selecting Images

- Definition of “image sets”
- By attribute values
 - Specific attributes, e.g. Modality, Anatomy
 - Specific values, e.g, CT, Chest
 - Supports all VRs, coded sequences, private elements and multi-frame functional groups
- By time
 - Relative time (today, yesterday, within last week)
 - Abstract priors (last, oldest, pre-operative, etc.)

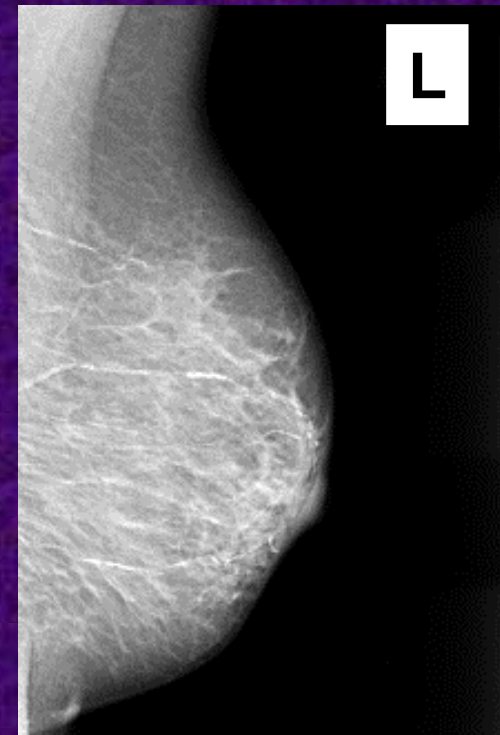
Successful Selection

- All hanging protocols depend on consistent and reliable (and standard) information being present in the images
- DICOM Hanging Protocols don't solve this integration problem
- Ideally - modality inserts correct anatomy and procedure and reason and orientation codes, and uses standard technique descriptions
- Worst case (typically?) - modality protocol (or operator) inserts recognizable Series Description

Information for Hanging

Modality: Mammography
Anatomic Region: Breast
Image Laterality: L
View Code: Medio-Lateral Oblique
Patient Orientation: A\FR

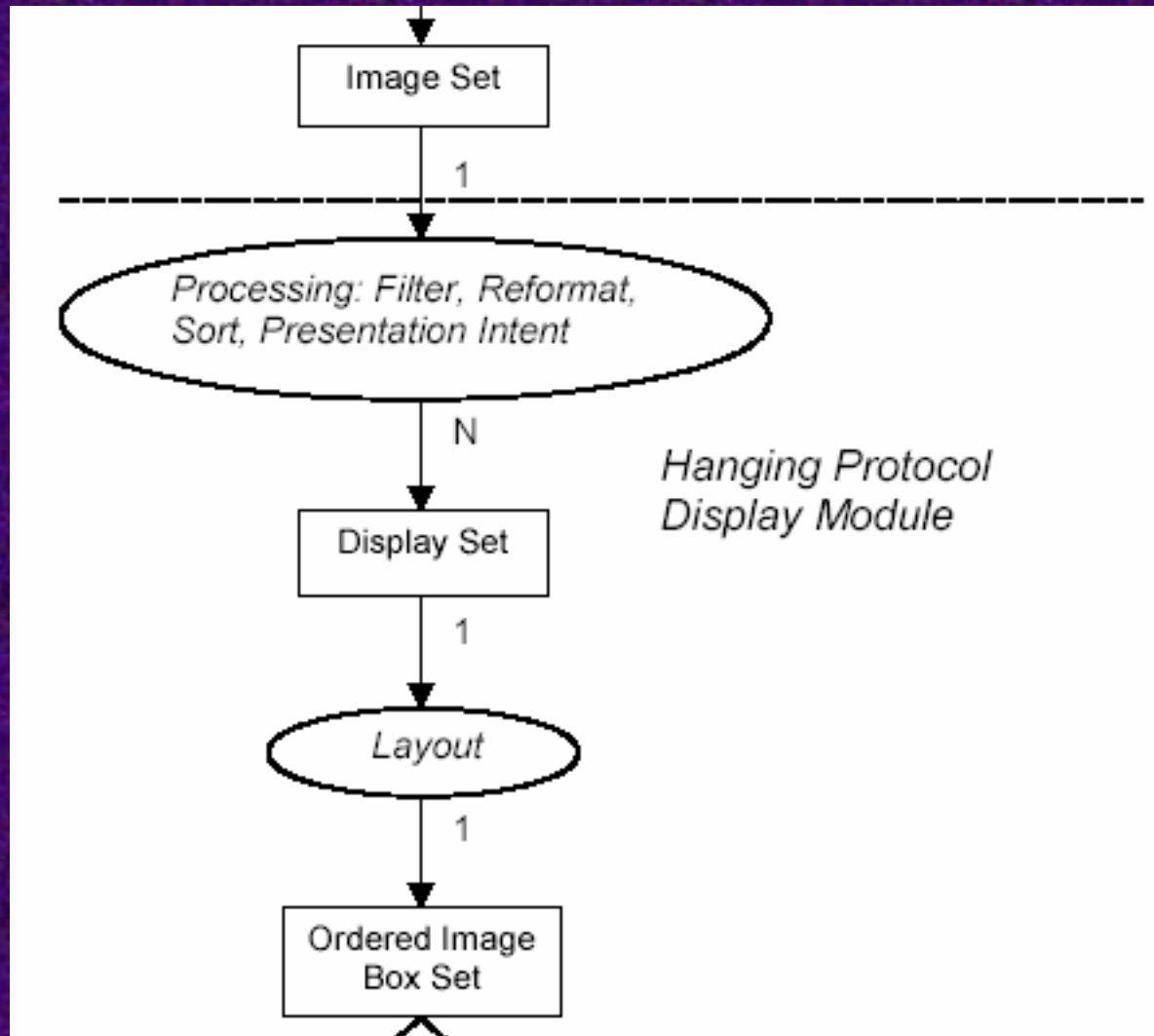
→ Anterior
↓
Foot
Right



Priors

- Concept of the “current” study required
- Protocol chooses priors based on
 - Relative time
 - Abstract temporal ranges (previous, last, etc.)
 - Abstract coded descriptions (“pre-operative”)
- Does NOT specify how to find them or get them
- May have been pushed, may need a query
- May be hard to find by abstract descriptions
- Creative use of queries or out-of-band information

Mapping to Display Sets



Mapping to Display Sets

- Image Sets are mapped to Display Sets using Filter, Reformat, Sort and Presentation Intent operations
 - HP Display Module Filter Operations Sequence
 - Multiplanar reformatting to resample images from a volume
 - HP Display Module Sorting Operations Sequence
 - Presentation Intent attributes

Mapping to Display Sets

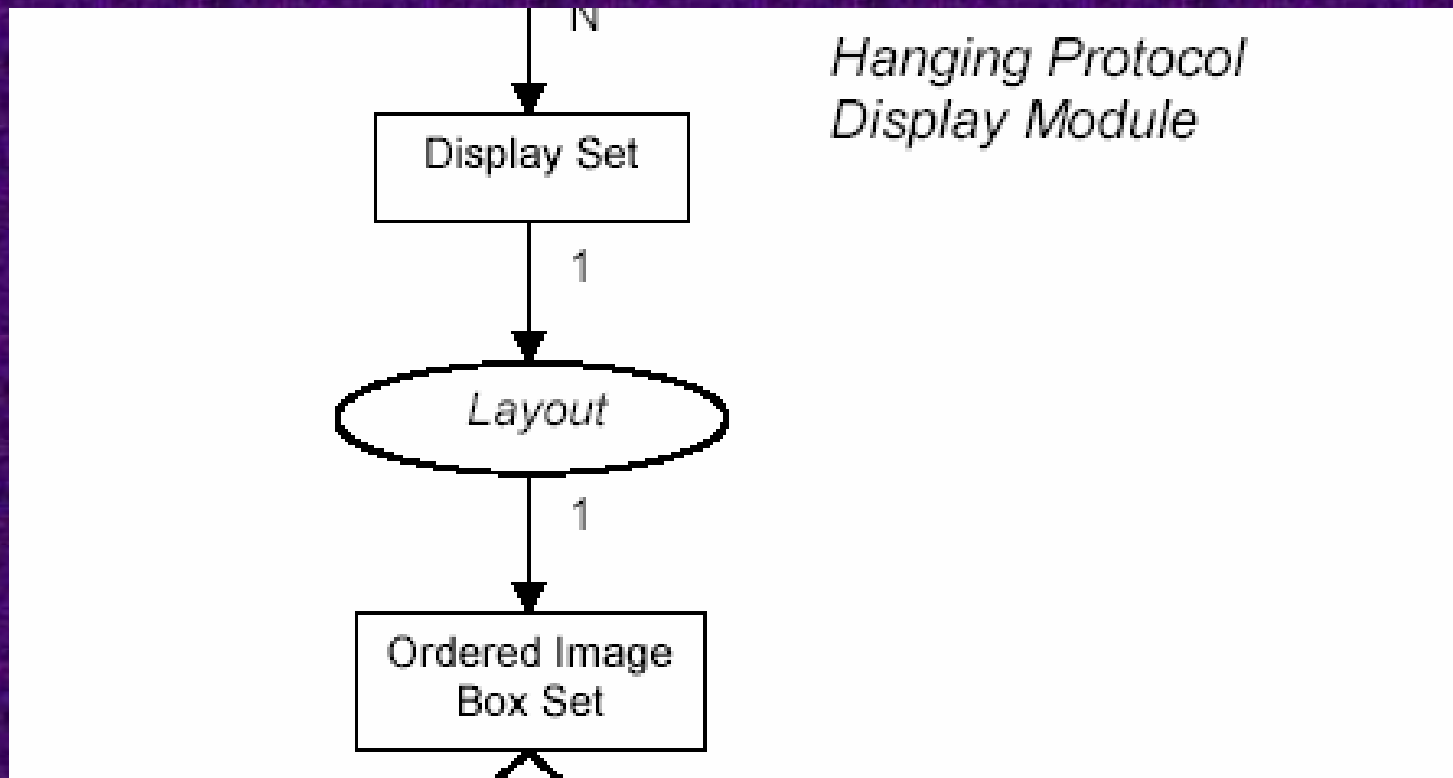
- **Filtering**
 - By attribute, or abstract, e.g. “category” of “image plane” “axial”
- **Sorting**
 - By attribute, or abstract, e.g. “along axis” “increasing”
- **Orientation**
 - E.g. rotate/flip until row left column posterior (L\P)
- **Annotation (Presentation Intent)**
 - Patient demographics, technique and graphics on or off

Display Set

- Is one Display Sets Sequence Item
- Container holding the final sets of images after all filter, sort, reformat and Presentation Intent operations have occurred.
- Images ready for rendering to locations on the screen(s)

Mapping to Image Boxes

- Image Boxes Sequence



Mapping to Image Boxes

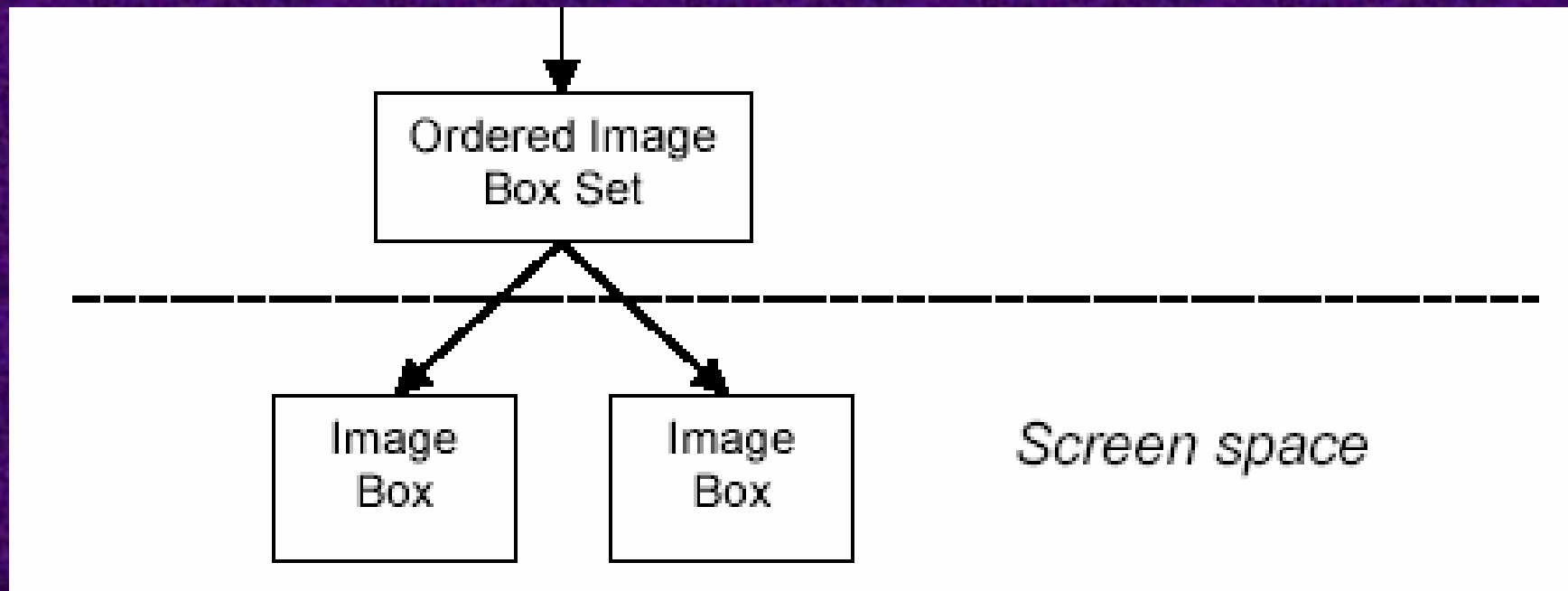
- Image Box types
 - Tiled (e.g. 3x4)
 - Stack (single image paged manually)
 - Cine (time-based play back)
 - Processed (e.g. MPR, 3D)
 - Single (e.g. a place for a report or waveform)
- Specify
 - Scrolling mode
 - Playback rate

Processing & Presentation

- Reformatting, e.g., MPR, 3D, slab
- Thickness, interval
- View direction, e.g., axial, sagittal, coronal
- Type, e.g., MIP, surface, volume
- VOI Type (windowing), e.g., brain, bone
- Pseudo-color type, e.g., hot iron
- Invert grayscale
- True size
- Synchronized scrolling (by Display Set number)
- Navigation and localization

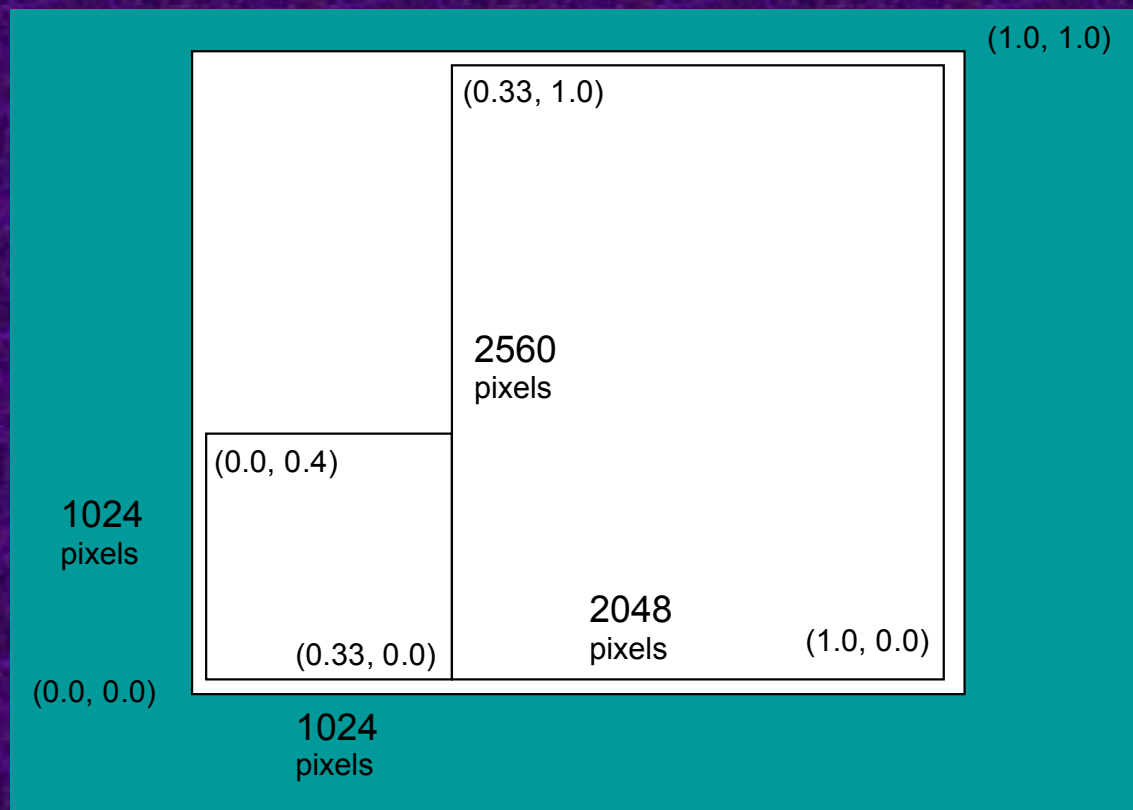
Display of Image Boxes

- Display environment Spatial Position



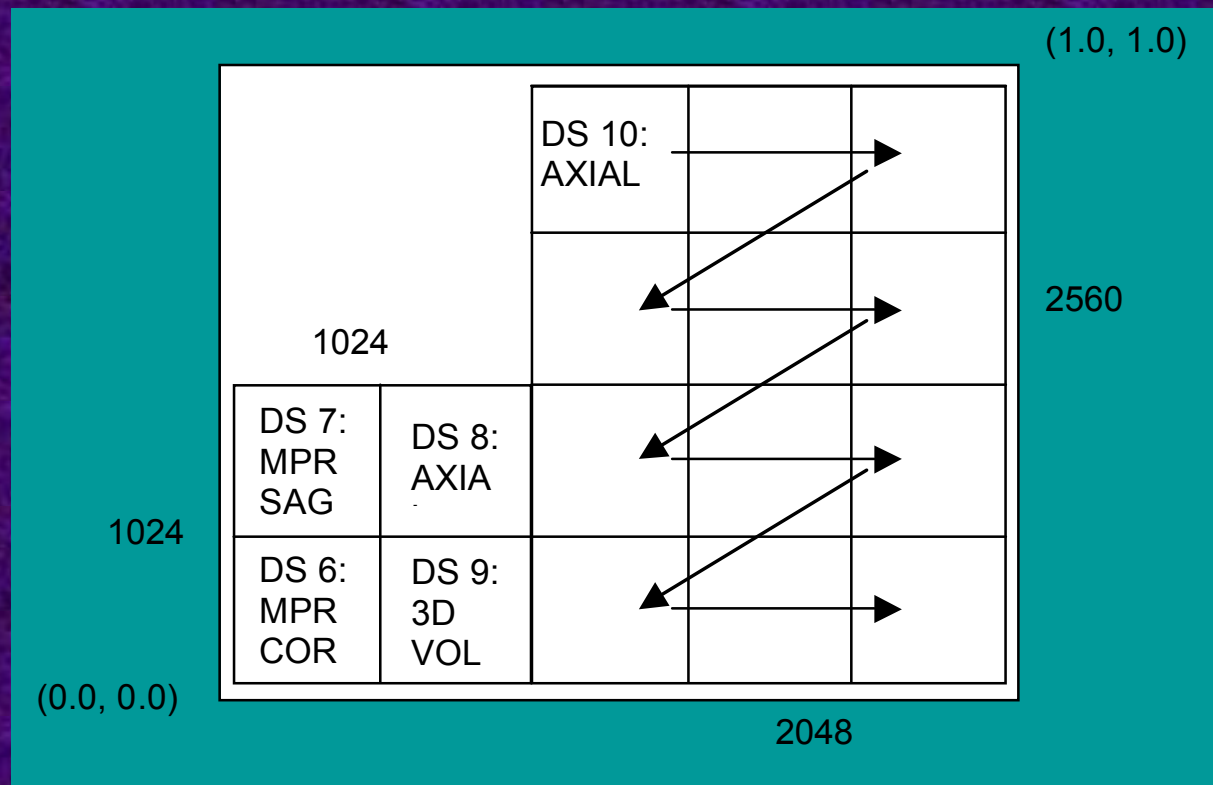
Display of Image Boxes

- Entire display environment from 0,0 to 1,1
- Individual screens are not distinguished



Display of Image Boxes

- Image Sets displayed in Image Boxes
- Image Boxes rendered at relative location



Hanging Protocols - Conclusion

- Interchangeable
- Vendor neutral
- Multi-modality
- Support selection of priors
- Full richness of current display modes
- Flexible
- Extensible
- Non-trivial to implement and retrofit
- Dependent on reliable image attributes