DICOM Conformance Statement (DCS)

Our Communications Tool

DICOM 2005 International Conferences and Workshop

Presented by
Donald E. Van Syckle
DVS Consulting, Inc.

www.dvsconsult.com
DCS - Our Communications Tool

- Documents how vendors implement DICOM into their products
- Required, Public, and often found on Vendor Web sites
- Follows a well defined format
- Facilitates comparisons of product implementations

12 years of Success
The More Information the Better!

- Detailed information aids a knowledgeable DICOM person greatly
- However, still very difficult for the non-DICOM knowledgeable person
- Many vendors have documented information beyond what DICOM requires

But not All!

Part 2 updated in 2004 via “Supplement 64”
New DCS – Major Enhancement

- Based on real-world experiences using Conformance Statements
- Helps non-knowledgeable DICOM users with a Conformance Statement Overview (i.e. executive summary)
- More info to better prepare for installations and troubleshooting of DICOM

Easier to read, more details
Enhanced Product Examples

- Integrated Modality (i.e. modality with worklist, etc.)
- Radiology Information System (RIS)
- Image Viewer (workstation)
- Print Server
- Query/Retrieve Server

Annex A provides common template
Executive Summary

- The DICOM “One Pager”
- Explains DICOM functionality in: “Laymen understandable terms”
- Marketing text instead of engineering (needs improvement in the real world)
- Table of SOP Classes and Roles supported (also includes Media)

Key for the Non-DICOM hospital personnel

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## Overview - Great First Look

<table>
<thead>
<tr>
<th>SOP Classes</th>
<th>User of Service (SCU)</th>
<th>Provider of Service (SCP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image Transfer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT Image Storage</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Query/Retrieve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study Root Information Model FIND</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Study Root Information Model Move</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Workflow Management</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modality Worklist Information Model - Find</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Print Management</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basics Grayscale Print Mgt.</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

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The Details – the real DCS

- After the overview, it really requires real DICOM experience to read the DCS
  - Implementation
  - Integration
  - Training
  - Know how to read DICOM Standard ……

- Need to learn DICOM terms and concepts
  - SOP Classes, IODs, SCU/SCP…
  - Abstract Syntax, Presentation Context…
  - Modules, Attributes, Context Tables…..
New DCS – Technical Changes

- Table of Contents, Definitions, Terms, Abbreviations
  - Some help to novice, much more help to technical

- Better "Sequencing of Real-World Activities"
  - Defines interactions between this vendor and others
  - Recommends UML Sequence Diagrams (Unified Modeling Language)
    » Shows the typical “DICOM Flow” of the product
    » Easy to understand, even without UML knowledge

Wording describing UML also key!
Modality – UML Example

1. Query Worklist
2. Receive Worklist
3. Select Workitem (MSPS)
4. Start Acquisition (Create MPPS)
5. Acquire Images
6. Complete Acquisition (Finalize MPPS)
7. Print Acquired Images
8. Store Acquired Images & GSPS
9. Commit Acquired Images & GSPS
AE Specification

- AE Specs and Annexes are probably the most important sections of DCS
- Association Negotiation
- SOP Specific (for each SOP)
- Used most by knowledgeable DICOM person

Provides the “real details”
Association Negotiation

- Describes how you Establish and/or Receive DICOM network connections
- Presentation Contexts, Abstract and Transfer Syntaxes, etc.
- Added “Sequence of Activity” UML plus text to association and SOP class flow
- More compression in the world today so documenting Transfer Syntax polices important – *What about Lossy compression?*
SOP Specifics

- Improvements to describe behavior of SOP Class
- Includes statuses for DICOM Commands and the behavior based on those statuses
  - Do you abort failed statues, log the event?
  - Try to recover and how?
  - What do you do when you are successful?
  - Use optional but important attributes Offending Element or Error Comment?

- Define time-outs and actions taken
- These sections have traditionally been weak and improvements are needed
SOP Specifics – Part 4

- Each individual SOP Class also defines required information

- Example – Storage Commitment states
  - The SCU shall specify the behavior and actions performed when a success status is received (i.e. if and when local SOP Instances copies are deleted)
  - The SCU shall specify the behavior and actions performed when a failure status is received (i.e. recovery mechanisms, etc.)

Don’t forget requirements defined by SOP Class
Attributes, Attributes, Attributes

- Major improvement in the requirements to document “how attributes are used”
- Query attributes listed in AE Specifications (I.e. Composite Queries and Worklist)
- Annexes created to specify IODs in detail
- Many vendors have already been doing this – *But many have not!*

Don’t just list attributes tell us how they are used!
## Query Attributes

<table>
<thead>
<tr>
<th>Module Name</th>
<th>Attribute Name</th>
<th>Tag</th>
<th>VR</th>
<th>M</th>
<th>R</th>
<th>Q</th>
<th>D</th>
<th>I O D</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOP Common</td>
<td>Specific Character Set</td>
<td>(0008,0005)</td>
<td>CS</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scheduled Procedure Step Sequence</td>
<td>(0040,0100)</td>
<td>SQ</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; Scheduled Station AET</td>
<td>(0040,0001)</td>
<td>AE</td>
<td></td>
<td>(S)</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; Scheduled Procedure Step Start Date</td>
<td>(0040,0002)</td>
<td>DA</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; Scheduled Procedure Step Start Time</td>
<td>(0040,0003)</td>
<td>TM</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
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<tr>
<td></td>
<td>&gt; Modality</td>
<td>(0040,0060)</td>
<td>CS</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
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<td></td>
<td>&gt; Scheduled Performing Physician’s Name</td>
<td>(0040,0006)</td>
<td>PN</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; Scheduled Procedure Step Description</td>
<td>(0040,0007)</td>
<td>LO</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x x</td>
</tr>
<tr>
<td></td>
<td>&gt; Scheduled Station Name</td>
<td>(0040,0010)</td>
<td>SH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; Scheduled Procedure Step Location</td>
<td>(0040,0011)</td>
<td>SH</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; Scheduled Protocol Code Sequence</td>
<td>(0040,0008)</td>
<td>SQ</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>&gt; Pre-Medication</td>
<td>(0040,0012)</td>
<td>LO</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>&gt; Scheduled Procedure Step ID</td>
<td>(0040,0009)</td>
<td>SH</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x x</td>
</tr>
<tr>
<td></td>
<td>&gt; Requested Contrast Agent</td>
<td>(0032,1070)</td>
<td>LO</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

**M** – Matching, **R** – Return Key, **Q**- User Query Enabled, **D** – Displayed, **IOD** – placed in IOD
Annex - IODs

- Specifies each IOD created (including Privates IODs)
- Attribute, Tag, VR and Value
- Values should contain the range and source (i.e. auto generated, user input, worklist, etc.)
- Content Items in Templates, Private Attributes…

Very powerful in the hands of a strong integrator
Range and User Input

- **Recommended Range values:**
  - VNAP - Value Not Always Present (attribute sent zero length if no value is present)
  - ANAP - Attribute Not Always Present
  - ALWAYS - Always Present with a value
  - EMPTY - Attribute is sent without a value

- **Recommended Source values:**
  - USER - the attribute value source is from User input
  - AUTO - the attribute value is generated automatically
  - MWL,MPPS - value received using Modality Worklist, Modality Performed Procedure Step, etc.
  - CONFIG - the attribute value source is a configurable parameter
## IOD Table Example

<table>
<thead>
<tr>
<th>IE</th>
<th>Module</th>
<th>Reference</th>
<th>Presence of Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient</td>
<td>Patient</td>
<td>Table B.8.1-3</td>
<td>ALWAYS</td>
</tr>
<tr>
<td>Study</td>
<td>General Study</td>
<td>Table B.8.1-4</td>
<td>ALWAYS</td>
</tr>
<tr>
<td></td>
<td>Patient Study</td>
<td>Table B.8.1-5</td>
<td>Not Used</td>
</tr>
<tr>
<td>Series</td>
<td>General Series</td>
<td>Table B.8.1-6</td>
<td>ALWAYS</td>
</tr>
<tr>
<td>Equipment</td>
<td>General Equipment</td>
<td>Table B.8.1-7</td>
<td>ALWAYS</td>
</tr>
<tr>
<td>Image</td>
<td>General Image</td>
<td>Table B.8.1-8</td>
<td>ALWAYS</td>
</tr>
<tr>
<td></td>
<td>Image Pixel</td>
<td>Table B.8.1-10</td>
<td>ALWAYS</td>
</tr>
<tr>
<td></td>
<td>Cine</td>
<td>Table B.8.1-11</td>
<td>Only if Multi-frame</td>
</tr>
</tbody>
</table>
## Module Table Example

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>VR</th>
<th>Value</th>
<th>Presence of Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Instance UID</td>
<td>(0020,000D)</td>
<td>UI</td>
<td>From Modality Worklist or generated by device</td>
<td>ALWAYS</td>
<td>MWL/AUTO</td>
</tr>
<tr>
<td>Study Date</td>
<td>(0008,0020)</td>
<td>DA</td>
<td>&lt;yyyyymmdd&gt;</td>
<td>ALWAYS</td>
<td>AUTO</td>
</tr>
<tr>
<td>Study Time</td>
<td>(0008,0030)</td>
<td>TM</td>
<td>&lt;hhmmss&gt;</td>
<td>ALWAYS</td>
<td>AUTO</td>
</tr>
<tr>
<td>Referring Physician’s Name</td>
<td>(0008,0090)</td>
<td>PN</td>
<td>From Modality Worklist</td>
<td>VNAP</td>
<td>MWL</td>
</tr>
<tr>
<td>Study ID</td>
<td>(0020,0010)</td>
<td>SH</td>
<td>Requested Procedure ID from Worklist or User Input</td>
<td>VNAP</td>
<td>MWL/AUTO USER</td>
</tr>
<tr>
<td>Accession Number</td>
<td>(0008,0050)</td>
<td>SH</td>
<td>From Modality Worklist or user input</td>
<td>VNAP</td>
<td>MWL/AUTO USER</td>
</tr>
<tr>
<td>Study Description</td>
<td>(0008,1030)</td>
<td>LO</td>
<td>Comment text box in study list. Maximum 1024 characters.</td>
<td>VNAP</td>
<td>USER</td>
</tr>
<tr>
<td>Referenced Study Sequence</td>
<td>(0008,1110)</td>
<td>SQ</td>
<td>From Modality Worklist</td>
<td>VNAP</td>
<td>MWL</td>
</tr>
</tbody>
</table>
Miscellaneous

- More definitive description of configurable parameters
  - Network (local and remote), time-outs, Application parameters…
- Coded terminology and/or templates
- Grayscale Image Consistency
  (I.e. Presentation State, Print LUT, …)
- Characters Sets, Security, Private Data
New DICOM Conformance Statement

- Understand how products connect to each other
- Summary improves understanding for the novice
- Enhanced details for the knowledgeable
  - UML flow diagrams, Command statues and behavior
  - SOP Class behavior, how are Attributes used, not just a list
  - And much more…….
- Not widely deployed but on the rise

Encourage the new format!

DCS - A Proven Success for 12 Years!
Thank You and Enjoy the Conference!