2017

Metadata Standards/Schemes Review

METADATA FOR IMAGES IN XML STANDARD (MIX)

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Purpose and History of the Scheme

The Metadata for Images in XML Schema (MIX) standard is created and maintained by the Library of Congress's office of Network Development and MARC Standards for the National Information Standards Organization. While MIX is its own standard, it is impossible to discuss MIX without discussing its parent scheme, "NISO Metadata for Images in XML" (NISO MIX). NISO MIX was the initial scheme created to manage metadata for raster images, and MIX is the encoding for NISO MIX in XML. MIX was created on May 1, 2006, and updated again on May 12, 2008 (Library of Congress 2015). The NISO MIX scheme was also created in 2006, but then revised on March 1, 2011(National Information Standards Organization 2006). The National Information Standards Organization (NISO) partnered with the Library of Congress' Network Development and MARC Standards to create an XML scheme so that standards would be set for the transfer and storage of NISO MIX. It does so by drawing upon the XML Scheme from the World Wide Web consortium (Library of Congress 2015). It general purpose is to allow users to apply these schemes in XML standard, and therefore increase interoperability between machines.

NISO MIX was created under the assumption that it would be encoded using XML, thus much of its structure has taken XML structure into account. It is maintained by the Library of Congresses Network Development and MARC Standards Office, but also it does have room for expansion via feedback from users in addition to updates by the Network Development and MARC office (Library of Congress 2015). MIX also doesn't have to be a standalone scheme, it can be used as an extension of Metadata Encoding & Transmission Standard (METS) (Guenther, 2007).

Guiding Principals

MIX and NISO MIX were created to be a very broad and encompassing metadata scheme. They were created with a few goals in mind: interchangeability, extensibility/scalability, independent of file format, consistent, and network ready (National Information Standards Organization 2011, 2). These were the design goals as NISO MIX were designed, and eventually migrated into the MIX standard as its purpose to was standardize the scheme for XML. During the initial creation of NISO MIX the writers did assume the primary encoding would be done through XML, so the schemes structure was considered as it was written (National Information Standards Organization 2011, 3). Though prior to the creation of MIX, NISO's data dictionary did not provide anything more than a set of definitions (Needleman 2013, 71). Therefore, when creating MIX, the goal was to take the list of definitions and create an encoding method that meets these same criteria (Needleman 2013, 71).

Structure and Major Elements

MIX includes five key headings: basic digital object information, basic image information, image capture metadata, image assessment metadata, and change history. Each of these headings is broken down into multiple subheadings which can again be broken down further. All of which is included on an as needed basis beyond the main heading. Each main heading has a definitive goal. Basic Digital Information provides general information about the image file, which is vital for image files in terms of both current usage and long-term compatibility (National Information Standards Organization 2006). Basic Image Information includes basic information about the image that is key to viewing the image on the screen (National Information Standards Organization 2006). Image Capture Metadata includes administrative metadata about the capture of the image (National Information Standards Organization 2006). Image Assessment Metadata provides key information for both the current output and migration to new formats, they are key to image quality (National Information Standards Organization 2006). Finally, Change History contains metadata pertaining to editing and transformations that have happened to the image both currently and future potential (National Information Standards Organization 2006). Each section contains important metadata both regarding current access, but also the longevity of the image.

Here is a sample of the Basic Digital Information and Basic Image Information structure, taken from a sample document on the Library of Congress's page (Library of Congress 2007):

```
<BasicDigitalObjectInformation>
      <ObjectIdentifier>
            <objectIdentifierType/>
            <objectIdentifierValue/>
      </ObjectIdentifier>
      <fileSize></fileSize>
      <FormatDesignation>
            <formatName/>
            <formatVersion/>
      </FormatDesignation>
      <FormatRegistry>
            <formatRegistryName/>
```

```
            <formatRegistryKey/>
      </FormatRegistry>
      <byteOrder use="system"></byteOrder>
      <Compression>
            <compressionScheme/>
            <compressionSchemeLocalList/>
            <compressionSchemeLocalValue/>
      <compressionRatio></compressionRatio>
      </Compression>
      <Fixity>
            <messageDigestAlgorithm></messageDigestAlgorithm>
            <messageDigest/>
            <messageDigestOriginator/>
      </Fixity>
</BasicDigitalObjectInformation>
<BasicImageInformation>
      <BasicImageCharacteristics>
            <imageWidth></imageWidth>
            <imageHeight></imageHeight>
            <PhotometricInterpretation>
                  <colorSpace/>
                  <ColorProfile>
                        <IccProfile>
                              <iccProfileName/>
                              <iccProfileVersion/>
                              <iccProfileURL/>
                        </IccProfile>
                        <LocalProfile>
                              <localProfileName/>
```

```
                        <localProfileURL/>
                    </LocalProfile>
                    <embeddedProfile/>
                </ColorProfile>
                <YCbCr>
                    <YCbCrSubSampling>
                        <yCbCrSubsampleHoriz></yCbCrSubsampleHoriz>
                        <yCbCrSubsampleVert></yCbCrSubsampleVert>
                    </YCbCrSubSampling>
                    <yCbCrPositioning></yCbCrPositioning>
                    <yCbCrCoefficients/>
                </YCbCr>
                <referenceBlackWhite/>
            </PhotometricInterpretation>
        </BasicImageCharacteristics>
        <SpecialFormatCharacteristics>
            <JPEG2000>
                <CodecCompliance>
                    <codec/>
                    <codecVersion/>
                    <codestreamProfile/>
                    <complianceClass/>
                </CodecCompliance>
                <EncodingOptions>
                <tiles/>
                    <qualityLayers></qualityLayers>
                    <resolutionLevels></resolutionLevels>
                </EncodingOptions>
            </JPEG2000>
```

```
            <MrSID>
                  <zoomLevels></zoomLevels>
            </MrSID>
            <Djvu>
                  <djvuFormat></djvuFormat>
            </Djvu>
      </SpecialFormatCharacteristics>
</BasicImageInformation>
```

These are just two of the main headings, but both show the structure and a variety of possible elements within the scheme. With all possible elements included an XML document including information can be many pages long, the full sample document is included in the sample section at the end. MIX is structured like all XML documents, broken down into a variety of levels of granularity. Each element can be left off as needed, and much of the information can be extracted from modern file formats such as a jpeg image. A full list of possible elements can be found in ANSI/NISO's "Data Dictionary – Technical Metadata for Digital Still Images" between pages 4 and 95. All elements follow the same progressively more detailed structure (National Information Standards Organization 2006).

Areas Currently Using It and Potential Challenges

It is currently widely used in digital libraries alongside METS to provide additional metadata that wouldn't necessarily be covered under METS, it also provides contextual metadata that is useful for the longer-term preservation of these files (Guenther 2007). MIX can also be used alongside other metadata schemes in this way to allow for more complete records when other schemes fall short. Currently systems that use METS are suggested to use MIX as one of the possibilities to fill in some gaps left in the metadata (Library of Congress 2008).

Though this leads to issues in terms of redundancy, since a few of the major schemes used together, MIX, METS, and PREMIS (Preservation Metadata: Implementation Strategies) have many identical or similar categories so the possibility for redundancy exists (Wagner 2011). Redundant metadata isn't necessarily an issue, but it can create more complex, and unnecessarily dense records that are more difficult to process. Additionally, with such a vast list of possible elements, all of which are technically optional it doesn't require a standard usage and wouldn't necessarily achieve a standardized use as again, it can create an overwhelming list of metadata when using in tandem with another massive metadata standard such as METS.

Examples of Usage

This sample was taken directly from the Library of Congress's MIX webpage. The page included an example in both verions .2 and 1.0. This is version 1.0 (Cundiff 2007).

```
<mix
xmlns="http://www.loc.gov/mix/v10" xmlns:xsi=http://www.w3.org/2001/XMLSchema
instance
xsi:schemaLocation="http://www.loc.gov/standards/mix/mix10/mix10.xsd">
<!--xsi:schemaLocation=http://www.loc.gov/mix/v10 mix10.xsd
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"-->

<!--  NISO Section 6  -->

<BasicDigitalObjectInformation>
      <ObjectIdentifier>
            <objectIdentifierType/>
            <objectIdentifierValue/>
      </ObjectIdentifier>
      <fileSize>33</fileSize>
      <FormatDesignation>
            <formatName/>
            <formatVersion/>
      </FormatDesignation>
      <FormatRegistry>
            <formatRegistryName/>
            <formatRegistryKey/>
      </FormatRegistry>
      <byteOrder use="system">little_endian</byteOrder>
      <Compression>
            <compressionScheme/>
            <compressionSchemeLocalList/>
```

```
            <compressionSchemeLocalValue/>
            <compressionRatio>10</compressionRatio>
      </Compression>
      <Fixity>
            <messageDigestAlgorithm>MD5</messageDigestAlgorithm>
            <messageDigest/>
            <messageDigestOriginator/>
      </Fixity>
</BasicDigitalObjectInformation>

<!--  NISO Section 7  -->

<BasicImageInformation>
      <BasicImageCharacteristics>
            <imageWidth>400</imageWidth>
            <imageHeight>200</imageHeight>
            <PhotometricInterpretation>
                  <colorSpace/>
                  <ColorProfile>
                        <IccProfile>
                              <iccProfileName/>
                              <iccProfileVersion/>
                              <iccProfileURL/>
                        </IccProfile>
                        <LocalProfile>
                              <localProfileName/>
                              <localProfileURL/>
                        </LocalProfile>
                        <embeddedProfile/>
```

```
            </ColorProfile>
            <YCbCr>
                  <YCbCrSubSampling>
                        <yCbCrSubsampleHoriz>1</yCbCrSubsampleHoriz>
                        <yCbCrSubsampleVert>1</yCbCrSubsampleVert>
                  </YCbCrSubSampling>
                  <yCbCrPositioning>1</yCbCrPositioning>
                  <yCbCrCoefficients/>
            </YCbCr>
            <referenceBlackWhite/>
      </PhotometricInterpretation>
</BasicImageCharacteristics>
<SpecialFormatCharacteristics>
      <JPEG2000>
            <CodecCompliance>
                  <codec/>
                  <codecVersion/>
                  <codestreamProfile/>
                  <complianceClass/>
            </CodecCompliance>
            <EncodingOptions>
                  <tiles/>
                  <qualityLayers>2</qualityLayers>
                  <resolutionLevels>2</resolutionLevels>
            </EncodingOptions>
      </JPEG2000>
      <MrSID>
            <zoomLevels>5</zoomLevels>
      </MrSID>
```

```
            <Djvu>
                  <djvuFormat>indirect</djvuFormat>
            </Djvu>
      </SpecialFormatCharacteristics>
</BasicImageInformation>

<!--  NISO Section 8  -->

<ImageCaptureMetadata>
      <SourceInformation>
            <sourceType/>
            <SourceID>
                  <sourceIDType/>
                  <sourceIDValue/>
            </SourceID>
            <SourceSize>
                  <SourceXDimension>
                        <sourceXDimensionValue>7.63</sourceXDimensionValue>
                        <sourceXDimensionUnit>in.</sourceXDimensionUnit>
                  </SourceXDimension>
                  <SourceYDimension>
                        <sourceYDimensionValue>5.29</sourceYDimensionValue>
                        <sourceYDimensionUnit>in.</sourceYDimensionUnit>
                  </SourceYDimension>
                  <SourceZDimension>
                        <sourceZDimensionValue>5.29</sourceZDimensionValue>
                        <sourceZDimensionUnit>in.</sourceZDimensionUnit>
                  </SourceZDimension>
            </SourceSize>
```

```
</SourceInformation>
<GeneralCaptureInformation>
      <dateTimeCreated>2006-06-06</dateTimeCreated>
      <imageProducer/>
      <captureDevice use="system">transmission scanner</captureDevice>
</GeneralCaptureInformation>
<ScannerCapture>
      <scannerManufacturer/>
      <ScannerModel>
            <scannerModelName/>
            <scannerModelNumber/>
            <scannerModelSerialNo/>
      </ScannerModel>
      <maximumOpticalResolution/>
      <scannerSensor>undefined</scannerSensor>
      <ScanningSystemSoftware>
            <scanningSoftwareName/>
            <scanningSoftwareVersionNo/>
      </ScanningSystemSoftware>
</ScannerCapture>
<DigitalCameraCapture>
      <digitalCameraManufacturer/>
      <DigitalCameraModel>
            <digitalCameraModelName/>
            <digitalCameraModelNumber/>
            <digitalCameraModelSerialNo/>
      </DigitalCameraModel>
      <cameraSensor>MonochromeArea</cameraSensor>
      <CameraCaptureSettings>
```

```
<ImageData>
      <fNumber>3</fNumber>
      <exposureTime>3.1</exposureTime>
      <exposureProgram>1</exposureProgram>
      <spectralSensitivity>0.015</spectralSensitivity>
      <isoSpeedRatings>100</isoSpeedRatings>
      <oECF use="system">
            <numerator>2</numerator>
      </oECF>
      <exifVersion>0220</exifVersion>
      <shutterSpeedValue use="system">
            <numerator>1</numerator>
            <denominator>8</denominator>
      </shutterSpeedValue>
      <apertureValue>
            <numerator>1</numerator>
            <denominator>3</denominator>
      </apertureValue>
      <brightnessValue use="system">
            <numerator>-99.99</numerator>
      </brightnessValue>
      <exposureBiasValue>
            <numerator>-3.0</numerator>
      </exposureBiasValue>
      <maxApertureValue>
            <numerator>0.00</numerator>
      </maxApertureValue>
      <subjectDistance>5.3</subjectDistance>
      <meteringMode>Multispot</meteringMode>
```

```
        <lightSource>Daylight</lightSource>
        <flash>Flash fired</flash>
        <focalLength>1</focalLength>
        <flashEnergy>
              <numerator>1</numerator>
              <denominator>2</denominator>
        </flashEnergy>
        <backLight>Front light</backLight>
        <exposureIndex>400</exposureIndex>
        <sensingMethod>1</sensingMethod>
        <cfaPattern>1</cfaPattern>
        <autoFocus use="system">Auto Focus Used</autoFocus>
        <PrintAspectRatio>
              <xPrintAspectRatio>1</xPrintAspectRatio>
              <yPrintAspectRatio>1</yPrintAspectRatio>
        </PrintAspectRatio>
  </ImageData>
  <GPSData>
        <gpsVersionID>2.2.0.0</gpsVersionID>
        <gpsLatitudeRef>N</gpsLatitudeRef>
        <gpsLatitude/>
        <gpsLongitudeRef>E</gpsLongitudeRef>
        <gpsLongitude/>
        <gpsAltitudeRef>0</gpsAltitudeRef>
        <gpsAltitude>
              <numerator>47</numerator>
        </gpsAltitude>
        <gpsTimeStamp/>
        <gpsSatellites/>
```

<gpsStatus>A</gpsStatus>

<gpsMeasureMode>2</gpsMeasureMode>

<gpsDOP>

<numerator>2</numerator>

</gpsDOP>

<gpsSpeedRef>K</gpsSpeedRef>

<gpsSpeed>

<numerator>2</numerator>

</gpsSpeed>

<gpsTrackRef>T</gpsTrackRef>

<gpsTrack>

<numerator>2</numerator>

</gpsTrack>

<gpsImgDirectionRef>T</gpsImgDirectionRef>

<gpsImgDirection>

<numerator>359.00</numerator>

</gpsImgDirection>

<gpsMapDatum/>

<gpsDestLatitudeRef>N</gpsDestLatitudeRef>

<gpsDestLatitude/>

<gpsDestLongitudeRef>E</gpsDestLongitudeRef>

<gpsDestLongitude/>

<gpsDestBearingRef>T</gpsDestBearingRef>

<gpsDestBearing>

<numerator>0.00</numerator>

</gpsDestBearing>

<gpsDestDistanceRef>K</gpsDestDistanceRef>

<gpsDestDistance>

<numerator>55</numerator>

```
                        </gpsDestDistance>
                        <gpsProcessingMethod/>
                        <gpsAreaInformation/>
                        <gpsDateStamp/>
                        <gpsDifferential>0</gpsDifferential>
                  </GPSData>
            </CameraCaptureSettings>
      </DigitalCameraCapture>
      <orientation>1</orientation>
      <methodology>string</methodology>
</ImageCaptureMetadata>

<!--  NISO Section 9  -->

<ImageAssessmentMetadata>
      <SpatialMetrics>
            <samplingFrequencyPlane>1</samplingFrequencyPlane>
            <samplingFrequencyUnit>1</samplingFrequencyUnit>
            <xSamplingFrequency>
                  <numerator>2</numerator>
            </xSamplingFrequency>
            <ySamplingFrequency>
                  <numerator>2</numerator>
            </ySamplingFrequency>
      </SpatialMetrics>
      <ImageColorEncoding>
            <bitsPerSample>
                  <bitsPerSampleValue>8,8,8</bitsPerSampleValue>
                  <bitsPerSampleUnit>integer</bitsPerSampleUnit>
```

```
        </bitsPerSample>
        <samplesPerPixel>1</samplesPerPixel>
        <extraSamples>1</extraSamples>
        <Colormap>
              <colormapReference/>
              <embeddedColormap/>
        </Colormap>
        <grayResponseCurve>N</grayResponseCurve>
        <grayResponseUnit>1</grayResponseUnit>
        <WhitePoint>
              <whitePointXValue/>
              <whitePointYValue/>
        </WhitePoint>
        <PrimaryChromaticities>
              <primaryChromaticitiesRedX/>
              <primaryChromaticitiesRedY/>
              <primaryChromaticitiesGreenX/>
              <primaryChromaticitiesGreenY/>
              <primaryChromaticitiesBlueX/>
              <primaryChromaticitiesBlueY/>
        </PrimaryChromaticities>
  </ImageColorEncoding>
  <TargetData>
        <targetType>1</targetType>
        <TargetID>
              <targetManufacturer/>
              <targetName/>
              <targetNo/>
              <targetMedia/>
```

```
            </TargetID>
            <externalTarget/>
            <performanceData/>
      </TargetData>
</ImageAssessmentMetadata>

<!--  NISO Section 10  -->

<ChangeHistory>
      <ImageProcessing>
            <dateTimeProcessed>2006-09-11</dateTimeProcessed>
            <sourceData/>
            <processingAgency/>
            <processingRationale/>
            <ProcessingSoftware>
                  <processingSoftwareName/>
                  <processingSoftwareVersion/>
                  <processingOperatingSystemName/>
                  <processingOperatingSystemVersion/>
            </ProcessingSoftware>
            <processingActions/>
      </ImageProcessing>
      <PreviousImageMetadata>
            <mix/>
            <mix/>
            <imageDate/>
      </PreviousImageMetadata>
</ChangeHistory>
</mix>
```

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