I.) Purpose

- To propose a simplified means of content negotiation whereby the transfer of Conneg would be optional.
- Provide detailed summary of UIF Profile requirements and how they differ from TIFF-FX Profiles

II.) Default Conneg

Proposed usage

1. The sender requests 'media-supported' and 'media-ready' attributes

The 'media-supported' and 'media-ready' attributes are described in the IPP specification [1]. The 'media-ready' attribute differs from 'media-supported' in that legal values only include the subset of 'media-supported' values that are physically loaded and ready for printing with no operator intervention required. I propose that the sender and receiver MUST support these two attributes so that the related Conneg feature tags (i.e., 'paper-size', 'size-x', and 'size-y') can be left out of the default Conneg strings.

2. The sender requests the 'uif-conneg' attribute.

If the response to the 'uif-conneg' request is the literal string "default", then the sender MUST request the 'uif-profiles-supported' attribute (newly added). From the 'uif-profiles-supported' response, the sender then chooses a supported profile and applies the default capabilities for the selected profile.

If, on the other hand, the response to the 'uif-conneg' request is a valid Conneg string, then the sender has the option of interpreting the returned Conneg string or the default string, as the default string MUST be a subset of what is allowed by a valid Conneg response. A sender that *does not* implement Conneg MUST request the 'uif-profiles-supported' attribute; a sender that *does* implement Conneg MAY request the 'uif-profiles-supported' attribute.

Both senders and receivers MAY choose to implement Conneg. If a sender that does not implement Conneg receives a 'uif-conneg' attribute response with the data set to anything other than "default", then the sender MUST determine which profiles the receiver supports by using the 'uif-profiles-supported' attribute.

Based on the IPP attribute values returned in steps 1 & 2, the sender now has enough information to send UIF-formatted data that is compatible with the receiver's features.

IPP Attribute Description

The following IPP attributes would need to be added to the UIF specification:

'uif-profiles-supported'
Format: (1setof enum)
Type: Printer Description Attribute
Description: List of profiles for which at least the base configuration (see Appendix B) is implemented.

- 0x00 reserved (not used)
- 0x01 reserved (not used)
- 0x02 'uif-profile-s'
- 0x03 'uif-profile-f'
- 0x04 'uif-profile-j'
- 0x05 'uif-profile-c'
- 0x06 'uif-profile-l'
- 0x07 'uif-profile-m'

Conformance: A receiver MUST support this attribute. A sender that does not implement Conneg MUST support this attribute; a sender that does implement Conneg MAY send this attribute.

UIF Default Conneg Strings

Default Conneg for UIF Profile S:

```
(& (image-file-structure=TIFF-minimal)
   (color=Binary)
   (image-coding=MH)
   (dpi=600)
   (dpi-xyratio=1)
   (MRC-mode=0) )
```

Default Conneg for UIF Profile F

```
(& (image-file-structure=[TIFF-minimal,TIFF-limited-uif])
   (color=Binary)
   (image-coding=MH)
   (dpi=600)
   (dpi-xyratio=1)
   (MRC-mode=0) )
```

Default Conneg for UIF Profile J

```
(| (& (image-file-structure=TIFF-minimal)
      (color=Binary)
      (image-coding=MH)
      (dpi=600)
      (dpi-xyratio=1)
      (MRC-mode=0) )
   (& (image-file-structure=TIFF-limited-uif)
```

```
      (color=Binary)
      (image-coding=JBIG)
      (image-coding-constraint=JBIG-T85)
      (JBIG-stripe-size=128)
      (dpi=600)
      (dpi-xyratio=1)
      (MRC-mode=0) ) )
```

Default Conneg for UIF Profile C

```
(| (& (image-file-structure=TIFF-minimal)
      (color=Binary)
      (image-coding=MH)
      (dpi=600) (dpi-xyratio=1)
      (MRC-mode=0) )
   (& (image-file-structure=TIFF-limited-uif)
      (color=grey)
      (color-levels<=256)
      (image-coding=JPEG)
      (image-coding-constraint=JPEG-T4E)
      (color-space=CIELAB)
      (CIELAB-L-min>=0)
      (CIELAB-L-max<=100)
      (color-illuminant=D50)
      (dpi=300) (dpi-xyratio=1)
      (MRC-mode=0) )
```

Default Conneg for UIF Profile L

```
(| (& (image-file-structure=TIFF-minimal)
      (color=Binary)
      (image-coding=MH)
      (dpi=600)
      (dpi-xyratio=1)
      (MRC-mode=0) )
   (& (image-file-structure=TIFF-limited-uif)
      (& (color=grey)
         (| (& (image-coding=JPEG)
               (image-coding-constraint=JPEG-T4E) )
            (& (image-coding=JBIG)
               (image-coding-constraint=JBIG-T43)
               (JBIG-stripe-size=128)
               (image-interleave=stripe) ) )
         (color-space=CIELAB)
         (color-levels<=256)
         (color-illuminant=D50)
         (CIELAB-L-min>=0)
         (CIELAB-L-max<=100)
         (dpi=300) (dpi-xyratio=1) )
      (MRC-mode=0) ) )
```

Default Conneg for UIF Profile M

```
(| (& (image-file-structure=TIFF-minimal)
      (color=Binary)
      (image-coding=MH)
      (MRC-mode=0)
      (dpi=600)
```

```
   (dpi-xyratio=1) )
(& (image-file-structure=TIFF-limited-uif)
   (color=grey)
   (color-levels<=256)
   (MRC-mode=0)
   (image-coding=JPEG)
   (image-coding-constraint=JPEG-T4E)
   (color-space=CIELAB)
   (CIELAB-L-min>=0)
   (CIELAB-L-max<=100)
   (color-illuminant=D50)
   (dpi=300) (dpi-xyratio=1) )
(& (image-file-structure=TIFF-MRC-limited)
   (MRC-mode=1)
   (MRC-max-stripe-size<=256) ) )
```

Note that the maximum dimensions of the image are implied once the sender chooses the media and resolution it will use. For example, if the sender decides to use a resolution of 600x600 dpi, and letter paper size, then the horizontal pixel width is necessarily less than or equal to (8.5in)(600dpi) = 5100 pixels, and the pixel length is necessarily less than or equal to (11in)(600dpi) = 6600 pixels. The default values for the "size-x" and "size-y" Conneg tags SHALL be less than or equal to the value implied by the choice of media size and resolution. If there are no implicit dimensions associated with the chosen media, then a receiver must specify valid imaging dimensions using the 'size-x' and 'size-y' feature tags.

III.) UIF Profile Description

UIF Profile S

This section defines UIF Profile S, which is the minimal black-and-white subset of TIFF that all implementations of UIF MUST support. UIF Profile S, which uses 1-dimensional Modified Huffman compression as defined in ITU-T T.4 [3], is based on TIFF-FX Profile S.

Differences between TIFF-FX Profile S and UIF Profile S:

1) ImageWidth is not constrained
2) XResolution is not constrained, but 600dpi MUST be supported
3) YResolution is not constrained, but 600dpi MUST be supported

The following Baseline and Extension fields and field values MUST be supported by all UIF implementations. For a complete description of the Baseline and Extension TIFF fields shown below, see the TIFF-FX specification [2].

Baseline Fields	Values
BitsPerSample	1
Compression	3: 1D Modified Huffman coding set T4Options = 0 or 4
FillOrder	2: least significant bit first

ImageWidth	m: width of image in pixels
ImageLength	n: length of image in pixels (total number of scanlines)
NewSubFileType	2: Bit 1 identifies single page of a multi-page document
PhotometricInterpretation	0: pixel value 1 means black
ResolutionUnit	2: inch
RowsPerStrip	number of scanlines per strip = ImageLength, with one strip
SamplesPerPixel	1
StripByteCounts	number of bytes in TIFF strip
StripOffsets	offset from beginning of file to single TIFF strip
XResolution	600, other resolutions are optional (written in pixels per inch)
YResolution	600, other resolutions are optional (written in pixels per inch)

Extension Fields	Values
PageNumber	n,m: page number n followed by total page count m
T4Options	0: MH coding, EOLs not byte aligned 4: MH coding, EOLs byte aligned

UIF Profile F

This section defines UIF Profile F, which uses Modified Read and Modified Modified Read (MMR) compression (described in ITU-T T.4 [3] and ITU-T T.6 [4]) in addition to the Modified Huffman compression used for UIF Profile S. UIF Profile F is based on TIFF-FX Profile F. The table that follows summarizes fields and field values that are required / recommended for UIF Profile F. For a complete description of the Baseline, Extension, and New TIFF fields shown below, see the TIFF-FX specification [2]. Implementations of this profile are required to also implement UIF Profile S.

Differences between TIFF-FX Profile F and UIF Profile F:

1) ImageWidth is not constrained
2) XResolution is not constrained, but 600dpi MUST be supported
3) YResolution is not constrained, but 600dpi MUST be supported

The following TIFF-FX recommended fields have been ommitted: ‘BadFaxLines’, ‘CleanFaxData’, ‘ConsecutiveBadFaxLines’, ‘ProfileType’, and ‘FaxProfile’

Recommended fields are shown with an asterisk *.

Required fields or values are shown with a double asterisk **. If the double asterisk is on the field name, then all the listed values are required of implementations; if the double

asterisks are in the Values column, then only the values suffixed with a double asterisk are required of implementations.

Baseline Fields	Values
BitsPerSample	1**
Compression	3**: 1D Modified Huffman and 2D Modified Read coding 4: 2D Modified Modified Read coding
DateTime*	{ASCII}: date/time in 24-hour format "YYYY:MM:DD HH:MM:SS"
FillOrder**	1: most significant bit first 2: least significant bit first
ImageDescription*	{ASCII}: A string describing the contents of the image
ImageWidth**	n: width of image in pixels
ImageLength**	n: length of image in pixels (total number of scanlines)
NewSubFileType	2**: Bit 1 identifies single page of a multi-page document
Orientation	1**-8, Default is 1
PhotometricInterpretation**	0: pixel value 1 means black 1: pixel value 1 means white
ResolutionUnit**	2: inch 3: centimeter
RowsPerStrip**	n: number of scanlines per TIFF strip
SamplesPerPixel	1**
Software*	{ASCII}: name & release number of creator software
StripByteCounts**	n: number of bytes in TIFF strip
StripOffsets**	n: offset from beginning of file to each TIFF strip
XResolution	600**, other resolutions are optional (written in pixels per inch)
YResolution	600**, other resolutions are optional (written in pixels per inch)

Extension Fields	Values
T4Options	0**: required if Compression is Modified Huffman, EOLs are not byte aligned 1: required if Compression is 2D Modified Read, EOLs are not byte aligned 4**: required if Compression is Modified Huffman, EOLs are byte aligned 5: required if Compression is 2D Modified Read, EOLs are byte aligned
T6Options	0: required if Compression is 2D Modified Modified Read

DocumentName*	{ASCII}: name of scanned document
PageNumber**	n,m: page number followed by total page count

New Fields	Values
GlobalParametersIFD*	IFD: global parameters IFD
CodingMethods*	n: compression algorithms used in file

UIF Profile J

This section defines Profile J for UIF, which uses lossless JBIG compression as it is defined in ITU-T T.82 [8] subject to the application rules given in ITU-T T.85 [9]. UIF Profile J is based on TIFF-FX Profile J. The following table summarizes fields and field values that are required / recommended. For a complete description of the Baseline, Extension, and New TIFF fields shown below, see the TIFF-FX specification [2]. Implementations of this profile are required to also implement UIF Profile S.

Differences between TIFF-FX Profile J as defined in [2] and UIF Profile J:

1) ImageWidth is not constrained
2) XResolution is not constrained, but 600dpi MUST be supported
3) YResolution is not constrained, but 600dpi MUST be supported
4) The following TIFF-FX recommended fields have been ommitted: 'ProfileType' and 'FaxProfile'

Recommended fields are shown with an asterisk *.

Required fields or values are shown with a double asterisk **. If the double asterisk is on the field name, then all the listed values are required of implementations; if the double asterisks are in the Values column, then only the values suffixed with a double asterisk are required of implementations.

Baseline Fields	Values
BitsPerSample	1**
Compression	9**: JBIG coding
DateTime*	{ASCII}: date/time in 24-hour format "YYYY:MM:DD HH:MM:SS"
FillOrder**	1: most significant bit first 2: least significant bit first
ImageDescription*	{ASCII}: A string describing the contents of the image
ImageWidth**	n: width of image in pixels
ImageLength**	n: length of image in pixels (total number of scanlines)
NewSubFileType**	2: Bit 1 identifies single page of a multi-page document

Orientation	1**-8, Default is 1
PhotometricInterpretation**	0: pixel value 1 means black 1: pixel value 1 means white
ResolutionUnit**	2: inch 3: centimeter
RowsPerStrip**	n: number of scanlines per TIFF strip
SamplesPerPixel**	1
Software*	{ASCII}: name & release number of creator software
StripByteCounts**	n: number of bytes in TIFF strip
StripOffsets**	n: offset from beginning of file to each TIFF strip
XResolution	600**, other resolutions are optional (written in pixels per inch)
YResolution	600**, other resolutions are optional (written in pixels per inch)

Extension Fields	Values
DocumentName*	{ASCII}: name of scanned document
PageNumber**	n,m: page number followed by total page count

New Fields	Values
GlobalParametersIFD*	IFD: global parameters IFD
T82Options**	0: T.85 profile of T.82
CodingMethods*	n: compression algorithms used in file

UIF Profile C

This section defines Profile C for UIF, which uses lossy JPEG compression as it is defined in ITU-T T.81 [7]. UIF Profile C is based on TIFF-FX Profile C. The following table summarizes fields and field values that are required / recommended. For a complete description of the Baseline, Extension, and New TIFF fields shown below, see the TIFF-FX specification [2]. Implementations of this profile are required to also implement UIF Profile S.

Differences between TIFF-FX Profile C as defined in [2] and UIF Profile C:

1) ImageWidth is not constrained
2) XResolution is not constrained, but 600dpi MUST be supported
3) YResolution is not constrained, but 600dpi MUST be supported
4) The following TIFF-FX recommended fields have been ommitted: ‘ProfileType’ and ‘FaxProfile’

Recommended fields are shown with an asterisk *.

Required fields or values are shown with a double asterisk **. If the double asterisk is on the field name, then all the listed values are required of implementations; if the double

asterisks are in the Values column, then only the values suffixed with a double asterisk are required of implementations.

Baseline Fields	Values
BitsPerSample	8**: 8 bits per color sample 12: optional 12 bits/sample
Compression**	7: JPEG
DateTime*	{ASCII}: date/time in 24-hour format "YYYY:MM:DD HH:MM:SS"
FillOrder**	1: most significant bit first 2: least significant bit first
ImageDescription*	{ASCII}: A string describing the contents of the image
ImageWidth**	n: width of image in pixels
ImageLength**	n: length of image in pixels (total number of scanlines)
NewSubFileType**	2: Bit 1 identifies single page of a multi-page document
Orientation	1**-8, Default is 1
PhotometricInterpretation**	10**: ITULAB
ResolutionUnit**	2: inch 3: centimeter
RowsPerStrip**	n: number of scanlines per TIFF strip
SamplesPerPixel**	1**: L* (lightness) 3: LAB
Software*	{ASCII}: name & release number of creator software
StripByteCounts**	n: number of bytes in TIFF strip
StripOffsets**	n: offset from beginning of file to each TIFF strip
XResolution	300** other resolutions are optional (written in pixels per inch)
YResolution	300** other resolutions are optional (written in pixels per inch)

Extension Fields	Values
DocumentName*	{ASCII}: name of scanned document
PageNumber**	n,m: page number followed by total page count
ChromaSubSampling	(1,1), (2, 2)** (1, 1): equal numbers of lightness and chroma samples horizontally and vertically (2, 2): twice as many lightness samples as chroma samples horizontally and vertically
ChromaPositioning	1**: centered

New Fields	Values
Decode**	minL, maxL, mina, maxa, minb, maxb: minimum and maximum values for L*a*b*
GlobalParametersIFD*	IFD: global parameters IFD
CodingMethods*	n: compression algorithms used in file
VersionYear*	byte sequence: year of ITU std

UIF Profile L

This profile is modeled after TIFF-FX Profile L. It uses JBIG compression (see [8]), subject to the application rules specified in ITU-T Recommendation T.43 [5] to losslessly code three types of color and grayscale images: one bit per color CMY, CMYK and RGB images; a palettized (i.e. mapped) color image; and continuous tone color and grayscale images.

Differences between TIFF-FX Profile L as defined in [2] and UIF Profile L:

1) ImageWidth is not constrained
2) XResolution is not constrained, but 300dpi MUST be supported
3) YResolution must match XResolution, but it is not otherwise constrained; 300dpi MUST be supported
4) The following TIFF-FX recommended fields have been ommitted: 'ProfileType' and 'FaxProfile'

The table that follows summarizes fields and field values that are required / recommended for implementation of UIF Profile L. For a complete description of the Baseline, Extension, and New TIFF fields shown below, see the TIFF-FX specification [2]. Implementations of this profile are required to also implement UIF Profile S, and UIF Profile C.

Recommended fields are shown with an asterisk *.

Required fields or values are shown with a double asterisk **. If the double asterisk is on the field name, then all the listed values are required of implementations; if the double asterisks are in the Values column, then only the values suffixed with a double asterisk are required of implementations.

Baseline Fields	Values
BitsPerSample	1: Binary RGB, CMY(K) 8**: 8 bits per color sample 9-16: optional
Compression**	10**: JBIG, per T.43
DateTime*	{ASCII}: date/time in 24-hour format "YYYY:MM:DD HH:MM:SS"

FillOrder**	1: most significant bit first 2: least significant bit first
ImageDescription*	{ASCII}: A string describing the contents of the image
ImageWidth**	n: width of image in pixels
ImageLength**	n: length of image in pixels (total number of scanlines)
NewSubFileType**	2: Bit 1 identifies single page of a multi-page document
Orientation	1**-8, Default is 1
PhotometricInterpretation	2: RGB 5: CMYK 10**: ITULAB
ResolutionUnit**	2: inch
RowsPerStrip**	n: number of scanlines per TIFF strip
SamplesPerPixel**	1**: L* (lightness) 3: LAB, RGB, CMY 4: CMYK
Software*	{ASCII}: name & release number of creator software
StripByteCounts**	n: number of bytes in TIFF strip
StripOffsets**	n: offset from beginning of file to each TIFF strip
XResolution	300** other resolutions are optional (written in pixels per inch)
YResolution	equal to XResolution (pixels MUST be square)

Extension Fields	Values
DocumentName*	{ASCII}: name of scanned document
PageNumber**	n,m: page number followed by total page count
Indexed	0: not a palette-color image 1: palette-color image

New Fields	Values
Decode**	minL, maxL, mina, maxa, minb, maxb: minimum and maximum values for L*a*b*
GlobalParametersIFD*	IFD: global parameters IFD
CodingMethods*	n: compression algorithms used in file
VersionYear*	byte sequence: year of ITU std

UIF Profile M

This profile is modeled after TIFF-FX Profile M, which uses Mixed Raster Content (MRC), defined in ITU-T Recommendation T.44 [6]. MRC enables different coding methods and resolutions within a single page. For a more detailed description of MRC and the Baseline, Extension, and New TIFF fields shown below, see [2] and [6].

Differences between TIFF-FX Profile M as defined in [2] and UIF Profile M:

1) ImageWidth is not constrained
2) XResolution is not constrained, but 600dpi MUST be supported with the bi-level mask layer, and 300dpi MUST be supported with the foreground and background layers.
3) YResolution must match XResolution, but it is not otherwise constrained; 600dpi MUST be supported with the bi-level mask layer; 300dpi MUST be supported with the foreground and background layers
4) The following TIFF-FX recommended fields have been ommitted: 'ProfileType' and 'FaxProfile'

The table that follows summarizes fields and field values that are required / recommended for implementation of UIF Profile M.. Implementations of this profile are required to also implement UIF Profile S, and UIF Profile C.

Recommended fields are shown with an asterisk *.

Required fields or values are shown with a double asterisk **. If the double asterisk is on the field name, then all the listed values are required of implementations; if the double asterisks are in the Values column, then only the values suffixed with a double asterisk are required of implementations.

Baseline Fields	Values
BitsPerSample	1**: binary mask, RGB, CMY(K) 2-8**: bits per color sample 9-16: optional 12 bits/sample
Compression**	1: None (ImageBaseColor IFD only) 3**: Modified Huffman and Modified Read 4: Modified Modified Read 7**: JPEG 9: JBIG, per [9] 10: JBIG, per [5]
DateTime*	{ASCII}: date/time in 24-hour format "YYYY:MM:DD HH:MM:SS"
FillOrder**	1: most significant bit first 2: least significant bit first
ImageDescription*	{ASCII}: A string describing the contents of the image
ImageWidth**	n: width of image in pixels
ImageLength**	n: length of image in pixels (total number of scanlines)
NewSubFileType**	16, 18: | Bit 1 indicates single page of a multi-page document on Primary IFD Bit 4 indicates MRC model

Orientation	1**-8, Default is 1
PhotometricInterpretation	0**: WhiteIsZero (Mask Layer) 2: RGB 5: CMYK 10**: ITULAB
ResolutionUnit**	2: inch
RowsPerStrip	n: number of scanlines per TIFF strip
SamplesPerPixel**	1**: L* (lightness) 3: LAB, RGB, CMY 4: CMYK
Software*	{ASCII}: name & release number of creator software
StripByteCounts**	n: number of bytes in TIFF strip
StripOffsets**	n: offset from beginning of file to each TIFF strip
XResolution	300**: background & foreground layers; 600**: binary mask layer; other resolutions are optional
YResolution	300**: background & foreground layers; 600**: binary mask layer; other resolutions are optional; must be equal to XResolution (pixels MUST be square)

Extension Fields	Values
T4Options	0**: required if Compression is Modified Huffman, EOLs not byte aligned 1: required if Compression 2D Modified Read, EOLs are not byte aligned 4**: required if Compression Modified Huffman, EOLs byte aligned 5: required if Compression 2D Modified Read, EOLs are byte aligned
T6Options	0: required if Compression is 2D Modified Modified Read
DocumentName*	{ASCII}: name of scanned document
PageNumber**	n,m: page number followed by total page count
ChromaSubSampling	(1,1), (2, 2)** (1, 1): equal numbers of lightness and chroma samples horizontally & vertically| (2, 2): twice as many lightness samples as chroma horizontally and vertically
ChromaPositioning	1: centered
Indexed	0: not a palette-color image 1: palette-color image
SubIFDs	<IFD>: byte offset to FG/BG IFDs
XPosition	horizontal offset in primary IFD resolution units
YPosition	vertical offset in primary IFD resolution units

New Fields	Values
Decode**	minL, maxL, mina, maxa, minb, maxb: minimum and maximum values for L*a*b*
ImageBaseColor	a,b,c: background color in ITULAB
StripRowCounts	n: number of scanlines in each strip
ImageLayer	n, m: layer number, imaging sequence (e.g., strip number)
T82Options	0: T.85 profile of T.82 coding
GlobalParametersIFD*	IFD: global parameters IFD
CodingMethods*	n: compression algorithms used in file
ModeNumber*	n: version of T.44 standard
VersionYear*	byte sequence: year of ITU std

References

[1] Herriot, Butler , Moore, Turner, Wenn. "Internet Printing Protocol/1.1: Encoding and Transport", RFC 2910

[2] McIntyre, Zilles, Buckley, Venable, Parsons, Rafferty "File Format for Internet Fax", RFC2301

[3] ITU-T Recommendation T.4, Standardization of group 3 facsimile apparatus for document transmission, October 1997

[4] ITU-T Recommendation T.6, Facsimile coding schemes and coding control functions for group 4 facsimile apparatus, November 1988

[5] ITU-T Recommendation T.43, Colour and gray-scale image representations using lossless coding scheme for facsimile, February 1997

[6] ITU-T Recommendation T.44, Mixed Raster Content (MRC), April 1999.

[7] ITU-T Recommendation T.81, Information technology - Digital compression and coding of continuous-tone still images - Requirements and guidelines, September 1992

[8] ITU-T Recommendation T.82, Information technology - Coded representation of picture and audio information - Progressive bi-level image compression, March 1995

[9] ITU-T Recommendation T.85, Application profile for Recommendation T.82 - Progressive bi-level image compression (JBIG coding scheme) for facsimile apparatus, August 1995