Workshop: Turning CID-Keyed Fonts Into OpenType Fonts Using AFDKO

Masataka Hattori | Senior Designer | Type Engineering Japanese R&D

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Type1→CIDFont→OTF

CID-keyed Font Build Process

OpenType Font Build Process

PFA

CID

cidfont.ps

- **tx**
- **mergeFonts**
- **autohint**
- **stemHist**

Begin with one or more name-keyed fonts
Merge name-keyed fonts into a CID-keyed font
Create multiple FDArray elements
Make stem histograms
Add hint information
...

- **makeotf**

- **edit OT features**

Alternate Metrics
Baseline
Pair Kerning
Glyph Substitution
Font Menu Name
CMap resource
....

CFF

BASE
GPOS
GSUB
VORG
OS/2
cmap
head
hhea
hmtx
name
vhea
vmtx
…

OpenType/CFF

Font Formats Supported By AFDKO

Format	Base	ROS	FDArrays	CMap	Hinting	Comments
Type 1	Name-keyed	N/A	N/A	N/A	○	PostScript font format for Latin before OTF was introduced, it uses ".ps",".pfa", or ".pfb" as its suffix, and serves as the foundation for AFDKO.
CIDFont	CID-keyed	Public	Single or Multiple	○	△/○	PostScript font format for CJK before OTF was introduced , it uses ".ps" as its suffix, and serves as an intermediate font to build CID-keyed OTF in AFDKO.
		Adobe-Identity-0	Multiple	△	○	
	Name-keyed	N/A	N/A	N/A	E （○） J （△）	This has CFF Table from converting Name-Keyed font. Generally, non-CJK font is made with this format.
			Single	○	△	This has CFF Table from converting CID-Keyed font but does not have Multiple FDArrays. e.g. some outline font editors support this format.
OpenType /CFF	CID-keyed	Public	Multiple	○	○	This has CFF Table from converting CID-Keyed font and has multiple FDArrays. Many CJK fonts including Adobe and Morisawa products are generated with this format.
		Adobe-Identity-0	Multiple	△	○	"Kazuraki" font uses this format, which is CID-Keyed and has multiple FDArrays. This format allows you to use an arbitrary glyph set, but it means no compatibility with public ROSes and their CMap resources.

We Will Build Two OpenType Fonts In This Workshop

- Adobe-Japan1-*x* ROS subset OpenType font
  - A very small OpenType font that uses a public ROS and standard CMap resources
  - All glyphs must be included in Adobe-Japan1-*x*
- Adobe-Identity-0 ROS OpenType font
  - A very small OpenType font that uses a special-purpose ROS and custom CMap resource
  - Add separate vertical kana glyphs that are not included in any public ROS, and make proportional
  - Make the default (horizontal) kana glyphs proportional

Input Files For Makeotf

- These two files were already made in Ken Lunde's session, which will be reused in my session
  - CIDFont resource (cidfont.ps)
  - "cidfontinfo" file

- Additional files to build OTF by makeotf, and make/edit them if necessay
  - CMap resources
  - "features" file
  - "FontMenuNameDB" file

Building Adobe-Japan1-*x* ROS Subset OpenType font

- Adobe Character Collections
  - The Adobe-Japan1-0 Character Collection is used for the sample font
  - It is a Public ROS (/Registry, /Ordering, and /Supplement) defined by Adobe

Adobe - Japan1 - 0

Registry Ordering Supplement

  - CID (Character ID) assignments are static
  - AFDKO Location : FDK/Tools/SharedData/CID charsets/
  - Public ROSes :

Adobe-Japan1-6	23,058 glyphs (CIDs 0 through 23057), JIS X 0208 + JIS X 0213 + JIS X 0212 + U-PRESS
Adobe-Korea1-2	18,352 glyphs (CIDs 0 through 18351), KS X 1001:1992
Adobe-GB1-5	Simplified Chinese supporting GB 18030; 30,284 glyphs (CIDs 0 through 30283)
Adobe-CNS1-6	Traditional Chinese supporting Big Five & Hong Kong SCS-2008; 19,156 glyphs (CIDs 0 through 19155)

CMap Resources

- Specifies a unidirectional mapping from an encoding (Unicode) to CIDs
- Standard CMap resources for building Adobe-Japan1-*x* ROS OpenType fonts
  - UniJIS2004-UTF32-H : Japanese JIS2004 based on UTF-32 encoding
  - 83pv-RKSJ-H : Mac OS Japanese (Shift-JIS)
- AFDKO Location : FDK/Tools/SharedData/Adobe Cmaps/
- Other common CMap resources
  - Japanese JIS90 : UniJIS-UTF32-H
  - Simplified Chinese : UniGB-UTF32-H & GBpc-EUC-H
  - Traditional Chinese : UniCNS-UTF32-H & B5pc-H
  - Korean: UniKS-UTF32-H & KSCpc-EUC-H

OpenType/CFF Tables

- A typical OpenType/CFF font contains the following 16 sfnt tables

BASE	Can be overridden; AFM data can be used to calculate its contents
CFF	Generated from a name- (PFA or "font.ps") or CID-keyed ("cidfont.ps") font
DSIG	Microsoft OpenType Font Signing Tool http://www.microsoft.com/typography/developers/dsig/dsig.htm
GPOS	Glyph POSitioning
GSUB	Glyph SUBstitution
0S/2	Can be overridden
VORG	Synthesized when the 'vmtx' table is overridden
cmap	Synthesized from specified CMap resources
head	Automatically generated, except for the ‘fontRevision’ parameter
hhea	Automatically generated; can be overridden if necessary
hmtx	Automatically generated
maxp	Automatically generated
name	Some strings are generated automatically, but most are specified in the "features" and "FontMenuNameDB" file
post	Automatically generated
vhea	Automatically generated; can be overridden if necessary
vmtx	Automatically generated; can be overridden if necessary

Features

- OpenType Feature File Specification
  - ADFKO Location : FDK/Technical Documentation/topic_feature_file_syntax.html
  - http://www.microsoft.com/typography/otspec/

- Script and Language declarations
  - languagesystem <script tag> <language tag>;

```
languagesystem DFLT dflt;
languagesystem hani dflt;
languagesystem kana dflt;
languagesystem latn dflt;
```

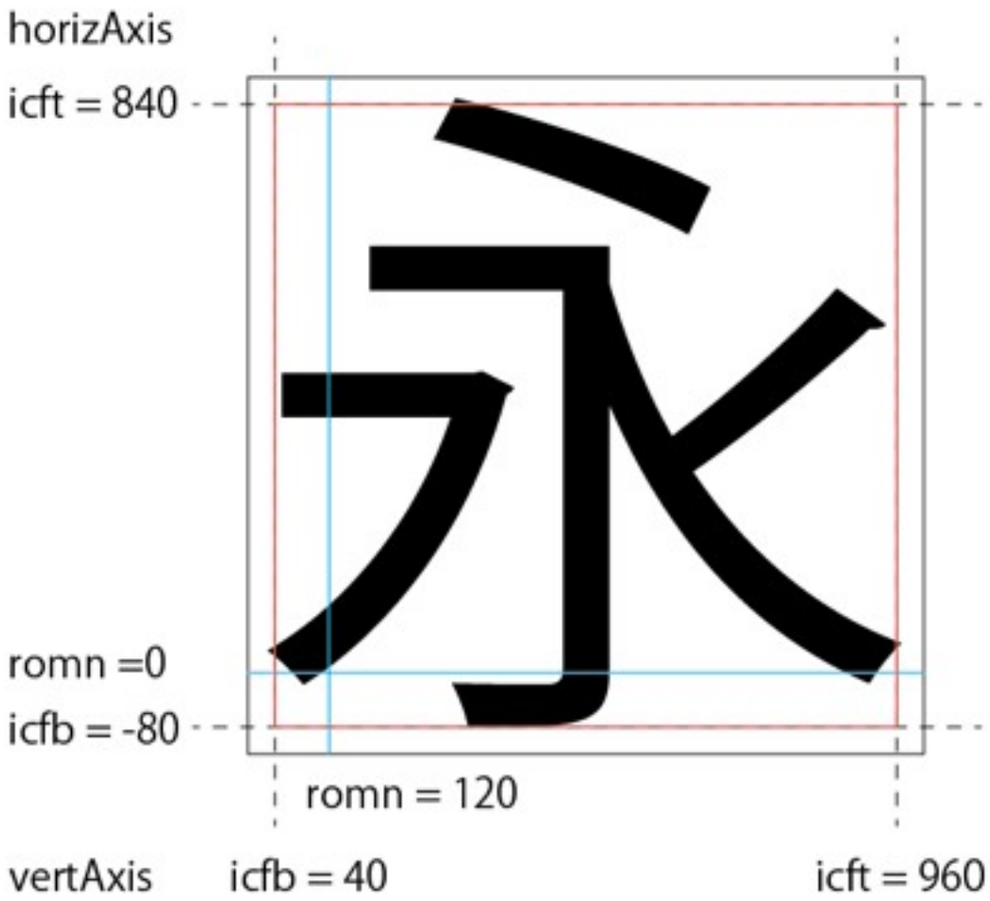
- head Table (overall OpenType version number)

```
table head {
  FontRevision 1.000;
} head;
```

Features

- BASE Table
  - ICF = Ideographic Character Face
  - icfb (ICF bottom), icft (ICF top)
  - to make BASE Table :

```
% tx –afm cidfont.ps AFM
% mkicf.pl <cmap> < AFM > BASE
```



Features

- Name Table
  - Copyright string (name.ID=0)
  - Trademark string (name.ID=7)
  - Manufacturer Name (name.ID=8)
  - Designer’s name (name.ID=9)
  - URL (name.ID=11)
  - Legal notice (name.ID=14)
  - Fully-qualified PostScript name for Mac OS (name.ID=20)

- Name ID, Platform ID, Script ID, and Language ID

```
table name {
   nameid 9 "\670d\90e8\6b63\8cb4"; # Windows (Unicode) 9 3 1 0x411
   nameid 9 1 "Masataka Hattori"; # Macintosh (Mac Roman) 9 1 0 0
   nameid 9 1 1 11 "\95\9e\95\94\90\b3\8b\4d"; # Macintosh (SJIS)
} name;
```

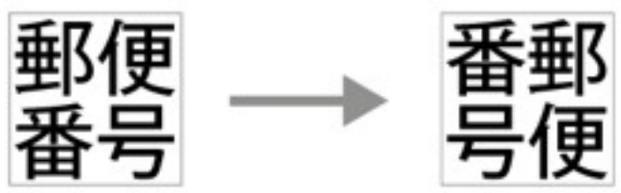
Features

- OS/2 Table
  - TypoAscender <metric> (Type foundry dependent)
  - TypoDescender <metric> (Type foundry dependent)
  - XHeight <metric> (Font and family dependent)
  - CapHeight <metric> (Font and family dependent)
  - WeightClass <metric> (Font and family dependent)
  - WidthClass 5 — (Fixed)
  - Panose <panose number> (Font and family dependent)
  - UnicodeRange <unicode range list> (For subset fonts, this should be set manually)
  - CodePageRange <code page list> (For subset fonts, this should be set manually)
  - FSType — 8 (4 is the minimum for PDF embedding)
    - If this setting is inconsistent with the CIDFont resource, makeotf will issue a warning
  - Vendor — <string> (Type foundry dependent)

    http://www.microsoft.com/typography/links/vendorlist.aspx

Features

- GSUB – Glyph SUBstitution table
  - aalt, expt, fwid, jp04, jp78, nlck, pwid, trad, vert, vrt2, liga, and so on



- GSUB syntax
  - substitute <glyph> by <glyph>;

```
substitute \634 by \7887;
```

  - substitute <glyph sequence> by <glyph>; # Ligature substitution

```
substitute \71 \71 \74 by \9359;
```

  - substitute <glyph> from <glyphclass>; # one from n substitution

```
substitute \1 from [\231 \326 \422 \515 \633 \8229 \8720 \9444];
```

Features

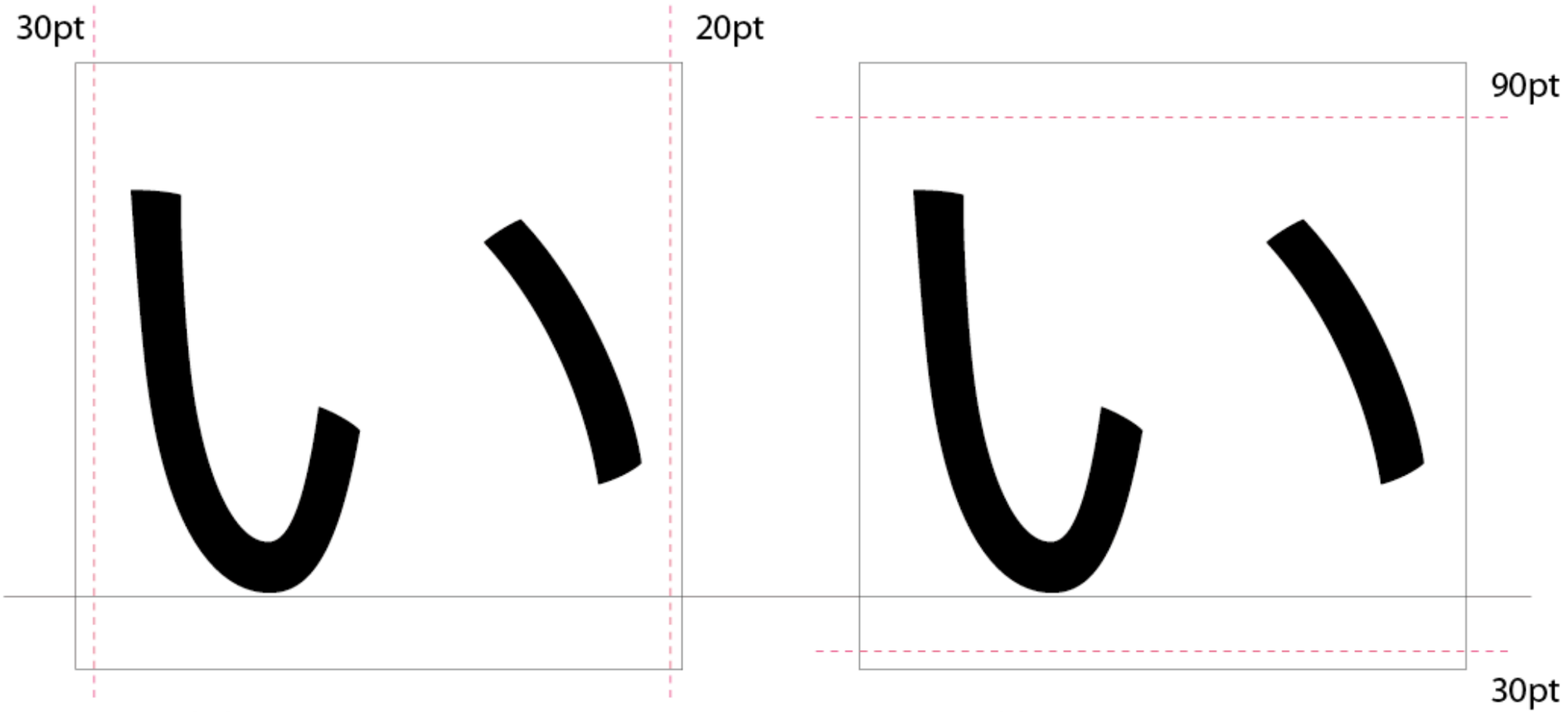
- GPOS – Glyph POSitioning tables
  - halt, palt, vhal, vpal, kern, vkrn
- GPOS syntax
  - position <glyph> <valuerecord>;

```
position \634 <-20 0 -500 0>;
```

  - position <glyph> <glyph> <valuerecord>; # Pair Kerning

```
position \9 \43 40;
```

Features




```
palt {
  position \845 <-30,0,-50,0>;
} palt;
```

```
vpal {
  position \845 <0,90,0,-120>;
} vpal;
```

FontMenuNameDB

- FontMenuName DataBase

  DataBase for Menu Naming information

  This information is stored in the ‘name’ Table

  ADFKO Location : FDK/Tools/SharedData/FontMenuNameDB

- FontMenuNameDB file syntax

  f= Preferred Family nameID=16

  s= Preferred Subfamily nameID=17

  l= Compatibility nameID=1&4

[KozGoAJ10-Medium]
f=3,1,0x411,小塚ゴシック AJ10
s=3,1,0x411,M
l=3,1,0x411,小塚ゴシック AJ10 M
f=1,1,11,小塚ゴシック AJ10
s=1,1,11,M
l=1,1,11,小塚ゴシック AJ10 M
f=Kozuka Gothic AJ10
s=M
l=Kozuka Gothic AJ10 M

→

[KozGoAJ10-Medium]
f=3,1,0x411,\5c0f\585a\30b4\30b7\30c3\30af AJ10
s=3,1,0x411,M
l=3,1,0x411,\5c0f\585a\30b4\30b7\30c3\30af AJ10 M
f=1,1,11,\8f\ac\92\cb\83\53\83\56\83\62\83\4e AJ10
s=1,1,11,M
l=1,1,11,\8f\ac\92\cb\83\53\83\56\83\62\83\4e AJ10 M
f=Kozuka Gothic AJ10
s=M
l=Kozuka Gothic AJ10 M

Make Adobe-Japan1-0 Subset OpenType Font

- CMap resources
- “cidfontinfo” file
- “FontMenuNameDB” file
- “features” file, which includes :
  - languagesystem
  - head, BASE, name, OS/2 overrides
  - GSUB feature : aalt, fwid, pwid, vert, vrt2
  - GPOS feature : palt, kern

- And simply enter this command line on the terminal :
  - % makeotf -f cidfont.ps -r

Building Adobe-Identity-0 ROS OpenType Font

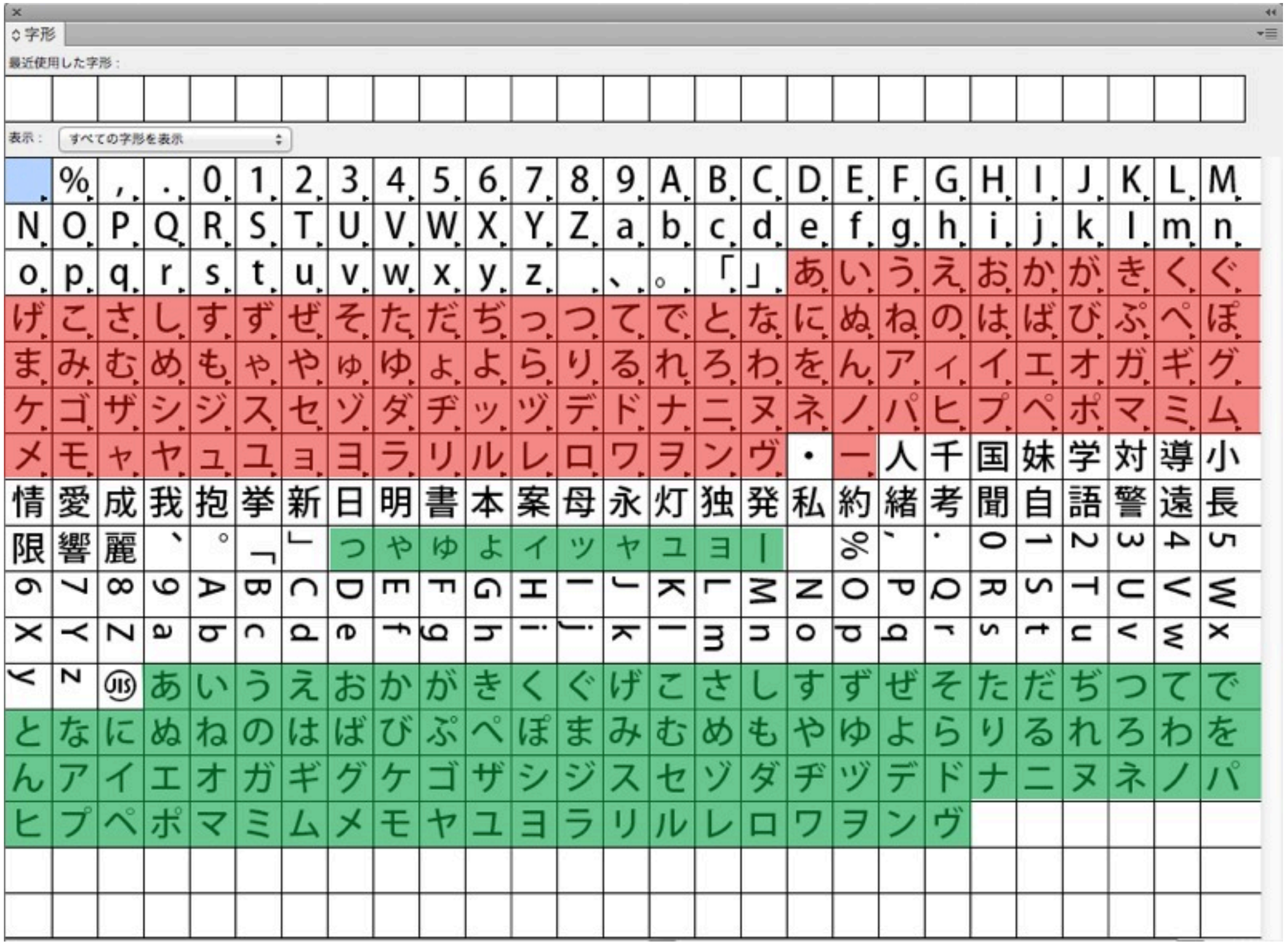
- CIDFont resource (cidfont.ps)
  - Make Truly Proportional Kana Glyphs
  - Add separate vertical kana glyphs that are not included in any public ROS, and make proportional
  - Make the default (horizontal) kana glyphs proportional

- Additional font-specific files for building the font
  - UniKozGoAI0-UTF32-H : font-specific CMap resource
  - kana_shift.map : to make the horizontal kana glyphs proportional
  - kana_v.map : duplicate special vertical kana

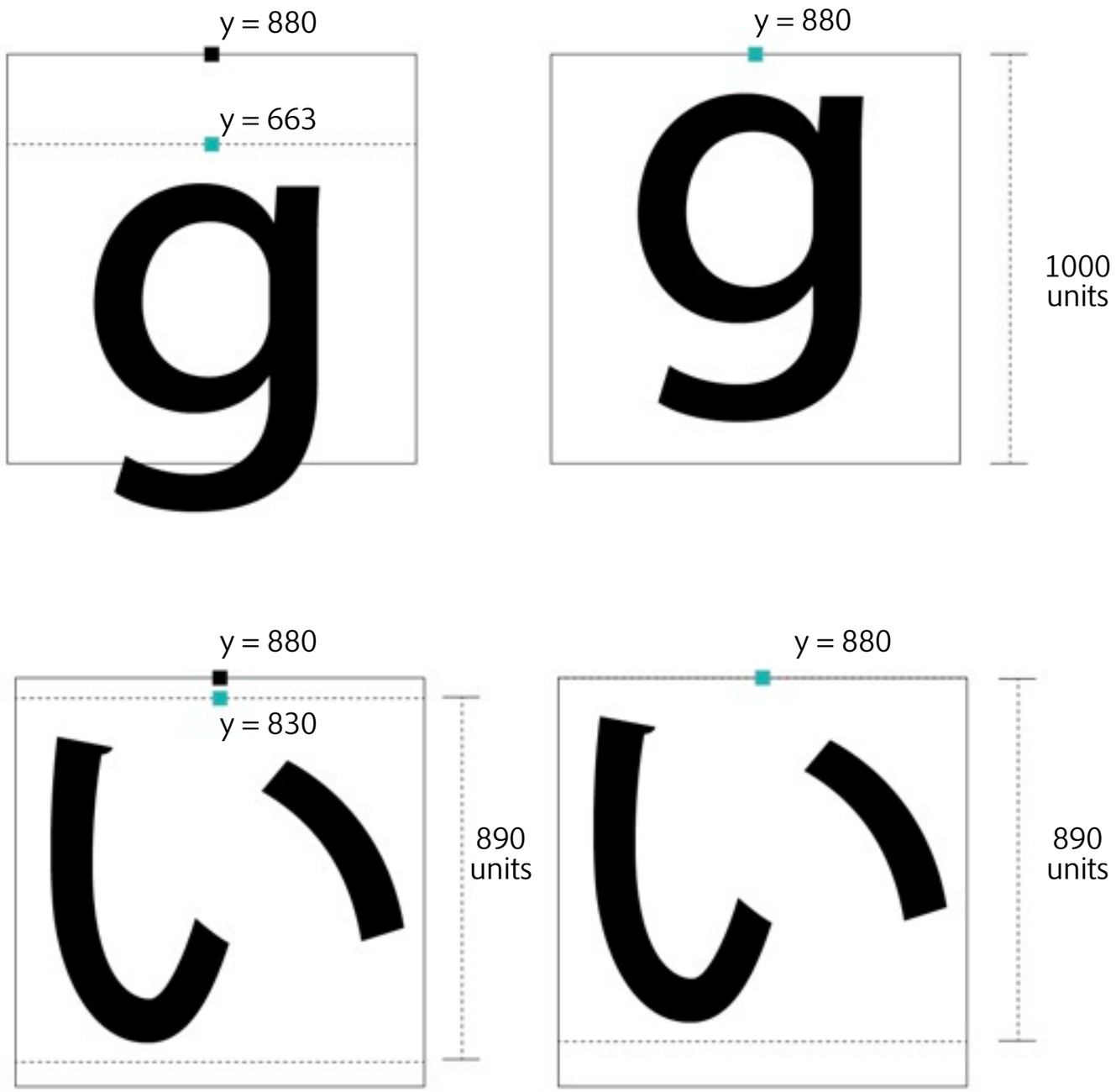
- Adobe Character Collections
  - Specify Adobe-Identity-0 ROS in cidfontinfo file
  - CID assignments are dynamic, on a per-font basis
  - Adobe's Japanese traditional Kana font "Kazuraki" is the first Adobe-Identity-0 font
  - The "features" file must be converted to font-specific Adobe-Identity-0 CIDs :

- CMap Resource
  - "UniKozGoAI0-UTF32-H" file
  - For Adobe-Identity-0, a font-specific UTF-32 CMap resource must be made
  - More details for CMap Resource specification :
    - http://blogs.adobe.com/CCJKType/2012/03/building-utf32-cmaps.html

Truly Proportional Kana Glyph Set



vmtx Table



Overriding the 'vmtx' table

Adjust the Y-axis position of full-width Latin glyphs for vertical writing

```
table vmtx {
…
  VertOriginY \822 663;
…
} vmtx;
```

Adjust the vertical origin and vertical advance of truly proportional kana glyphs

```
table vmtx {
…
  VertOriginY \302 830;
  VertAdvanceY \302 890;
…
} vmtx;
```

Rebuild “cidfont.ps”

- Change “cidfont.ps” file name
  - % mv cidfont.ps cidfont_AI0.ps
- Check FDarrary list in “cidfont_AI0.ps”
  - % fdarray-check.pl cidfont_AI0.ps
  - See this line : KozGoAI0-Medium-Kana (2): 72-179,181,224-233
- Extract the glyphs for CIDs 72–179 and 181 to a name-keyed font
  - % tx -t1 -n -decid -usefd 2 -g /72-/179,/181 cidfont_AI0.ps kana.pfa
- Make truly proportional horizontal kana glyph by using the rotateFont tool
  - % rotateFont -t1 -rtf kana_shift.map kana.pfa kana_s.pfa

Rebuild “cidfont.ps”

- Rebuild “kana.cid”, which contains proportional horizontal and full-width vertical kana glyphs
  - % mergeFonts -cid cidfontinfo kana.cid kana_s.pfa kana_v.map kana.pfa
- Insert the “kana.cid” glyphs into “cidfont.ps”
- Use the "-gx" option to exclude CIDs 72–179 and 181 in the original font
  - % mergeFonts -gx /72-/179,/181 cidfont.ps cidfont_AI0.ps kana.cid
- Rehint kana glyphs
  - % autohint -g /72-/179,/181,/301-/399 -r -q cidfont.ps

Edit “features” file

- Replace "AJ10" to "AI0" in FontMenuNameDB file
- Convert standard feature definitions from public ROS to font-specific Adobe-Identity-0 ROS
- The name.ID=20 entry is not needed
  - erase name.ID=20 line in 'name' table override of "features" file
- Add new JIS mark as Discretionary Ligature substitution

```
feature dlig {
  #JIS Mark
  substitute \24 \23 \33 by \300;
} dlig;
```

- Insert ‘vmtx’ table overrides into “features” file
- Insert additional substitutions into ‘vert’/‘vrt2’ tags
- Remove ‘palt’ and ‘kern’ tags from features

Building an Adobe-Identity-0 OpenType Font

- % makeotf -f cidfont.ps -r -cs 1 -ch UniKozGoAI0-UTF32-H
  - -cs 1

    Explicitly set the language of the Macintosh 'cmap' subtable to Japanese

  - -ch UniKozGoAI0-UTF32-H
    - Specify font-specific UTF-32 CMap resource

AJ10 Font vs AI0 Font

小塚ゴシック AJ10

永遠に愛されることば

11W(10)

小塚ゴシック AI0

永遠に愛されることば

11W(10)

小塚ゴシック AJ10

永遠に愛されることば

11W(10)

小塚ゴシック AI0

永遠に愛されることば

11W(10)

Adobe