PDAPI: OpenPrinting Vector Printer Driver API Overview

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What is a Vector Printer Driver?

- Send graphics commands to printer, instead of rasterized bitmap image.
- Called by render engine such as Ghostscript or X print server.
- Objectives
  - Performance Optimization
    - Achieve full speed printing on fast laser printers
    - Utilizes graphical acceleration feature supported by printer controllers
  - Data Size Optimization
    - Reduces size of print data using high level graphics commands.
    - Contributes to reduce network bandwidth and increase through-put
  - Print Quality Optimization
    - Utilizes printer's graphics quality enhancement technology by sending vector graphics command
    - Color Optimization
      - Driver can recognize the kind of graphics primitives and switch color scheme – natural color for bitmaps and vivid colors for graphics and text.

Graphic Model

- Have Studied:
  - Postscript & PDF
  - X Window
  - Windows GDI
  - Java2D
  - SVG
  - PDLs – PCL6, LIPS IV (Canon), etc.
- Not based on specific graphics model among them. Took practical model for printer support.

API Overview

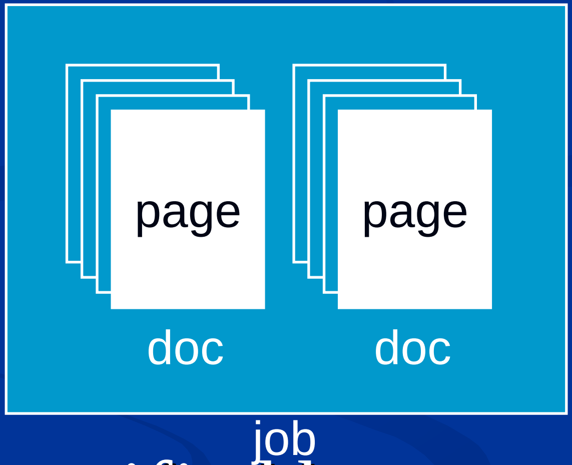
- Job Control
  - Open/Close driver
  - Set Job/Document/Page attributes
- Graphics State Operation
  - Set attributes for each graphics objects
- Drawing Operations
  - Path
  - Text
  - Bitmap Image
  - Scanline
  - Raster Image
- Stream Data (embedded PDL)

Printer Context Operations

- OpenPrinter()
  - Create printer context
  - Register API entry pointers
  - Specify file descriptor for data stream
- ClosePrinter()
  - Closes printer context
  - Driver releases all resources

Job Control Operations

- A print job consist of documents.
- A document consist of pages (document is optional unit).
- StartJob(), EndJob()
- StartDoc(), EndDoc()
- StartPage(), EndPage()
- Job, doc and page attributes are specified by each StartXxx() function.



Query Device Capabilities and Information

- QueryDeviceCapability()
  - Query if the device can do number-up, duplex, etc.
  - Information such as media size, media source and etc. which are supported by the device can be retrieved.
- QueryDeviceInfo()
  - Query current settings of the device.

Data format for Job and Query APIs

- (Try to) use notation by PWG/UPDF
- May not accurate.
- Some are out of scope of PWG/UPDF.

Graphics State Object Operations

- Graphics State is managed as GS object
  - Operation to GS – InitGS, SaveGS, RestoreGS
- Controls to each items in GS
  - CTM (Coordinate Translate Matrix)
  - Color Space
  - Raster Operation – ROP3
  - Fill Mode – even/odd or winding
  - Alpha Constant
  - Line Style – width, dash/solid, cap, join
  - Paint Mode – opaque or transparent
  - Stroke and fill color – brush control
  - Foreground and background color – solid brush

Path Operations

- A path is a virtual track object
  - Will be visible by stroke or fill operations
  - Will be used to define clip region
- Lines, rectangles, polygons, arc/pie and bezier are all treated as “path.”
- Operations:
  - NewPath() – Declare start of a path
  - EndPath() – Declare end of a path
  - StrokePath(), FillPath(), StrokeFillPath() – make visible path
  - SetClipPath(), ResetClipPath() – defines clip region by current path

Text Operations

- Still under investigation…
- Current DrawBitmapText() will be removed.
- Text Operations will includes:
  - Define and Query font metrics
  - Device Font Utilization
  - Font Downloading

Bitmap and Scanline Operations

- Bitmap is a bit oriented image data drawn in rectangle region
  - DrawImage()
  - StartDrawImage(), TransferDrawImage(), EndDrawImage()
- Scanline is a horizontal line defined by start and end point pairs.
  - Used to draw graphics rendered by renderer
  - StartScanLine(), ScanLine(), EndScanLine()

Raster Image Operation

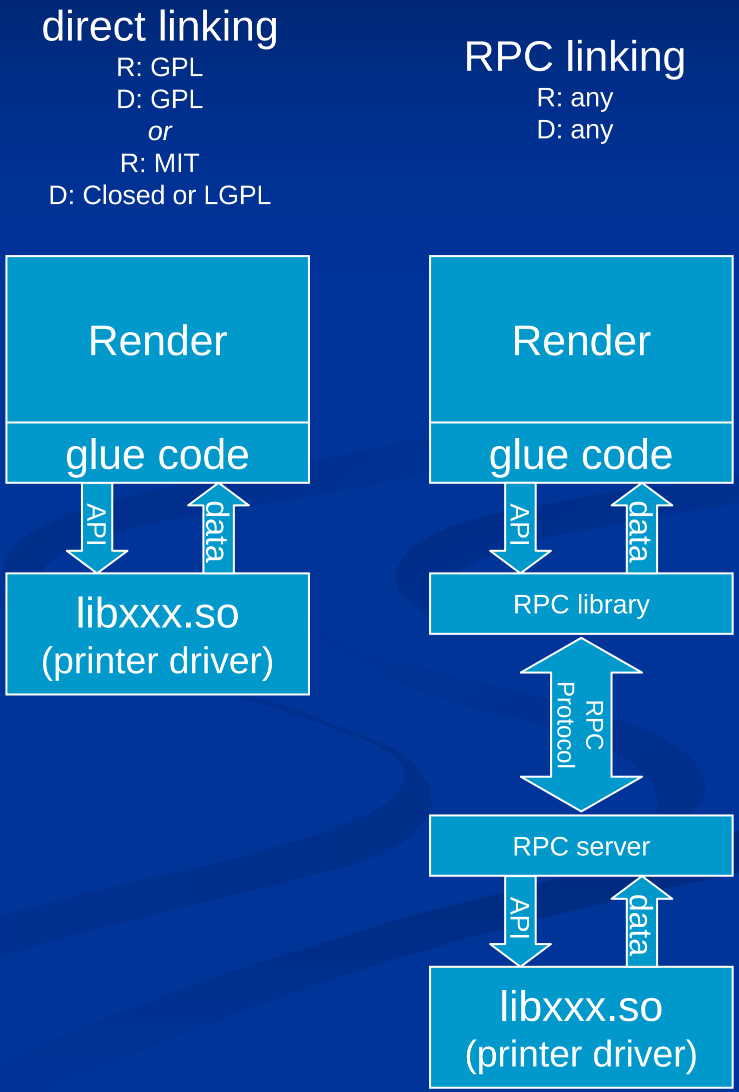
- If the device does not any graphic primitives, raster image can be sent by these operation.
- StartRaster(), TransferRasterData(), EndRaster()

Stream Data Operations

- Direct PDL embedding is possible by these operation.
- Can be used for “form printing”, eps embedding, or direct device control.
- StartStream(), TransferStreamData(), EndStream()

Linking with Render

- Printer driver is provided as a dynamic library.
- Driver can be linked dynamically or via RPC.
  - avoids license problem



Plan for 2004 and beyond

- Refinement by feedback from opfc project.
- Define Text Operations
- Make consistency with PWG/UPDF spec.
- Fallback Mechanism

Thank you!